Local Government Energy Audit: Energy Audit Report

Administration Building

46 Highlander Rd

West Milford, New Jersey 07480

West Milford Township School District

September 7, 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.

Table of Contents

Table of Figures

1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for the Administration Building.

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's public 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

Administration Building is an 8,000 square foot facility primarily comprised of office space. The building has two (2) floors and includes a kitchenette and conference rooms. The building is of typical residential style construction and was built in 1976. The building is occupied between Monday and Friday, 8:00 AM to 4:30 PM, year round. There are 18 full time staff members who occupy the building. The building is 100% heated and 100% cooled.

The HVAC equipment and systems at the Administration Building consists of aging and inefficient HVAC equipment in need of replacement. A thorough description of the facility and our observations are located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC evaluated 12 measures that together represent an opportunity for the Administration Building to reduce annual energy costs by roughly $8,020 and annual greenhouse gas emissions by 37,789 lbs CO_2e. We estimate that if all measures were implemented, the project would pay for itself in roughly 6.1 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 the Administration Building's annual energy costs by 39%.

TRC recommends 10 of these measures to be high priority for implementation. These high priority measures together represent an opportunity for the Administration Building to reduce annual energy costs by roughly $6,249 and annual greenhouse gas emissions by 28,319 lbs CO_2e. We estimate that if all high priority measures were implemented as recommended, the project would pay for itself in roughly 2.6 years. Together these high priority measures represent an opportunity to reduce the Administration Building's annual energy costs by 31%.

Figure 1 – Previous 12 Month Utility Costs

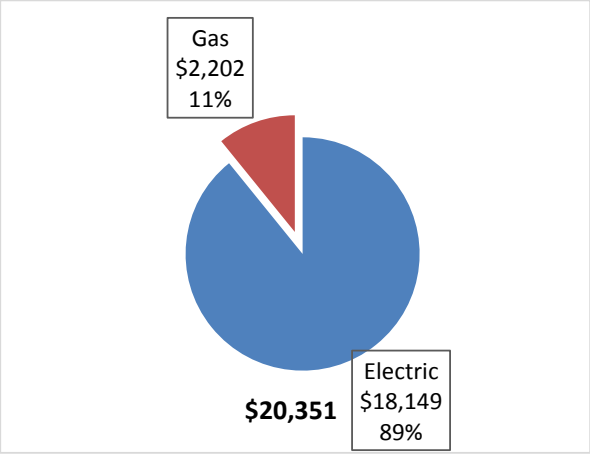


Figure 2 – Potential Post-Implementation Costs (All Measures)

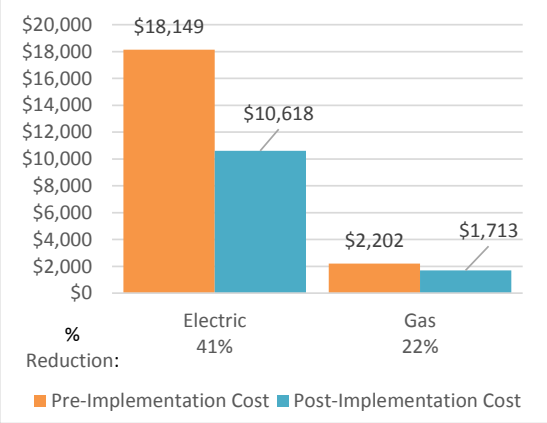
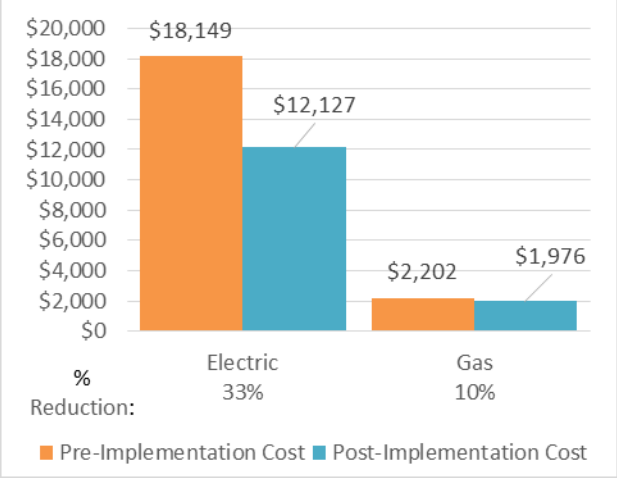


Figure 3 – Potential Post-Implementation Costs (High Priority Measures)



A detailed description of the Administration Building'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 4. A brief description of each category can be found below and a description of savings opportunities can be found in Section 4.

Figure 4 – 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			**15,902**	**3.0**	**0.0**	**$3,750.18**	**$11,426.04**	**$1,990.00**	**$9,436.04**	**2.5**	**16,013**
ECM 1	Install LED Fixtures	Yes	4,476	0.0	0.0	$1,055.58	$3,516.09	$500.00	$3,016.09	2.9	4,507
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	391	0.1	0.0	$92.25	$351.00	$30.00	$321.00	3.5	394
ECM 3	Retrofit Fixtures with LED Lamps	Yes	11,035	2.9	0.0	$2,602.35	$7,558.95	$1,460.00	$6,098.95	2.3	11,112
Lighting Control Measures			**2,612**	**0.7**	**0.0**	**$616.01**	**$3,572.00**	**$380.00**	**$3,192.00**	**5.2**	**2,630**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	1,986	0.6	0.0	$468.28	$2,972.00	$380.00	$2,592.00	5.5	2,000
ECM 5	Install High/Low Lighitng Controls	Yes	626	0.1	0.0	$147.72	$600.00	$0.00	$600.00	4.1	631
Electric Unitary HVAC Measures			**6,398**	**3.5**	**0.0**	**$1,508.87**	**$23,815.43**	**$1,580.00**	**$22,235.43**	**14.7**	**6,443**
	Install High Efficiency Electric AC	No	6,398	3.5	0.0	$1,508.87	$23,815.43	$1,580.00	$22,235.43	14.7	6,443
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**25.8**	**$262.96**	**$10,195.80**	**$400.00**	**$9,795.80**	**37.3**	**3,027**
	Install High Efficiency Furnaces	No	0	0.0	25.8	$262.96	$10,195.80	$400.00	$9,795.80	37.3	3,027
HVAC System Improvements			**571**	**0.0**	**3.5**	**$170.22**	**$329.87**	**$0.00**	**$329.87**	**1.9**	**985**
ECM 6	Install Programmable Thermostats	Yes	571	0.0	3.5	$170.22	$329.87	$0.00	$329.87	1.9	985
Domestic Water Heating Upgrade			**0**	**0.0**	**0.4**	**$4.13**	**$14.34**	**$0.00**	**$14.34**	**3.5**	**48**
ECM 7	Install Low-Flow Domestic Hot Water Devices	Yes	0	0.0	0.4	$4.13	$14.34	$0.00	$14.34	3.5	48
Plug Load Equipment Control - Vending Machine			**1,612**	**0.0**	**0.0**	**$380.12**	**$230.00**	**$0.00**	**$230.00**	**0.6**	**1,623**
ECM 8	Vending Machine Control	Yes	1,612	0.0	0.0	$380.12	$230.00	$0.00	$230.00	0.6	1,623
Custom Measures			**4,840**	**0.0**	**18.3**	**$1,327.94**	**$3,295.00**	**$0.00**	**$3,295.00**	**2.5**	**7,021**
ECM 9	Computer Power Management Software	Yes	3,746	0.0	0.0	$883.53	$2,995.00	$0.00	$2,995.00	3.4	3,773
ECM 10	Install Duct Insulation	Yes	1,093	0.0	18.3	$444.40	$300.00	$0.00	$300.00	0.7	3,248
TOTALS			**31,935**	**7.3**	**48.1**	**$8,020.42**	**$52,878.48**	**$4,350.00**	**$48,528.48**	**6.1**	**37,789**

