Local Government Energy Audit:
Energy Audit Report

Pershing Field Athletic Complex

City of Jersey City
201 Central Avenue
Jersey City, NJ 07307

February 19, 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 saving are included in this report to help make decisions about reducing energy use at the facility. This report, however, is not intended to serve as a detailed engineering design document. Further design and analysis may be necessary in order to implement some of the measures recommended in this report.

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

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

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

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I EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Pershing Field Athletic Complex. The goal of a LGEA is to provide you with information on how your facility uses energy, identify energy conservation measures (ECMs) that can help to reduce your energy usage, and put you in a position to implement the recommended ECMs. The LGEA program also helps you to receive financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing the ECMs.

This study was conducted by TRC Energy Services (TRC), as part of a comprehensive effort to assist New Jersey local governments in reducing their energy usage, to help them control costs, reduce demand on energy systems, and help protect our environment.

1.1 Facility Summary

Pershing Field Athletic Complex is comprised of three (3) one-story buildings totaling 38,108 square feet. The site construction was completed in 1960. Two (2) buildings are used for swimming and ice skating activities and the third building is used as the main office and the pool's locker room. The facility is part of a larger recreational park.

The sloped roof of the ice skating rink holds a 75-kW solar photovoltaic array. A thorough description of the facility and our observations are located in Section 2.

1.2 Your Cost Reduction Opportunities

Energy Conservation Measures

TRC recommends 11 measures, which together represent an opportunity to reduce annual energy costs by roughly $23,263 and reduce annual greenhouse gas emissions by 264,106 lbs CO_2e. We estimate that the measures would likely pay for themselves in energy savings in roughly 6.4 years. The breakdown of existing and potential utility costs is illustrated in Figure 1 and Figure 2, respectively. These measures represent an opportunity to reduce Pershing Field Athletic Complex's annual energy usage by about 30%.

Figure 1 – Previous 12 Month Utility Costs

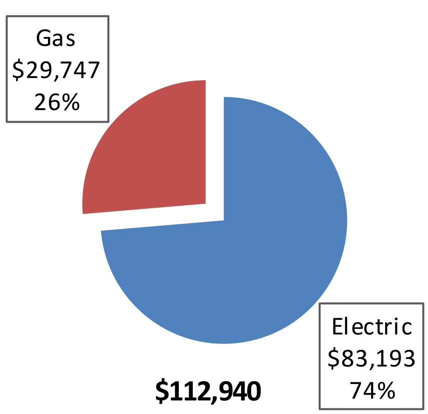
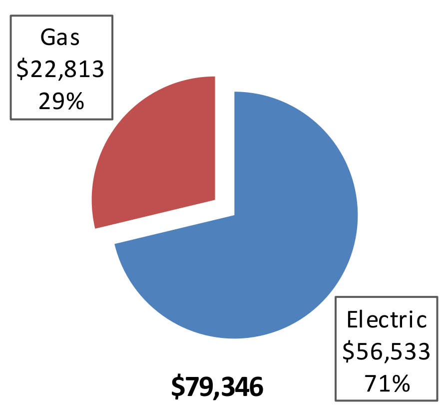


Figure 2 – Potential Post-Implementation Costs



A detailed description of Pershing Field Athletic Complex's existing energy use can be found in Section 3.

The evaluated measures have been listed and grouped into major categories as shown in Figure 3. Brief descriptions of the categories can be found below and descriptions of the individual opportunities can be found in Section 4.

Figure 3 – Summary of Energy Conservation Measures

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			**143,198**	**67.0**	**0.0**	**$14,990.40**	**$109,840.81**	**$7,750.00**	**$102,090.81**	**6.81**	**144,199**
ECM 1	Install LED Fixtures	Yes	132,680	62.5	0.0	$13,889.36	$99,939.08	$7,700.00	$92,239.08	6.64	133,608
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	8,173	3.9	0.0	$855.60	$7,802.67	$0.00	$7,802.67	9.12	8,230
ECM 3	Retrofit Fixtures with LED Lamps	Yes	998	0.5	0.0	$104.51	$270.63	$50.00	$220.63	2.11	1,005
ECM 4	Install LED Exit Signs	Yes	1,346	0.1	0.0	$140.93	$1,828.44	$0.00	$1,828.44	12.97	1,356
Lighting Control Measures			**891**	**0.4**	**0.0**	**$93.31**	**$1,624.00**	**$280.00**	**$1,344.00**	**14.40**	**898**
ECM 5	Install Occupancy Sensor Lighting Controls	Yes	891	0.4	0.0	$93.31	$1,624.00	$280.00	$1,344.00	14.40	898
Motor Upgrades			**5,189**	**3.4**	**0.0**	**$543.20**	**$7,396.64**	**$0.00**	**$7,396.64**	**13.62**	**5,225**
ECM 6	Premium Efficiency Motors	Yes	5,189	3.4	0.0	$543.20	$7,396.64	$0.00	$7,396.64	13.62	5,225
Variable Frequency Drive (VFD) Measures			**5,869**	**1.4**	**0.0**	**$614.40**	**$8,744.15**	**$0.00**	**$8,744.15**	**14.23**	**5,910**
ECM 7	Install VFDs on Hot Water Pumps	Yes	1,518	0.4	0.0	$158.93	$2,728.85	$0.00	$2,728.85	17.17	1,529
ECM 8	Install VFDs on Boiler Feedwater Pumps	Yes	4,351	1.0	0.0	$455.47	$6,015.30	$0.00	$6,015.30	13.21	4,381
Electric Unitary HVAC Measures			**836**	**0.1**	**0.0**	**$87.54**	**$2,054.62**	**$0.00**	**$2,054.62**	**23.47**	**842**
ECM 9	Install High Efficiency Electric AC	Yes	836	0.1	0.0	$87.54	$2,054.62	$0.00	$2,054.62	23.47	842
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**90.3**	**$685.17**	**$26,989.58**	**$2,105.25**	**$24,884.33**	**36.32**	**10,576**
ECM 10	Install High Efficiency Hot Water Boilers	Yes	0	0.0	90.3	$685.17	$26,989.58	$2,105.25	$24,884.33	36.32	10,576
Domestic Water Heating Upgrade			**0**	**0.0**	**823.8**	**$6,248.80**	**$1,394.07**	**$0.00**	**$1,394.07**	**0.22**	**96,455**
ECM 11	Install Low-Flow Domestic Hot Water Devices	Yes	0	0.0	823.8	$6,248.80	$1,394.07	$0.00	$1,394.07	0.22	96,455
TOTALS			**155,984**	**72.3**	**914.1**	**$23,262.83**	**$158,043.87**	**$10,135.25**	**$147,908.62**	**6.36**	**264,106**

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

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

Lighting Upgrades generally involve the replacement of existing lighting components such as lamps and ballasts (or the entire fixture) with higher efficiency lighting components. These 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 conditions allow. Automated control reduces reliance on occupant behavior for adjusting lights. These measures save energy by reducing the amount of time lights are on.

Motor Upgrades generally involve replacing old standard efficiency motors with motors of the current efficiency standard (EISA 2007). Motors will be replaced with the same size motors. This measure saves energy by reducing the power used by the motors due to improved electrical efficiency.

Variable Frequency Drives measures generally involve controlling the speed of a motor to achieve a flow or temperature rather than using a valve, damper, or no means at all. These measures save energy by slowing a motor which is an extremely efficient method of control.

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

Gas Heating (HVAC/Process) measures generally involve replacing old inefficient hydronic heating systems with modern energy efficient systems. Gas heating systems can provide heating equivalent to older systems, but use less energy. These measures save energy by reducing the fuel used by the heating due to improved combustion and heat transfer efficiency.

Domestic Hot Water Heating System upgrade measures generally involve replacing old inefficient domestic water heating systems and components with modern energy efficient systems. New domestic water heating systems can provide equivalent or greater capacity and performance as older systems, but use less energy. These measures save energy by reducing the fuel used by the domestic water heating systems due to improved efficiency, the removal of standby losses, or reduced demand for hot water.

Energy Efficient Practices

TRC also identified 14 low (or no) cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems. Through these practices equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. Opportunities identified at Pershing Field Athletic Complex include:

- Reduce Air Leakage
- Close Doors and Windows
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Ensure Lighting Controls Are Operating Properly
- Turn Off Unneeded Motors
- Reduce Motor Short Cycling
- Perform Routine Motor Maintenance
- Assess Chillers & Request Tune-Ups
- Clean and/or Replace HVAC Filters
- Perform Proper Boiler Maintenance
- Perform Proper Water Heater Maintenance
- Install Plug Load Controls
- Water Conservation

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

On-Site Generation Measures

TRC evaluated the potential for installing on-site generation measures at Pershing Field Athletic Complex. The site has a solar PV array installed. Based on the configuration of the site and its thermal demand, there appears to be a low potential for installing any combined heat and power (CHP) self-generation measures.

For details on our evaluation and the self-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):

1. SmartStart
2. Pay for Performance - Existing Building (P4P EB)
3. Energy Savings Improvement Program (ESIP)

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

Larger facilities interested in maximizing potential savings for their building should consider participating in the Pay for Performance (P4P) program. P4P offers the opportunity for a deeper whole building analysis of building systems. This program has minimum savings requirements and the incentives are based on actual measured performance savings. The application process is more detailed, and requires working with an eligible contractor who is an approved P4P program partner, but it may result in more lucrative incentives up to 50% of total project cost.

For 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 is a (non-NJCEP) program designed to reduce consumer electric load when wholesale electricity prices are high or when the reliability of the electric grid is threatened due to peak 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 Curtailment Service Providers and energy consumers 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 to large-sized users of electric power for their participation in DR programs. Program participation is voluntary and participants will receive payments whether or not their facility is called upon to curtail their electric load. Refer to Section 7 for additional information on this program.

Additional descriptions of all relevant incentive programs are located in Section 8 or: www.njcleanenergy.com/ci.

2 Facility Information and Existing Conditions

2.1 Project Contacts

Figure 4 – Project Contacts

Name	Role	E-Mail	Phone #
Customer			
John Mercer	Assistant Business Administrator	jmercer@jcnj.org	201-547-4417
Designated Representative			
Michael Zozzo	Facility Maintenance Personnel		201-547-4449
TRC Energy Services			
Moussa Traore	Auditor	mtraore@trcsolutions.com	732-855-2883

2.2 General Site Information

On July 13, 2016, TRC performed an energy audit at Pershing Field Athletic Complex located in Jersey City, New Jersey. TRC's team met with Michael Zozzo, Facility Maintenance Personnel to review the facility operations and focus the investigation on specific energy-using systems.

Pershing Field Athletic Complex is a 38,108 square foot facility comprised of three (3) one-story buildings. The main office and the swimming pool areas have 16,988 square feet of conditioned space, and the covered ice rink area is 21,120 square feet. The facility is part of a larger recreational park that also includes a children's play area, a small field house, a running track, tennis and basketball courts and a garden area. The field house was not accessible during the audit.

2.3 Building Occupancy

Pershing Athletic Field is a recreational facility that operates year-round. The facility's peak electrical demand usually occurs on Saturday and sometimes Sunday with group pool lessons and scheduled events occurring at that time. The typical schedule is presented in the table below.