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

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

TOTALS (High Priority)			**25,537**	**3.8**	**22.2**	**$6,248.59**	**$18,867.25**	**$2,370.00**	**$16,497.25**	**2.6**	**28,319**

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

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

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

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

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

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

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 Administration Building include:

- Reduce Air Leakage
- Close Doors and Windows
- Use Window Treatments/Coverings
- Perform Routine Motor Maintenance
- Use Fans to Reduce Cooling Load
- Clean Evaporator/Condenser Coils on AC Systems
- Clean and/or Replace HVAC Filters
- Check for and Seal Duct Leakage
- Perform Proper Furnace Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- Water Conservation

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

On-Site Generation Measures

TRC evaluated the potential for installing on-site generation for the Administration Building. Based on the configuration of the site and its loads there is a low potential for installing any PV and combined heat and power self-generation measures.

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

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
- 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 4are 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 8.3 for additional information on the ESIP Program.

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

Additional information on relevant incentive programs is located in Section 8. You may also check the following website for more details: www.njcleanenergy.com/ci.

2 FACILITY INFORMATION AND EXISTING CONDITIONS

2.1 Project Contacts

Figure 5 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
Chris Kelly	Supervisor Buildings & Grounds	chris.kelly@wmtps.org	973-229-5929
TRC Energy Services			
Smruiti Srinivasan	Auditor	SSrinivasan@trcsolutions.com	(732) 855-0033

2.2 General Site Information

On February 14, 2016, TRC performed an energy audit at Administration Building located in West Milford, New Jersey. TRC met with facility personnel to review the facility operations and help focus our investigation on specific energy-using systems.

Administration Building is an 8,000 square foot facility primarily comprised of office space. The building has two (2) floors and includes a kitchenette and conference rooms. The building is of typical residential style construction and was built in 1976. The building is 100% heated and 100% cooled. The HVAC equipment and systems at the Administration Building consist of aging and inefficient HVAC equipment in need of replacement. The building is mainly conditioned by a split system AC and a forced air gas-fired furnace for heating. This is one (1) air handling system that is direct fired for heating and is equipped with a cooling coil served by the outdoor condensing unit. The building is cooled by an outdoor condensing unit that is older than its effective useful life.

2.3 Building Occupancy

The building is occupied between Monday and Friday, 8:00 AM to 4:30 PM, year-round. There are 18 full time staff members who occupy the building. The typical schedule is presented in the table below.

Figure 6 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Administration Building	Weekday	8:00AM - 4:30PM
Administration Building	Weekend	No Use

2.4 Building Envelope

The building is constructed of concrete block with a vinyl-siding facade. The building has a pitched roof that is covered with asphalt shingles. The building has double-pane windows, which are in good condition and show little sign of excessive infiltration. The exterior doors are constructed of vinyl and are in good condition.

Figure 7-Building Interior - Windows

2.5 On-Site Generation

Administration Building does not have any on-site electric generation capacity.

2.6 Energy-Using Systems

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

Lighting System

Lighting at the facility is provided mostly by 32-Watt linear fluorescent T8 lamps with electronic ballasts as well as some compact fluorescent lamps (CFL). Most of the fixtures are 2-lamp or 4-foot long troffers with diffusers. Exit signs throughout the building use LED technology. Light fixtures are manually controlled via wall switches.

Figure 8-Lighting Systems

The building's exterior lighting is minimal and consists primarily of high pressure sodium (HPS) fixtures that are controlled by photocells. There are recessed can fixtures under the canopies with incandescent lamps.

Heating System

The building is heated by a forced air system which consists of a gas-fired 450 MBh output furnace that is of standard 80% efficiency and in fair condition. The unit was installed about six years ago; however, the distribution ductwork is likely as old as the building. Insulation is in poor condition or missing ductwork.

Figure 9- Furnace and Distribution

The heating system is controlled by a manual dial thermostat. Per discussions with facility personnel, the occupied temperature set point is typically set at 72°F and is manually set back to 62°F over nights and weekends. However, due to the energy intensity of the building, it is likely that there are nights and weekends that the temperature setback is not implemented.

Cooling System

The building is cooled by a forced air system which consists of an inefficient 20-ton outdoor condensing unit that is in poor condition. It is past its effective useful life at over 15 years old.

Figure 10-Cooling Equipment

A manual dial thermostat controls the cooling system. Per discussions with facility personnel, the occupied temperature set point is typically set at 72°F and is manually turned off overnights and weekends. However due to the energy intensity of the building, it is likely that there are nights and weekends that the cooling is left on.

Domestic Hot Water Heating System

The domestic hot water heating system for the facility consists of a gas fired 40-gallon storage tank water heater. It has a capacity of 40 MBh and is standard 80% efficiency. It is in good condition and was recently installed. This heater provides domestic hot water to sinks throughout the building.

Figure 11- Domestic Hot Water

Building Plug Load

The plug loads in the building include general office and café equipment. There are roughly 33 computer work stations throughout the facility. It appears that there is no centralized PC power management software installed. There is also a refrigerated beverage vending machine, which is not currently controlled based on occupancy.

Figure 12-Plug Load Systems

2.7 Water-Using Systems

There are two (2) restrooms in the Administrative Building. A sampling of restrooms found that faucets are rated for 1.5 gallons per minute (gpm), the toilets are rated at 1.6 gallons per flush (gpf) and the urinals are rated at 1.0 gpf.

3 SITE ENERGY USE AND COSTS

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

3.1 Total Cost of Energy

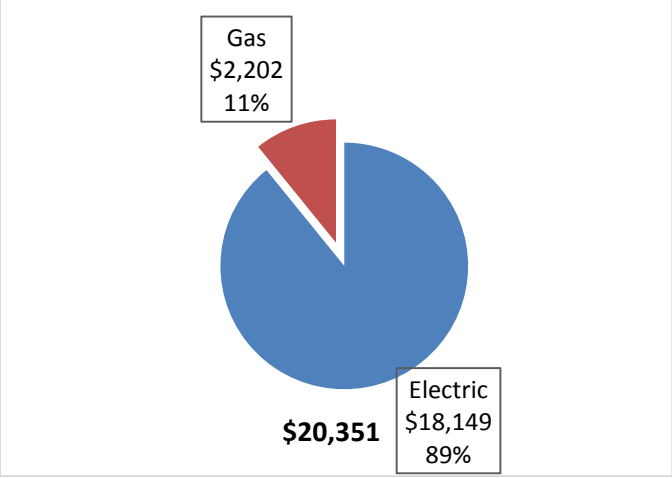
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

Figure 13 - Utility Summary

Utility Summary for Administration Building		
Fuel	**Usage**	**Cost**
Electricity	76,959 kWh	$18,149
Natural Gas	2,164 Therms	$2,202
Total		**$20,351**

The current annual energy cost for this facility is $20,351 as shown in the chart below.

Figure 14 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by Rockland Electric. The average electric cost over the past 12 months was $0.236/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The building pays electric demand charges. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 15 - Electric Usage & Demand

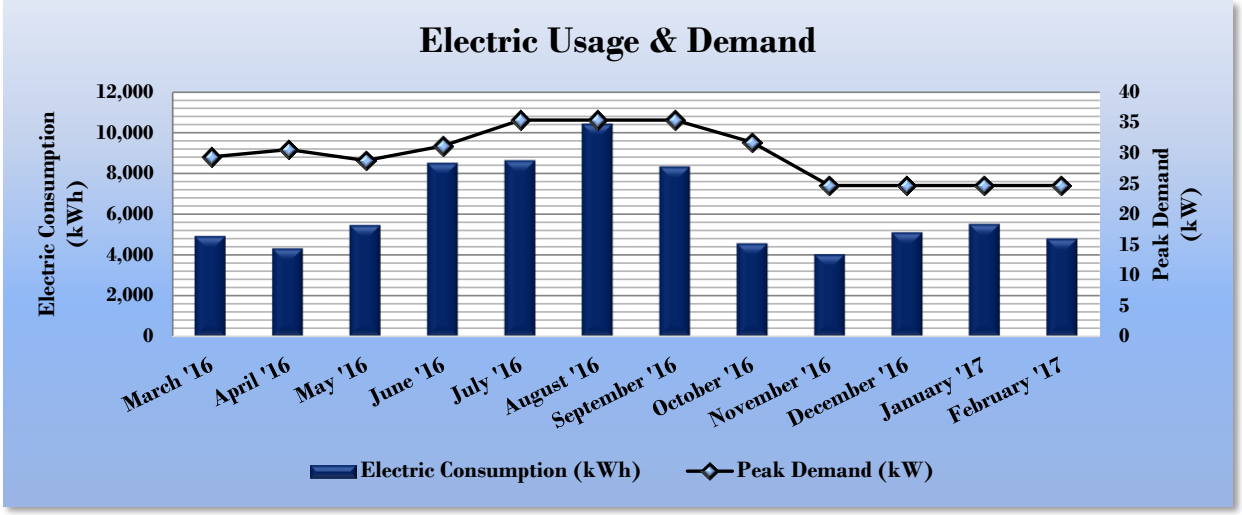


Figure 16 - Electric Usage & Demand

Electric Billing Data for Administration Building					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
3/23/16	28	4,920	29	$118	$1,185
4/20/16	27	4,320	31	$123	$1,064
5/19/16	28	5,460	29	$116	$1,294
6/22/16	33	8,520	31	$125	$1,962
7/22/16	29	8,640	35	$142	$2,025
8/23/16	31	10,440	35	$142	$2,391
9/23/16	30	8,340	35	$142	$1,956
10/24/16	30	4,560	32	$128	$1,125
11/22/16	28	4,020	25	$99	$968
12/21/16	28	5,100	25	$99	$1,196
1/25/17	34	5,520	25	$99	$1,305
2/23/17	28	4,800	25	$99	$1,131
Totals	**354**	**74,640**	**35.4**	**$1,434**	**$17,602**
Annual	**365**	**76,959**	**35.4**	**$1,478**	**$18,149**

3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $1.017/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

Figure 17 - Natural Gas Usage

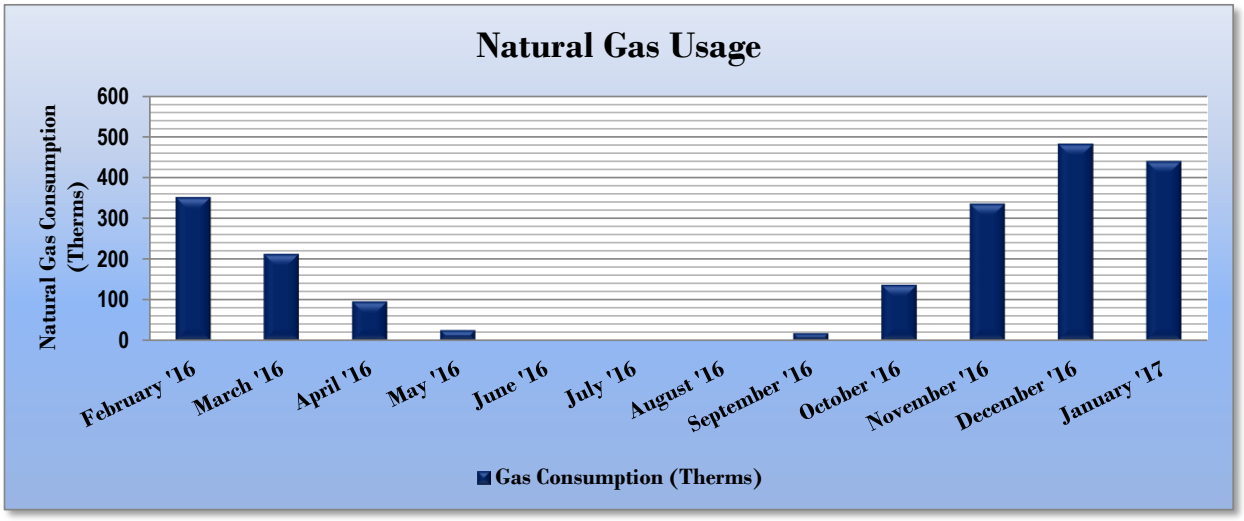


Figure 18 - Natural Gas Usage

Gas Billing Data for Administration Building			
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost
3/11/16	29	352	$331
4/12/16	31	213	$191
5/11/16	28	96	$92
6/10/16	29	25	$33
7/12/16	31	0	$12
8/10/16	28	0	$12
9/9/16	29	0	$12
10/10/16	30	18	$27
11/10/16	30	137	$144
12/12/16	31	336	$338
1/12/17	30	483	$504
2/10/17	28	440	$440
Totals	**354**	**2,099**	**$2,135**
Annual	**365**	**2,164**	**$2,202**

3.4 Benchmarking

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

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

Figure 19 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Administration Building	National Median Building Type: Office
Source Energy Use Intensity (kBtu/ft^2)	131.5	148.1
Site Energy Use Intensity (kBtu/ft^2)	59.9	67.3

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

Figure 20 - Energy Use Intensity Comparison – Following Installation of Recommended Measures

Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Administration Building	National Median Building Type: Office
Source Energy Use Intensity (kBtu/ft^2)	94.4	148.1
Site Energy Use Intensity (kBtu/ft^2)	46.2	67.3

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 74.