Figure 5 - Building Schedule

Building Name	Weekday/Weekend	Operating Schedule
Pershing Field Athletic Complex.	Weekday	9:00 PM - 10:30 PM
Pershing Field Athletic Complex.	Weekend	12:00 PM - 10:30 PM

2.4 Building Envelope

The three (3) buildings are slab on grade with perimeter beams or masonry foundations. The main office and ice rink building are constructed of brick masonry with a steel-framed flat roof. The pool enclosure is an exposed steel rigid frame with exterior masonry walls and roof panels of insulated fiberglass. Part of the roof is made of retractable fiberglass panels. The ice rink enclosure has a rigid steel frame with steel columns supporting four sloped roof structures. The facility buildings have few windows. The offices, the corridors, and the locker rooms have an insulated windows. Exterior doors are constructed of metal and are in need of adjustment for proper sealing.

2.5 On-site Generation

Pershing Field Athletic Complex has a 75-kW solar panel array installed on the ice rink's sloped roof.

Energy-Using Systems

The interior lighting system consists mostly of older technology fixtures. Offices, locker rooms, bathrooms, corridors, and mechanical rooms are lit with linear fluorescent T12 lamps and fixtures, incandescent and halogen lamps. The pool and the ice rink areas are lit with high intensity discharge (HID) lamps. A small area of spaces (bathrooms and locker rooms) haves a limited number of circular compact fluorescent (CFL) and linear T8 lamps. Lighting control is provide throughout the facility by manual wall switches. Exit signs throughout the facility are incandescent. Exterior perimeter lighting wall packs contain HID lamps controlled by photocells.

Significant energy saving could be achieved by replacing the existing lighting system with LED linear tubes and LED lamps or fixtures. Installing occupancy sensors in select areas will yield additional energy savings.

Please refer to Appendix A: Equipment Inventory & Recommendations for an inventory of your equipment.

Hot Water

The main office lobby and the locker rooms are served by one (1) gas-fired Weil McLain boiler. The boiler has an output rated for 843 KBtu/hr. It is old, appeared in poor condition, and is oversized to the area it serves. This boiler has been proposed for replacement with a more appropriately sized and higher efficiency boiler.

The pool mechanical room contains three (3) gas-fired boilers that are used for pool water and space heating. Each boiler has an output of 843 KBtu/hr and operate in a lead-lag configuration. The boilers appeared in good condition. No upgrade is recommended for these units.

The Zamboni room houses an old hot water boiler that serves the ice melt tank. The boiler appeared in poor condition and has been proposed for replacement. The Zamboni room also has one (1) gas-fired water heater with an output rating of 523 KBtu/hr and a nominal efficiency of 70%. Hot water for showers is supplied by a gas-fired boiler with a 200-gallons storage tank and circulator pump. Warm air unit heaters are also found in the corridors, boiler rooms, compressor area, and the Zamboni room.

Air Conditioning Systems (CHW)

There are two (2) air-cooled chillers that serve the ice rink. Each chiller is rated for 145 tons, and operates in a lead-lag configuration. Each chiller has two (2) refurbished Trane compressors. The chillers run at a constant volume and appeared old, but were well maintained. We were told by the Zamboni operator that they are operating efficiently as the compressors that have been recently refurbished. You may consider replacing the chillers with a high-efficiency system in the near future as investment with a potential for large energy efficiency gains.

Air Conditioning (DX)

Two (2) three-ton roof-mounted packaged heat pumps and one (1) mini-split heat pump are used to heat and cool the main office, lobby and locker rooms. The mini-split heat pump is old and has a low efficiency rating, so we have proposed that it be replaced. They are also controlled by manual thermostats.

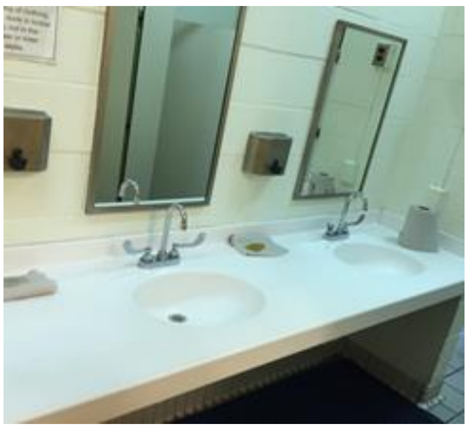
Domestic Hot Water

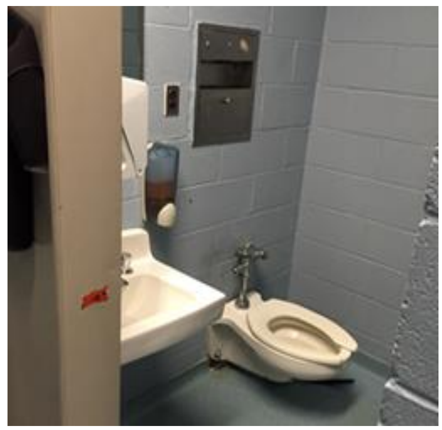
Hot water for pool showers and locker rooms is supplied by a gas-fired boiler. The boiler has a 200-gallon storage tank. The ice rink locker rooms were not accessible during the field audit. One (1) 0.3 hp pump is used to distribute 120°F domestic hot water to the pool showers

Plug load & Vending Machines

There are five (5) computer work stations throughout the facility, and there is no centralized PC power management software installed as well as no server closet in the facility. There are no vending machines.

2.6 Water-Using Systems





The facility has a large number of restrooms and locker rooms. A sampling of restrooms found that the faucets are rated for 2.5 gallons per minute (gpm) or higher, the toilets are rated at 2 gallons per flush and the urinals are rated at 2 gpf. The showerheads are rated at 2.5 gpm.