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

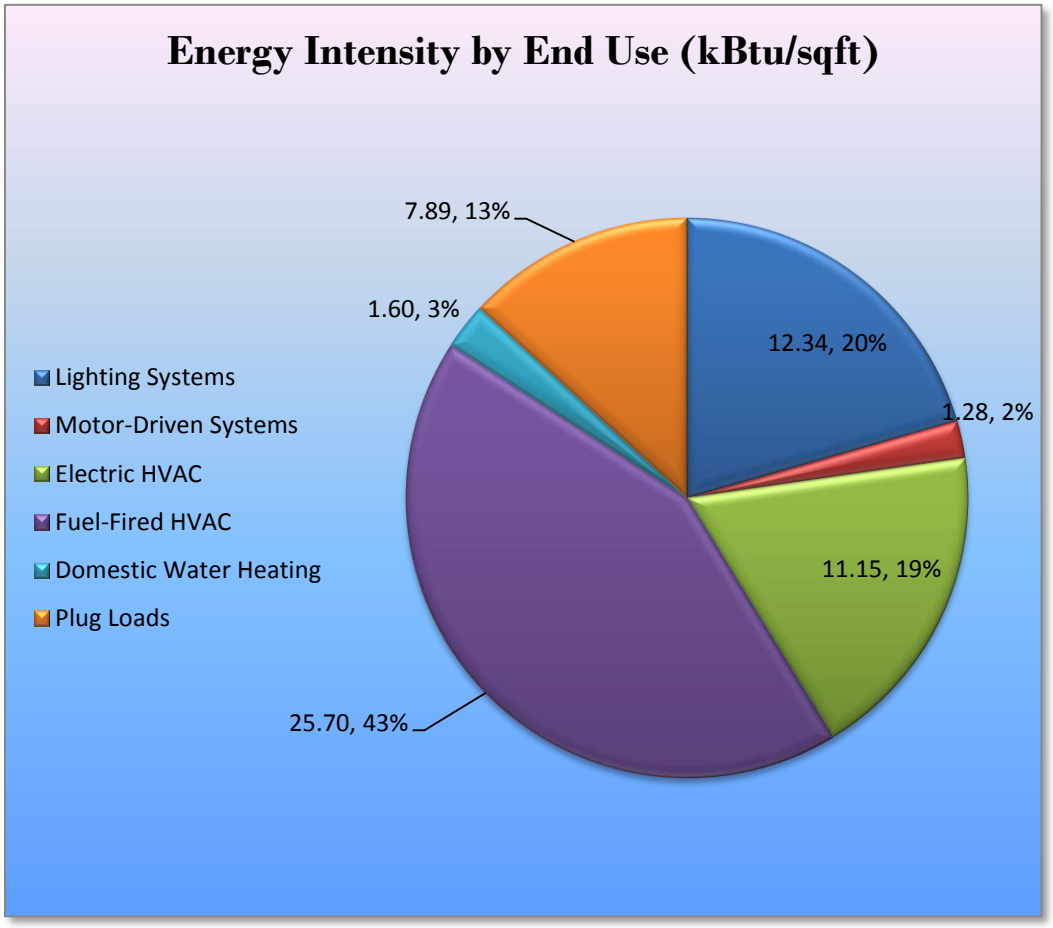
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

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. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building to determine their proportional contribution to overall building energy usage. This chart of energy end uses highlights the relative contribution of each equipment category to total energy usage. This can help determine where the greatest benefits might be found from energy efficiency measures.

Figure 21 - Energy Balance (% and kBtu/SF)



4 ENERGY CONSERVATION MEASURES

Level of Analysis

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information to the Administration Building 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 22 – 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		**15,902**	**3.0**	**0.0**	**$3,750.18**	**$11,426.04**	**$1,990.00**	**$9,436.04**	**2.5**	**16,013**
ECM 1	Install LED Fixtures	4,476	0.0	0.0	$1,055.58	$3,516.09	$500.00	$3,016.09	2.9	4,507
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	391	0.1	0.0	$92.25	$351.00	$30.00	$321.00	3.5	394
ECM 3	Retrofit Fixtures with LED Lamps	11,035	2.9	0.0	$2,602.35	$7,558.95	$1,460.00	$6,098.95	2.3	11,112
Lighting Control Measures		**2,612**	**0.7**	**0.0**	**$616.01**	**$3,572.00**	**$380.00**	**$3,192.00**	**5.2**	**2,630**
ECM 4	Install Occupancy Sensor Lighting Controls	1,986	0.6	0.0	$468.28	$2,972.00	$380.00	$2,592.00	5.5	2,000
ECM 5	Install High/Low Lighitng Controls	626	0.1	0.0	$147.72	$600.00	$0.00	$600.00	4.1	631
HVAC System Improvements		**571**	**0.0**	**3.5**	**$170.22**	**$329.87**	**$0.00**	**$329.87**	**1.9**	**985**
ECM 6	Install Programmable Thermostats	571	0.0	3.5	$170.22	$329.87	$0.00	$329.87	1.9	985
Domestic Water Heating Upgrade		**0**	**0.0**	**0.4**	**$4.13**	**$14.34**	**$0.00**	**$14.34**	**3.5**	**48**
ECM 7	Install Low-Flow Domestic Hot Water Devices	0	0.0	0.4	$4.13	$14.34	$0.00	$14.34	3.5	48
Plug Load Equipment Control - Vending Machine		**1,612**	**0.0**	**0.0**	**$380.12**	**$230.00**	**$0.00**	**$230.00**	**0.6**	**1,623**
ECM 8	Vending Machine Control	1,612	0.0	0.0	$380.12	$230.00	$0.00	$230.00	0.6	1,623
Custom Measures		**4,840**	**0.0**	**18.3**	**$1,327.94**	**$3,295.00**	**$0.00**	**$3,295.00**	**2.5**	**7,021**
ECM 9	Computer Power Management Software	3,746	0.0	0.0	$883.53	$2,995.00	$0.00	$2,995.00	3.4	3,773
ECM 10	Install Duct Insulation	1,093	0.0	18.3	$444.40	$300.00	$0.00	$300.00	0.7	3,248
TOTALS		**25,537**	**3.8**	**22.2**	**$6,248.59**	**$18,867.25**	**$2,370.00**	**$16,497.25**	**2.6**	**28,319**

* - 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).

4.2 Lighting Upgrades

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

Figure 23 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**14,841**	**3.0**	**0.0**	**$3,499.85**	**$9,863.34**	**$1,990.00**	**$7,873.34**	**2.2**	**14,944**
ECM 1	Install LED Fixtures	4,476	0.0	0.0	$1,055.58	$1,953.39	$500.00	$1,453.39	1.4	4,507
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	391	0.1	0.0	$92.25	$351.00	$30.00	$321.00	3.5	394
ECM 3	Retrofit Fixtures with LED Lamps	9,973	2.9	0.0	$2,352.03	$7,558.95	$1,460.00	$6,098.95	2.6	10,043

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

ECM 1: Install LED Fixtures

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0
Exterior	4,476	0.0	0.0	$1,055.58	$1,953.39	$500.00	$1,453.39	1.4	4,507

Measure Description

We recommend replacing existing fixtures containing high pressure sodium lamps with new reduced wattage, 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 that are much longer than traditional HID technologies, including high pressure sodium.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	391	0.1	0.0	$92.25	$351.00	$30.00	$321.00	3.5	394
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.0	0

Measure Description

We recommend retrofitting existing T12 fluorescent fixtures by removing fluorescent tubes and ballasts and replacing them with LEDs and LED drivers (if necessary), which are designed to be used retrofitted fluorescent fixtures. The measure uses the existing fixture housing but replaces the rest of the components with more efficient lighting technology. This measure saves energy by installing LEDs, which use less power than other lighting technologies yet provide equivalent lighting output for the space.

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

ECM 3: Retrofit Fixtures with LED Lamps

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	10,575	2.9	0.0	$2,493.87	$7,397.69	$1,450.00	$5,947.69	2.4	10,649
Exterior	460	0.0	0.0	$108.48	$161.26	$10.00	$151.26	1.4	463

Measure Description

We recommend retrofitting existing incandescent, compact fluorescent and T8 fluorescent fixtures 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 that are more than twice that of fluorescent tubes and more than 10 times longer than many incandescent lamps.

4.3 Lighting Control Measures

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

Figure 24 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**2,612**	**0.7**	**0.0**	**$616.01**	**$3,572.00**	**$380.00**	**$3,192.00**	**5.2**	**2,630**
ECM 4	Install Occupancy Sensor Lighting Controls	1,986	0.6	0.0	$468.28	$2,972.00	$380.00	$2,592.00	5.5	2,000
ECM 5	Install High/Low Lighitng Controls	626	0.1	0.0	$147.72	$600.00	$0.00	$600.00	4.1	631

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)
1,986	0.6	0.0	$468.28	$2,972.00	$380.00	$2,592.00	5.5	2,000

Measure Description

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

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

ECM 5: Install High/Low 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)
626	0.1	0.0	$147.72	$600.00	$0.00	$600.00	4.1	631

Measure Description

We recommend installing occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons. Typical areas for such lighting control are hallway areas.

Lighting fixtures with these controls operate at default low levels when the area is not occupied to provide minimal lighting to meet security or safety requirements. Sensors detect occupancy using ultrasonic and/or infrared sensors. The lighting systems are switched to full lighting levels whenever an occupant is detected. Fixtures are automatically switched back to low level after an area has been vacant for a preset period of time. Energy savings results from only providing full lighting levels when it is required.

For this type of measure the occupancy sensors will generally be ceiling or fixture mounted. Sufficient sensor coverage needs to be provided to ensure that lights turn on in each area as an occupant approaches. Additional savings from reduced lighting maintenance may also result from this measure, due to reduced lamp operation.

4.4 HVAC System Upgrades

Our recommendation for HVAC system improvement are summarized in Figure 25 below.

Figure 25 - Summary of HVAC System Improvement ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**571**	**0.0**	**3.5**	**$170.22**	**$329.87**	**$0.00**	**$329.87**	**1.9**	**985**
ECM 6	Install Programmable Thermostats	571	0.0	3.5	$170.22	$329.87	$0.00	$329.87	1.9	985

ECM 6: Install Programmable Thermostats

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)
571	0.0	3.5	$170.22	$329.87	$0.00	$329.87	1.9	985

Measure Description

We recommend replacing the main HVAC system manual thermostat with a programmable thermostat. This thermostat controls the air handling system that operates as a gas fired furnace in the heating season and is equipped with a cooling coil served by the outdoor condensing unit during the cooling season. Manual thermostats are generally adjusted to a single heating and cooling setpoint and left at that setting regardless of occupancy in the area served by the HVAC equipment. As a result, the same level of heating and cooling is provided regardless of the occupancy in the space. Programmable thermostats can be set to maintain different temperature settings for different times of day and for different days of the week. By reducing heating temperature setpoints and raising cooling temperature setpoints when space are unoccupied, the operation of the HVAC equipment is reduced while still maintaining reasonable space temperatures for building usage at all times.

Programmable thermostats provide energy savings by reducing heating and cooling energy usage when a room is unoccupied.

4.5 Domestic Hot Water Heating System Upgrades

Our recommendations for domestic water heating system improvements are summarized in Figure 26 below.

Figure 26 - Summary of Domestic Water Heating ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**0.4**	**$4.13**	**$14.34**	**$0.00**	**$14.34**	**3.5**	**48**
ECM 7	Install Low-Flow Domestic Hot Water Devices	0	0.0	0.4	$4.13	$14.34	$0.00	$14.34	3.5	48

ECM 7: Install Low-Flow DHW Devices

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
0	0.0	0.4	$4.13	$14.34	$0.00	$14.34	3.5	48

Measure Description

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

4.6 Plug Load Equipment Control - Vending Machines

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

Figure 27 - Summary of Plug Load Equipment ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Plug Load Equipment Control - Vending Machine		**1,612**	**0.0**	**0.0**	**$380.12**	**$230.00**	**$0.00**	**$230.00**	**0.6**	**1,623**
ECM 9	Vending Machine Control	1,612	0.0	0.0	$380.12	$230.00	$0.00	$230.00	0.6	1,623

ECM 8: Vending Machine Control

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
1,612	0.0	0.0	$380.12	$230.00	$0.00	$230.00	0.6	1,623

Measure Description

Vending machines operate continuously, even during non-business hours. It is recommended to install occupancy sensor controls to reduce the energy use of the beverage vending machine. 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.

4.7 Custom Measures

Additional custom measure energy saving opportunities are addressed in this section. Recommended custom measures are summarized in Figure 28 below.