We recommend upgrading the water fixtures to low-flow devices to reduce hot water consumption and energy demand for hot water heating.

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

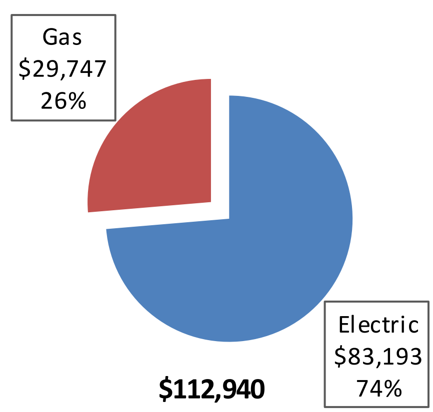
The following energy consumption and cost data is based on the most recent 12-month period of utility billing data that was available. A profile of the annual energy consumption and costs for the facility was developed from this information.

Figure 6 - Utility Summary

Utility Summary for Pershing Field Athletic Complex		
Fuel	**Usage**	**Cost**
Electricity	685,817 kWh	$83,193
Natural Gas	39,216 Therms	$29,747
Total		**$112,940**

The current utility cost for this site is $112,940 as shown in the chart below.

Figure 7 - Energy Cost Breakdown



3.2 Electricity Usage

Electricity is provided by PSE&G. The average electric cost over the past 12 months was $0.105/kWh, which is the blended rate that includes energy supply, distribution, and other charges. This rate is used throughout the analyses in this report to assess energy costs and savings. The monthly electricity consumption and peak demand are shown in the chart below.

Figure 8 - Electric Usage & Demand

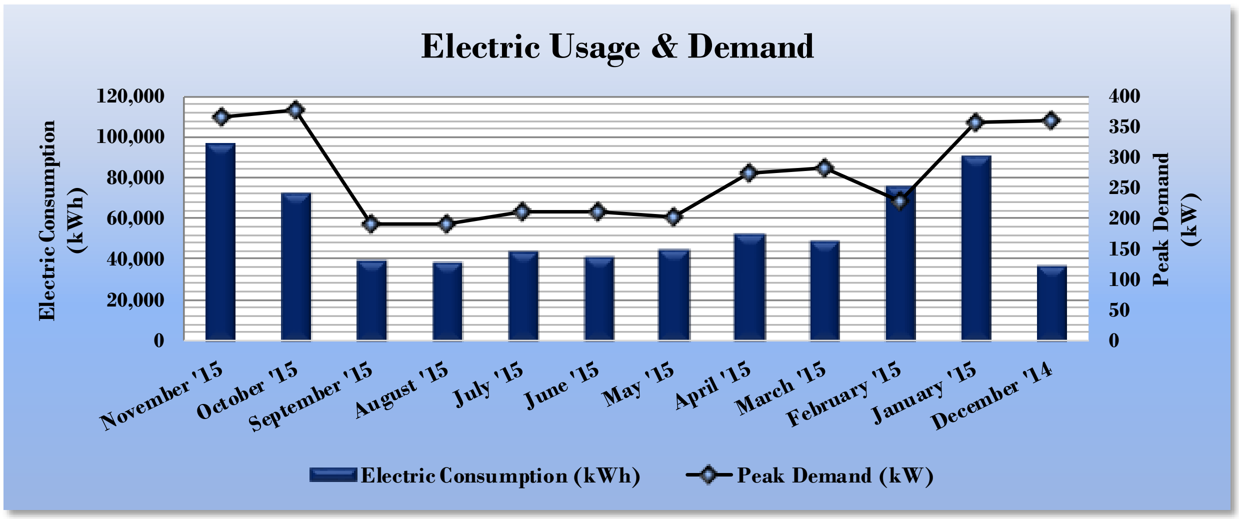


Figure 9 - Electric Usage & Demand

Electric Billing Data for Pershing Field Athletic Complex					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
11/30/15	30	96,616	368	$1,439	$13,179
10/31/15	29	72,680	377	$1,479	$10,654
9/30/15	30	39,917	191	$801	$4,869
8/31/15	31	38,998	190	$797	$3,866
7/31/15	30	44,422	212	$891	$5,506
6/30/15	30	41,534	211	$890	$5,225
5/31/15	31	45,230	201	$841	$4,818
4/30/15	30	52,987	275	$1,051	$5,607
3/31/15	30	49,390	283	$923	$5,348
2/28/15	31	75,901	228	$918	$8,786
1/31/15	31	90,940	357	$1,010	$10,711
12/31/14	32	37,202	360	$360	$4,625
Totals	**365**	**685,817**	**377.1**	**$11,400**	**$83,193**
Annual	**365**	**685,817**	**377.1**	**$11,400**	**$83,193**

3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $0.759/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown the chart below.

Figure 10 - Natural Gas Usage

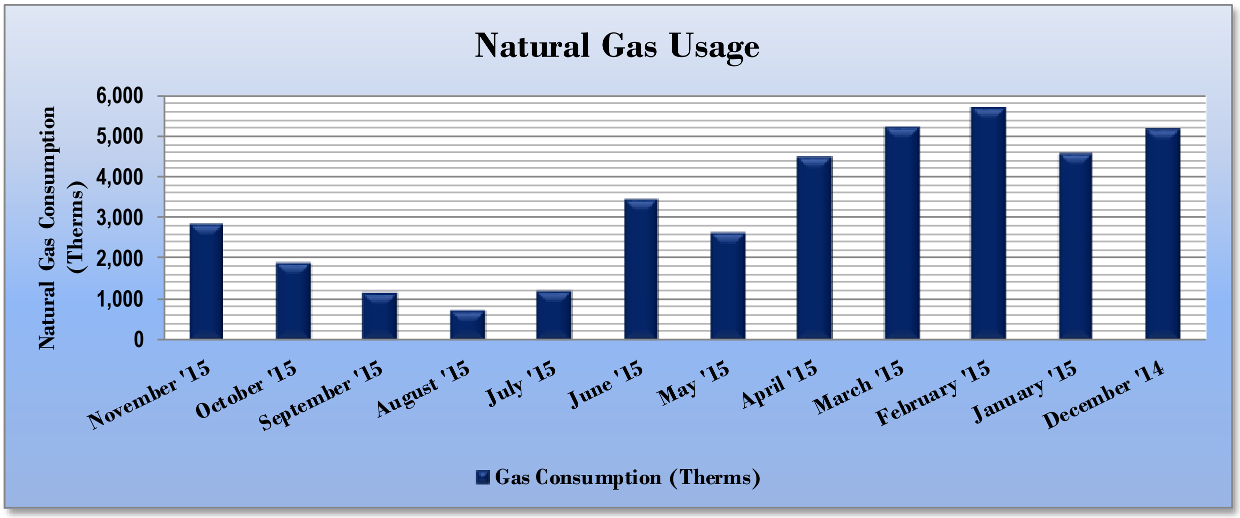


Figure 11 - Natural Gas Usage

Gas Billing Data for Pershing Field Athletic Complex				
Period Ending	Days in Period	Natural Gas Usage (Therms)	Natural Gas Cost	TRC Estimated Usage?
11/30/15	30	2,852	$2,418	No
10/31/15	29	1,901	$1,155	No
9/30/15	30	1,162	$786	No
8/31/15	31	731	$540	No
7/31/15	30	1,216	$816	No
6/30/15	30	3,470	$2,402	No
5/31/15	31	2,653	$1,589	No
4/30/15	30	4,519	$2,762	No
3/31/15	30	5,253	$4,290	No
2/28/15	31	5,696	$4,775	No
1/31/15	31	4,575	$4,270	No
12/31/14	32	5,187	$3,944	No

3.4 Benchmarking

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

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

Figure 12 - Energy Use Intensity Comparison – Existing Conditions

Energy Use Intensity Comparison - Existing Conditions		
	Pershing Field Athletic Complex	National Median Building Type: Rec./Entertainment/Parks
Source Energy Use Intensity (kBtu/ft^2)	300.9	96.8
Site Energy Use Intensity (kBtu/ft^2)	164.3	41.2

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

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

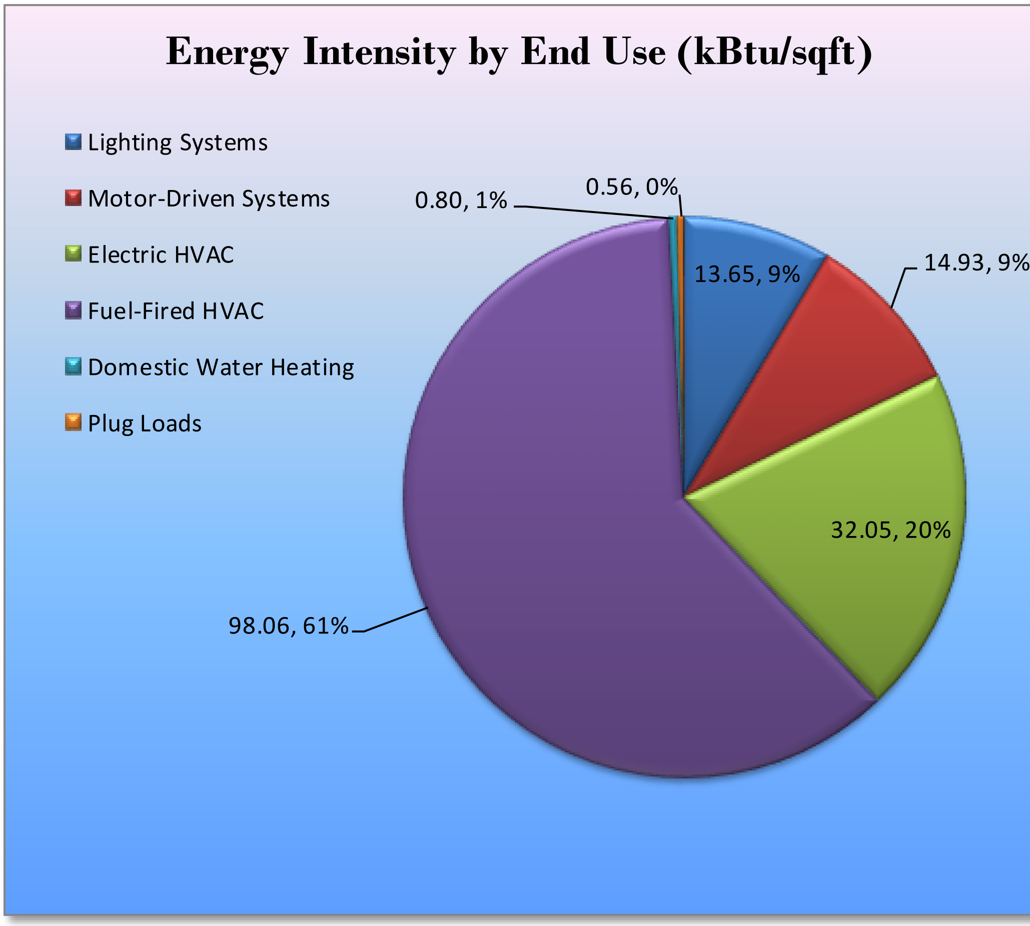
Energy Use Intensity Comparison - Following Installation of Recommended Measures		
	Pershing Field Athletic Complex	National Median Building Type: Rec./Entertainment/Parks
Source Energy Use Intensity (kBtu/ft^2)	231.8	96.8
Site Energy Use Intensity (kBtu/ft^2)	126.4	41.2

This site does not currently qualify to receive a score due to missing or incomplete data.