Figure 28 - Summary of Custom ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Custom Measures		**4,840**	**0.0**	**18.3**	**$1,327.94**	**$3,295.00**	**$0.00**	**$3,295.00**	**2.5**	**7,021**
ECM 9	Computer Power Management Software	3,746	0.0	0.0	$883.53	$2,995.00	$0.00	$2,995.00	3.4	3,773
ECM 10	Install Duct Insulation	1,093	0.0	18.3	$444.40	$300.00	$0.00	$300.00	0.7	3,248

ECM 9: Computer Power Management Software

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
3,746	0.0	0.0	$883.53	$2,995.00	$0.00	$2,995.00	3.4	3,773

Measure Description

We recommend the implementation of computer power management software. The computing environment in most school and office facilities includes desktops, which are typically left on over nights, weekends and holidays. Screen savers are commonly confused as a power management strategy. This contributes to excessive electrical energy consumption, which may be avoided by proper management. There are innovative software packages available in the market today that are designed to deliver significant energy saving and provide ongoing tracking measurements. Operational and maintenance benefits are captured through the use of a central power management platform where issues may be diagnosed and problematic devices may be isolated. Energy savings policies may be enforced as well as identifying and eliminating underutilized devices. This measure investigates the potential benefits to implementing computer power management software to better match the energy use to user needs.

ECM 10: Install Duct Insulation

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
1,093	0.0	18.3	$444.40	$300.00	$0.00	$300.00	0.7	3,248

Measure Description

We recommend installing insulation on distribution ductwork for the main HVAC system. Distribution system losses are dependent on supply air temperature, the size of the distribution system, the heating and cooling equipment efficiencies as well as the level of existing insulation. Significant energy savings can be achieved when insulation has not been well maintained. This measure saves energy by reducing heating and cooling losses from the HVAC distribution system.

It should be noted that if the furnace and condensing unit are replaced with high efficiency equipment, this will impact the energy savings as there would be interactive effects.

4.8 ECMs Evaluated, But Not Recommended as High Priority

The measures below have been evaluated by the auditor but are not recommended for implementation at the facility based on program protocols. Reasons for exclusion can be found in each measure description section. It should be noted that these measures were evaluated to increase the value of this audit report and they would be recommended if the School District pursed implementation under the Energy Savings Improvement Program.

Figure 29 – Summary of Measures Evaluated, But Not Recommended as High Priority

Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures	**6,398**	**3.5**	**0.0**	**$1,508.87**	**$23,815.43**	**$1,580.00**	**$22,235.43**	**14.7**	**6,443**
Install High Efficiency Electric AC	6,398	3.5	0.0	$1,508.87	$23,815.43	$1,580.00	$22,235.43	14.7	6,443
Gas Heating (HVAC/Process) Replacement	**0**	**0.0**	**25.8**	**$262.96**	**$10,195.80**	**$400.00**	**$9,795.80**	**37.3**	**3,027**
Install High Efficiency Furnaces	0	0.0	25.8	$262.96	$10,195.80	$400.00	$9,795.80	37.3	3,027
TOTALS	**6,398**	**3.5**	**25.8**	**$1,771.83**	**$34,011.23**	**$1,980.00**	**$32,031.23**	**18.1**	**9,470**

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

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

Install High Efficiency Air Conditioning Units

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
6,398	3.5	0.0	$1,508.87	$23,815.43	$1,580.00	$22,235.43	14.7	6,443

Measure Description

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

Reasons for not Recommending as a High Priority Measure

This measure is not recommended based on energy savings alone because the payback period for the measure is approximately equivalent to the expected life of the replacement equipment at 15 years . This unit is in poor condition, therefore, based on the existing condition we suggest considering this measure for implementation based on other benefits such as improved indoor air quality, reduced maintenance and increased efficiency.

Considerations

If the school district moves forward toward implementation of a comprehensive project under the Energy Savings Improvement Program, we would recommend including this measure.

Install High Efficiency Furnaces

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	25.8	$262.96	$10,195.80	$400.00	$9,795.80	37.3	3,027

Measure Description

We recommend replacing existing standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases which can significantly improve furnace efficiency. Savings result from improved system efficiency. Condensing furnaces may reach efficiencies of 95% which is a significant increase over the standard 80% of the existing equipment.

Reasons for not Recommending as a High Priority Measure

This measure is not recommended based on energy savings alone because the payback period for the measure exceeds the expected life of the replacement equipment, which is about 18 years. This unit is in poor condition, therefore, based on the existing condition we suggest considering this measure for implementation based on other benefits such as improved indoor air quality, reduced maintenance and increased efficiency.

Considerations

If the school district moves forward toward implementation of a comprehensive project under the Energy Savings Improvement Program, we would recommend including this measure.

5 ENERGY EFFICIENT PRACTICES

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

Reduce Air Leakage

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

Close Doors and Windows

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

Use Window Treatments/Coverings

A substantial amount of heat gain can occur through uncovered or untreated windows, especially older single pane windows and east or west-facing windows. Treatments such as high-reflectivity films or covering windows with shades or shutters can reduce solar heat gain and, consequently, cooling load and can reduce internal heat loss and the associated heating load.

Perform Routine Motor Maintenance

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

Use Fans to Reduce Cooling Load

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

Clean Evaporator/Condenser Coils on AC Systems

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

Clean and/or Replace HVAC Filters

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

Check for and Seal Duct Leakage

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

Perform Proper 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.

Plug Load Controls

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

Water Conservation

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

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

Refer to Section 4.5 for any low-flow ECM recommendations.