3.5 Energy End-Use Breakdown

In order to provide a complete overview of energy consumption across building systems, an energy balance was performed at this facility. An energy balance utilizes standard practice engineering methods to evaluate all components of the various electric and fuel-fired systems found in a building and determine their proportional contribution to overall building energy usage. This graphical representation of energy end-uses highlights where the most benefit might be achieved from energy efficiency upgrades and measures.

Figure 14 - Energy Balance (% and kBtu/SF)



4 Energy Conservation Measures

Level of Analysis

The goal of this audit report is to identify potential energy projects, help prioritize specific measures for implementation, and set Pershing Field Athletic Complex on the path to receive financial incentives. 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 considered sufficient to make decisions and to prioritize energy projects. Savings are based on the New Jersey Board of Public Utilities New Jersey Clean Energy Program Protocols to Measure Resource Savings dated June 29, 2016. Further analysis or investigation may be required to calculate more accurate savings to support any custom SmartStart, Pay for Performance, or Large Energy Users incentive applications. Financial incentives for the ECMs identified in this report have been calculated based the NJ prescriptive SmartStart program. Depending on your implementation strategy, the project may be eligible for more lucrative incentives through other programs as identified in Section 8.

The following sections describe the recommended measures.

4.1 Recommended ECMs

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

Figure 15 – Summary of Recommended ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**143,198**	**67.0**	**0.0**	**$14,990.40**	**$109,840.81**	**$7,750.00**	**$102,090.81**	**6.81**	**144,199**
ECM 1	Install LED Fixtures	132,680	62.5	0.0	$13,889.36	$99,939.08	$7,700.00	$92,239.08	6.64	133,608
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	8,173	3.9	0.0	$855.60	$7,802.67	$0.00	$7,802.67	9.12	8,230
ECM 3	Retrofit Fixtures with LED Lamps	998	0.5	0.0	$104.51	$270.63	$50.00	$220.63	2.11	1,005
ECM 4	Install LED Exit Signs	1,346	0.1	0.0	$140.93	$1,828.44	$0.00	$1,828.44	12.97	1,356
Lighting Control Measures		**891**	**0.4**	**0.0**	**$93.31**	**$1,624.00**	**$280.00**	**$1,344.00**	**14.40**	**898**
ECM 5	Install Occupancy Sensor Lighting Controls	891	0.4	0.0	$93.31	$1,624.00	$280.00	$1,344.00	14.40	898
Motor Upgrades		**5,189**	**3.4**	**0.0**	**$543.20**	**$7,396.64**	**$0.00**	**$7,396.64**	**13.62**	**5,225**
ECM 6	Premium Efficiency Motors	5,189	3.4	0.0	$543.20	$7,396.64	$0.00	$7,396.64	13.62	5,225
Variable Frequency Drive (VFD) Measures		**5,869**	**1.4**	**0.0**	**$614.40**	**$8,744.15**	**$0.00**	**$8,744.15**	**14.23**	**5,910**
ECM 7	Install VFDs on Hot Water Pumps	1,518	0.4	0.0	$158.93	$2,728.85	$0.00	$2,728.85	17.17	1,529
ECM 8	Install VFDs on Boiler Feedwater Pumps	4,351	1.0	0.0	$455.47	$6,015.30	$0.00	$6,015.30	13.21	4,381
Electric Unitary HVAC Measures		**836**	**0.1**	**0.0**	**$87.54**	**$2,054.62**	**$0.00**	**$2,054.62**	**23.47**	**842**
ECM 9	Install High Efficiency Electric AC	836	0.1	0.0	$87.54	$2,054.62	$0.00	$2,054.62	23.47	842
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**90.3**	**$685.17**	**$26,989.58**	**$2,105.25**	**$24,884.33**	**36.32**	**10,576**
ECM 10	Install High Efficiency Hot Water Boilers	0	0.0	90.3	$685.17	$26,989.58	$2,105.25	$24,884.33	36.32	10,576
Domestic Water Heating Upgrade		**0**	**0.0**	**823.8**	**$6,248.80**	**$1,394.07**	**$0.00**	**$1,394.07**	**0.22**	**96,455**
ECM 11	Install Low-Flow Domestic Hot Water Devices	0	0.0	823.8	$6,248.80	$1,394.07	$0.00	$1,394.07	0.22	96,455
TOTALS		**155,984**	**72.3**	**914.1**	**$23,262.83**	**$158,043.87**	**$10,135.25**	**$147,908.62**	**6.36**	**264,106**

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

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

4.1.1 Lighting Upgrades

Recommended lighting upgrades are summarized in Figure 16 below.

Figure 16 – Summary of Lighting Upgrade ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**143,198**	**67.0**	**0.0**	**$14,990.40**	**$109,840.81**	**$7,750.00**	**$102,090.81**	**6.81**	**144,199**
ECM 1	Install LED Fixtures	132,680	62.5	0.0	$13,889.36	$99,939.08	$7,700.00	$92,239.08	6.64	133,608
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	8,173	3.9	0.0	$855.60	$7,802.67	$0.00	$7,802.67	9.12	8,230
ECM 3	Retrofit Fixtures with LED Lamps	998	0.5	0.0	$104.51	$270.63	$50.00	$220.63	2.11	1,005
ECM 4	Install LED Exit Signs	1,346	0.1	0.0	$140.93	$1,828.44	$0.00	$1,828.44	12.97	1,356

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	123,908	59.5	0.0	$12,971.05	$91,934.58	$5,685.00	$86,249.58	6.65	124,774
Exterior	8,772	3.0	0.0	$918.30	$8,004.49	$2,015.00	$5,989.49	6.52	8,834

Measure Description

We recommend replacing existing fluorescent, incandescent, and HID fixtures with new high performance LED light fixtures. This measure saves energy by installing LED sources which use less power than other technologies with a comparable light output.