6 On-Site Generation Measures

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

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

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

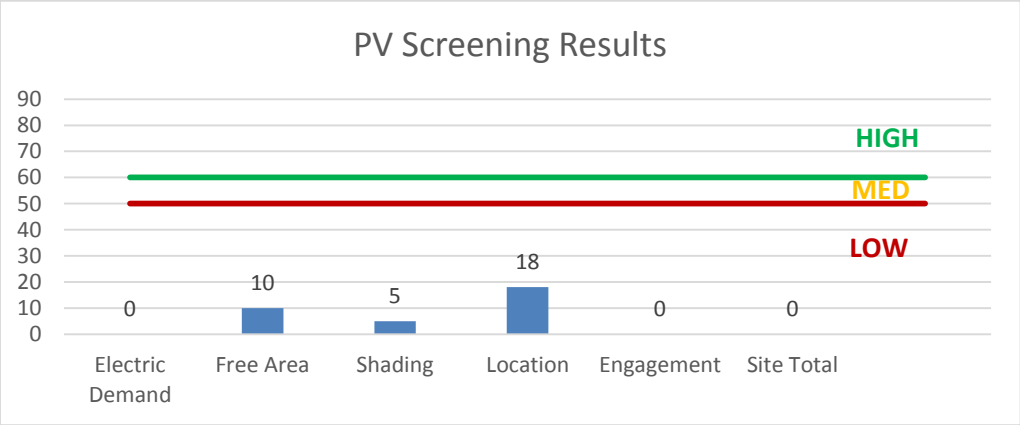
6.1 Photovoltaic

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

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

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

Figure 30 - Photovoltaic Screening



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

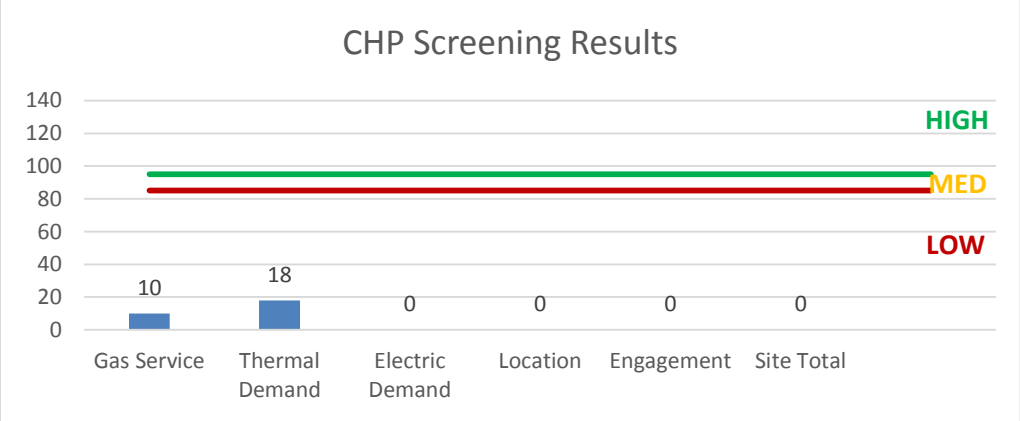
Combined heat and power (CHP) is the on-site generation of electricity along with the recovery of heat energy, which is put to beneficial use. Common technologies for CHP include reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines. Electric 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 31 - 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, DR is not applicable to this facility.

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

Figure 32 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Direct Install	Pay For Performance Existing Buildings	Large Energy Users Program	Combined Heat & Power and Fuel Cell
ECM 1	Install LED Fixtures	x		x			
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	x		x			
ECM 3	Retrofit Fixtures with LED Lamps	x		x			
ECM 4	Install Occupancy Sensor Lighting Controls	x		x			
ECM 5	Install High/Low Lighitng Controls			x			
ECM 6	Install Programmable Thermostats	x		x			
ECM 7	Install Low-Flow Domestic Hot Water Devices			x			
ECM 8	Vending Machine Control			x			
ECM 9	Computer Power Management Software						
ECM 10	Install Duct Insulation						

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 program is a "whole-building" energy improvement program designed for larger facilities. It requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single facility or several facilities, with incentives capped based on the entity's annual energy consumption. LEUP applicants can use in-house staff or a preferred contractor.

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

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

8.1 SmartStart

Overview

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

Equipment with Prescriptive Incentives Currently Available:

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

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

Incentives

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

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

How to Participate

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

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

8.2 Direct Install

Overview

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

Incentives

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

How to Participate

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

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

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

8.3 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
Conference Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,210	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	2,210	0.03	109	0.0	$25.80	$75.20	$15.00	2.33
Business Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	93	2,210	Relamp	Yes	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,547	0.20	647	0.0	$152.57	$416.80	$80.00	2.21
Admin Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	0.12	380	0.0	$89.52	$306.27	$60.00	2.75
Office Suite	20	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	20	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	1.17	3,796	0.0	$895.17	$2,442.67	$470.00	2.20
Reception	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	0.12	380	0.0	$89.52	$306.27	$60.00	2.75
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Office	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	2,210	0.02	75	0.0	$17.68	$63.20	$0.00	3.57
Office	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	0.18	569	0.0	$134.27	$401.40	$80.00	2.39
Director's Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Director's Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	0.12	380	0.0	$89.52	$306.27	$60.00	2.75
Office Suite	10	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	0.58	1,898	0.0	$447.58	$1,491.33	$270.00	2.73
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Restroom Hallway	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	4,000	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	2,800	0.12	687	0.0	$162.02	$390.27	$40.00	2.16
Restroom	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	0.12	380	0.0	$89.52	$460.27	$75.00	4.30
Restroom	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.03	85	0.0	$20.12	$58.50	$10.00	2.41
Janitors Closet	1	Incandescent: Screw in Lamp	Wall Switch	40	2,210	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	Wall Switch	6	2,210	0.03	88	0.0	$20.73	$53.75	$5.00	2.35
Restroom	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	1,547	0.06	201	0.0	$47.44	$396.40	$35.00	7.62
Restroom	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	10	2,210	None	No	3	LED Screw-In Lamps: Screw in Lamp	Wall Switch	10	2,210	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Basement Entrance	2	Compact Fluorescent: Screw in Lamp	Wall Switch	42	2,210	Relamp	No	2	LED Screw-In Lamps: Screw in Lamp	Wall Switch	29	2,210	0.02	65	0.0	$15.37	$97.71	$0.00	6.36
Basement Hallway	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	4,000	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	2,800	0.23	1,374	0.0	$324.04	$580.53	$80.00	1.54
Conference Kitchenette	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,547	0.12	380	0.0	$89.52	$460.27	$75.00	4.30
Hallway	3	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	4,000	Relamp	Yes	3	LED - Linear Tubes: (4) 4' Lamps	High/Low Control	58	2,800	0.18	1,031	0.0	$243.03	$485.40	$60.00	1.75

	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
Testing Office	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Tech Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.03	85	0.0	$20.12	$58.50	$10.00	2.41
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.03	85	0.0	$20.12	$58.50	$10.00	2.41
Conference Room	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,547	0.10	323	0.0	$76.28	$445.50	$65.00	4.99
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.03	85	0.0	$20.12	$58.50	$10.00	2.41
Copy Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.03	85	0.0	$20.12	$58.50	$10.00	2.41
Storage Hallway	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	4,000	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,000	0.03	154	0.0	$36.42	$58.50	$10.00	1.33
Storage Hallway	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	4,000	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	4,000	0.04	262	0.0	$61.81	$95.13	$20.00	1.22
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.03	85	0.0	$20.12	$58.50	$10.00	2.41
Plan Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	2,210	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	2,210	0.04	145	0.0	$34.15	$95.13	$20.00	2.20
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.03	85	0.0	$20.12	$58.50	$10.00	2.41
Storage	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,210	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,210	0.05	153	0.0	$35.98	$117.00	$10.00	2.97
Furnace Room	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	2,210	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,547	0.13	431	0.0	$101.71	$350.00	$40.00	3.05
Closet	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	2,210	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,547	0.11	350	0.0	$82.57	$350.00	$20.00	4.00
Transition Spaces	8	Exit Signs: LED - 2 W Lamp	None	6	8,760	None	No	8	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Exterior	2	Halogen Incandescent: Recessed Can	None	65	4,000	Relamp	No	2	LED Screw-In Lamps: Screw in Lamp	None	10	4,000	0.00	440	0.0	$103.77	$107.51	$10.00	1.04
Exterior	2	High-Pressure Sodium: (1) 400W Lamp	None	465	4,000	Fixture Replacement	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	120	4,000	0.00	2,760	0.0	$650.89	$2,344.06	$200.00	3.60
Exterior	3	High-Pressure Sodium: (1) 150W Lamp	None	188	4,000	Fixture Replacement	No	3	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	None	45	4,000	0.00	1,716	0.0	$404.68	$1,172.03	$300.00	2.90
Exterior	1	Compact Fluorescent: Wall Pack	None	18	4,000	Relamp	No	1	LED Screw-In Lamps: Screw in Lamp	None	13	4,000	0.00	20	0.0	$4.72	$53.75	$0.00	11.40

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
Furnace	Blower Motor	1	Supply Fan	1.5	85.0%	No	2,745	No	85.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Furnace	Burner Motor	1	Other	0.1	74.0%	No	2,745	No	74.0%	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
Copy Room	Cooling	1	Window AC	1.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Exterior	Cooling	1	Split-System AC	20.00		Yes	1	Split-System AC	20.00		11.50		No	3.54	6,398	0.0	$1,508.87	$23,815.43	$1,580.00	14.74

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
Mechanical Room	Heating	1	Furnace	450.00	Yes	1	Furnace	450.00	95.00%	AFUE	0.00	0	25.8	$262.96	$10,195.80	$400.00	37.25

Programmable Thermostat Recommendations

		Recommendation Inputs				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	Thermostat Quantity	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Admin Building	Heating/Cooling	1	20.00		450.00	0.00	571	3.5	$170.22	$329.87	$0.00	1.94

DHW Inventory & Recommendations

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

Low-Flow Device Recommendations

	Recommedation Inputs				Energy Impact & Financial Analysis						
Location	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	2	Faucet Aerator (Lavatory)	1.50	1.00	0.00	0	0.4	$4.13	$14.34	$0.00	3.47

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Admin Building	33	Computer	120.0	
Admin Building	5	Small Printer	90.0	
Admin Building	7	Medium Printer	250.0	
Admin Building	2	Large Printer	1,200.0	
Admin Building	3	Shredder	400.0	
Admin Building	2	Projector	500.0	
Admin Building	1	Microwave	1,500.0	
Admin Building	1	Medium Fridge	450.0	
Admin Building	1	Large Fridge	690.0	
Admin Building	3	Coffee Machine	1,200.0	
Admin Building	1	Toaster	1,100.0	
Admin Building	2	TV	90.0	

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
Admin Building	1	Refrigerated	Yes	0.00	1,612	0.0	$380.12	$230.00	$0.00	0.61

Custom Recommendations

Computer Power Management Software

# of Desktops	Normal Running Mode					Idle Running Mode					Suspended/Off Mode				
33	*Mon - Fri 8AM-5PM*	*Mon - Fri 5PM-8AM*	*Weekends & Holidays*	Energy Rate (W)*	Weekly Run Hours	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	*Weekends & Holidays*	*Energy Rate (W)**	*Weekly Run Hours*	Mon - Fri 8AM-5PM	Mon - Fri 5PM-8AM	Weekends & Holidays	Energy Rate (W)*	*Weekly Run Hours*
Existing Conditions	75%	25%	0%	120	**50**	25%	5%	5%	80	**16**	0%	70%	95%	5	**102**
Proposed Conditions	75%	5%	0%	120	**34**	5%	0%	0%	80	**2**	20%	95%	100%	5	**132**

Usage per Device			Energy Impact & Financial Analysis					
Weeks of Use	Annual kWh Usage	*Diversity Factor***	Total Annual kWh Savings	Total Annual Energy Cost Savings	*Cost per Desktop*	*Add'l Hardware Cost*	Total Installation Cost	Simple Payback Period (Years)
48	375	90%	3,746	$884	$15.00	$2,500.0	$2,995	3.39
48	249							

Install Duct Insulation

Existing Conditions												
Ductwork Description (must be in unconditioned space)	*Duct Width (in)*	*Duct Height (in)*	*Uninsulated Duct Length (ft)*	*Cooling Capacity of Ducted System (Tons)*	*Average Cooling Efficiency (kW/Ton)*	*Affected Heating Fuel*	*Heating Capacity of Ducted System (Btu/hr)*	*Average Heating Efficiency (kW/Ton Electric; %AFUE Fuel)*	*Duct Cross-Section (in2)*	*Annual EFL Cooling Hours*	*Annual EFL Heating Hours*	*Square Footage of Ductwork*
Furnace	36	24	10	20	1.04	Gas	450,000	80%	864	909	366	100

Energy Impact & Financial Analysis					
Annual kWh Savings	**Elec Cost Savings**	**Annual Gas Savings (mmBtu)**	**Gas Cost Savings**	**Estimated Install Cost**	**Simple Payback Period (Years)**
1,093	$258	18	$187	$300	0.68

Equations: (Based on Industry Standards)

kWh Savings = Ton/Unit x kW/Ton x EFLH (of System with Ductwork to be Treated) x (1- ExistingEfficiency/ProposedEfficiency)
mmBtu Savings = Btu/hr / AFUE x EFLH (of System with Ductwork to be Treated) x (1- ExistingEfficiency/ProposedEfficiency) / 1000000
Effective Duct Efficiencies are Estimated Based on Previous Project Experience, Data below
Distribution System Estimated Efficieies for a General Office Building
Estimated Costs at $3.00/sqft

88% Cooling Existing
94% Cooling Proposed
74% Heating Existing
81% Heating Proposed

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

ENERGY STAR® Statement of Energy Performance

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74

ENERGY STAR® Score[1]

Administration Building

Primary Property Type: Office
Gross Floor Area (ft²): 8,000
Built: 1976

For Year Ending: January 31, 2017
Date Generated: February 25, 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
Administration Building 46 Highlander Drive West Milford, New Jersey 07480	West Milford Township School District 46 Highlander Drive West Milford, NJ 07480 (973) 697-1700	Barbara Francisco 46 Highlander Drive West Milford, NJ 07480 (973) 697-1700 Ext. 5050 barbara.francisco@wmtps.org

Property ID: 6234708

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
58.2 kBtu/ft²

Source EUI
128.1 kBtu/ft²

Annual Energy by Fuel		
Electric - Grid (kBtu)	256,458 (55%)	
Natural Gas (kBtu)	209,412 (45%)	

National Median Comparison	
National Median Site EUI (kBtu/ft²)	78
National Median Source EUI (kBtu/ft²)	171.7
% Diff from National Median Source EUI	-25%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	40

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)