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

ECM 2: Retrofit Fluorescent Fixtures and Ballasts 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	8,173	3.9	0.0	$855.60	$7,802.67	$0.00	$7,802.67	9.12	8,230
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0

Measure Description

We recommend replacing linear fluorescent lamps and ballasts with LED tube lamps and drivers specifically designed to be used in existing linear fluorescent fixtures. The proposed retrofits would use the existing fixture housings but replace the rest of the components with efficient LED technology. This measure saves energy by installing LEDs which use less power than other technologies with a comparable light output and efficiently projects the light into the space.

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

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	998	0.5	0.0	$104.51	$270.63	$50.00	$220.63	2.11	1,005
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0

Measure Description

We recommend replacing linear fluorescent lamps with LED tube lamps and replacing incandescent and halogen lamps with LED lamps. Many LED tube lamps are direct replacements for existing fluorescent lamps and can be installed although there is a fluorescent fixture ballast in place. Other tube lamps require that fluorescent fixture ballasts be removed or replaced with LED drivers. LED lamps can be used as a direct replacement for most types of screw-in or plug-in lamps. This measure saves energy by installing LEDs which use less power than other lighting technologies with a comparable light output.

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

ECM 4: Install LED Exit Signs

Summary of Measure Economics

Interior/ Exterior	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Interior	1,346	0.1	0.0	$140.93	$1,828.44	$0.00	$1,828.44	12.97	1,356
Exterior	0	0.0	0.0	$0.00	$0.00	$0.00	$0.00	0.00	0

Measure Description

We recommend replacing compact fluorescent lighting in exit signs with LEDs. LEDs require virtually no maintenance and LED exit signs have a life expectancy of at least 20 years. Exit signs are on 24 hours per day, so even the low wattage bulbs in them consume significant power over time. Upgrading them all to LED exit signs improves energy efficiency and fire safety. A reduction in maintenance costs may also result from the proposed retrofit because lamps will not have to be replaced as frequently.

4.1.2 Lighting Control Measures

Recommended lighting control measures are summarized in Figure 17 below.

Figure 17 – Summary of Lighting Control ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**891**	**0.4**	**0.0**	**$93.31**	**$1,624.00**	**$280.00**	**$1,344.00**	**14.40**	**898**
ECM 5	Install Occupancy Sensor Lighting Controls	891	0.4	0.0	$93.31	$1,624.00	$280.00	$1,344.00	14.40	898

ECM 5: 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)
891	0.4	0.0	$93.31	$1,624.00	$280.00	$1,344.00	14.40	898

Measure Description

We recommend installing occupancy sensors to control light fixtures that are currently manually controlled in restrooms, storage rooms, and private offices. Sensors detect occupancy using ultrasonic and/or infrared wave technologies. Lighting systems are enabled when an occupant is detected. Fixtures are automatically turned off after an area has been vacant for a preset period. Occupants will also be able to manually turn off fixtures. Energy savings result 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. Ceiling-mounted or remote-mounted sensors require the use of low voltage switching relays or a wireless signal to the switch. In general, use wall switch replacement sensors for single occupant offices and other small rooms. Install ceiling-mounted or remote mounted sensors in locations without local switching, in situations where the existing wall switches are not in the line-of-sight of the main work area, and in large spaces. We recommend a holistic design approach that considers both the technology of the lighting sources and how they are controlled.

4.1.3 Motor Upgrades

ECM 6: Premium Efficiency Motors

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
5,189	3.4	0.0	$543.20	$7,396.64	$0.00	$7,396.64	13.62	5,225

Measure Description

We recommend replacing standard efficiency motors with high efficiency motors rated to EISA 2007 standards. This evaluation assumes existing motors will be replaced with the same size motors. It is important that the rated speeds for each new motor match the rated speeds of existing motors as closely as possible. The base case motor efficiencies are obtained from nameplate information. Proposed motor upgrade efficiencies are obtained from the New Jersey's Clean Energy Program Protocols to Measure Resource Savings (2012). Savings are based on the difference between baseline and proposed efficiencies and an estimate of annual operating hours.

4.1.4 Variable Frequency Drive Measures

Recommended variable frequency drive (VFD) measures are summarized in Figure 18 below.

Figure 18 – Summary of Variable Frequency Drive ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**5,869**	**1.4**	**0.0**	**$614.40**	**$8,744.15**	**$0.00**	**$8,744.15**	**14.23**	**5,910**
ECM 7	Install VFDs on Hot Water Pumps	1,518	0.4	0.0	$158.93	$2,728.85	$0.00	$2,728.85	17.17	1,529
ECM 8	Install VFDs on Boiler Feedwater Pumps	4,351	1.0	0.0	$455.47	$6,015.30	$0.00	$6,015.30	13.21	4,381

ECM 1: Install VFDs on Hot Water PumpsMeasure Description

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

ECM 7: Install VFDs on Boiler Feedwater Pumps

Summary of Measure Economics

Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
4,351	1.0	0.0	$455.47	$6,015.30	$0.00	$6,015.30	13.21	4,381

Measure Description

We recommend installing a variable frequency drive (VFD) to control boiler feedwater pumps. The existing level control valve will need to be maintained fully open and its control signal used to modulate the feedwater pump VFD speed. Energy savings result from reducing pump motor speed (and power) at reduced feedwater flow. The magnitude of energy savings is based on the amount of time at reduced loads.

4.1.5 Electric Unitary HVAC Measures

Recommended Unitary HVAC upgrade measures are summarized in Figure 19 below.

Figure 19 - Summary of Unitary HVAC ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Electric Unitary HVAC Measures		**836**	**0.1**	**0.0**	**$87.54**	**$2,054.62**	**$0.00**	**$2,054.62**	**23.47**	**842**
ECM 9	Install High Efficiency Electric AC	836	0.1	0.0	$87.54	$2,054.62	$0.00	$2,054.62	23.47	842

ECM 8: Install High Efficiency Electric AC

Measure Description

We recommend replacing packaged air conditioners with high efficiency packaged air conditioners. There have been significant improvements in both compressor and fan motor efficiencies in recent years. 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 difference in efficiency between the old and new unit, the estimated cooling load, and the annual operating hours.

4.1.6 Gas Heating (HVAC/Process) Replacement

Recommended gas heating replacement measures are summarized in Figure 20 below.

Figure 20 - Summary of Gas Heating Replacement ECMs

Energy Conservation Measure		Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)	Estimated Net Cost ($)	Simple Payback Period (yrs)	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**90.3**	**$685.17**	**$26,989.58**	**$2,105.25**	**$24,884.33**	**36.32**	**10,576**
ECM 10	Install High Efficiency Hot Water Boilers	0	0.0	90.3	$685.17	$26,989.58	$2,105.25	$24,884.33	36.32	10,576

ECM 9: Install High Efficiency Hot Water Boilers

Measure Description

We recommend replacing old inefficient hot water boilers with new high efficiency hot water boilers. Significant improvements have been made in combustion technology in recent years resulting in increases in overall boiler efficiency. Savings result from improved combustion efficiency and reduced standby losses at low loads.

Condensing hydronic boilers that can achieve over 90% efficiency under the proper conditions. Condensing hydronic boilers typically operate at efficiencies between 85% and 87% (comparable to other high efficiency boilers) when the return water temperature is above 130°F. The boiler efficiency increases as the return water temperature drops below 130°F. Therefore, condensing hydronic boilers were only evaluated when the return water temperature is less than 130°F during most of the operating hours. As a result condensing hydronic boilers were not recommended for this site. Condensing boilers also produce acidic condensate that needs to be drained.

4.1.7 Domestic Hot Water Heating System Upgrade

Recommended domestic hot water heating system upgrades are summarized in Figure 21 below.

Figure 21 - 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**	**823.8**	**$6,248.80**	**$1,394.07**	**$0.00**	**$1,394.07**	**0.22**	**96,455**
ECM 11	Install Low-Flow Domestic Hot Water Devices	0	0.0	823.8	$6,248.80	$1,394.07	$0.00	$1,394.07	0.22	96,455

ECM 10: Install Low-Flow DHW Devices

Measure Description

We recommend installing low flow domestic water devices to reduce overall water flow rates to reduce hot water usage. Low flow faucet aerators reduce water flow rates. 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.

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 low or no-cost efficiency strategies. By employing certain behavioral and operational adjustments as well as performing routine maintenance on building systems, equipment lifetime can be extended; occupant comfort, health and safety can be improved; and annual energy, operation, and maintenance costs can be reduced. The recommendations below are provided as a framework for developing a whole building maintenance plan that is customized to your facility. Consult with qualified equipment specialists for details on proper maintenance and system operation.

Reduce Air Leakage

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

Close Doors and Windows

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

Perform Proper Lighting Maintenance

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

Develop a Lighting Maintenance Schedule

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

Ensure Lighting Controls Are Operating Properly

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

Turn Off Unneeded Motors

Electric motors often run unnecessarily, and this is an overlooked opportunity to save energy. These motors should be identified and turned off when appropriate. For example, exhaust fans often run unnecessarily when ventilation requirements are already met. Reducing run hours for these motors can result in significant energy savings. Whenever possible, use automatic devices such as twist timers or occupancy sensors to ensure that motors are turned off when not needed.

Reduce Motor Short Cycling

Frequent stopping and starting of motors subjects rotors and other parts to substantial stress. This can result in component wear, reducing efficiency, and increasing maintenance costs. Adjust the load on the motor to limit the amount of unnecessary stopping and starting to improve motor performance.

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.

Assess Chillers & Request Tune-Ups

Chillers are responsible for a substantial portion of a commercial building's overall energy usage. When components of a chiller are not optimized, this can quickly result in a noticeable increase in energy bills. Chiller diagnostics can produce a 5% to 10% cost avoidance potential from discovery and implementation of low/no cost optimization strategies.

Clean and/or Replace HVAC Filters

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

Perform Proper Boiler Maintenance

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

Perform Proper Water Heater Maintenance

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

Plug Load Controls

There are a variety of ways to limit the energy use of plug loads including increasing occupant awareness, removing under-utilized equipment, installing hardware controls, and using software controls. Some control steps to take are to enable the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips.

Water Conservation

Installing dual flush or low flow toilets and low flow or waterless urinals are additional ways to reduce the sites water use, however, these devices do not provide energy savings at the site level. Any reduction in water use does however ultimately reduce grid level electricity use since a significant amount of electricity is used to deliver water from reservoirs to end users. The EPA WaterSense™ ratings for urinals is 0.5 gallons per flush (gpf) and toilets that use as little as 1.28 gpf (this is lower than the current 1.6 gpf federal standard). Refer to Section 4.1.7 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.

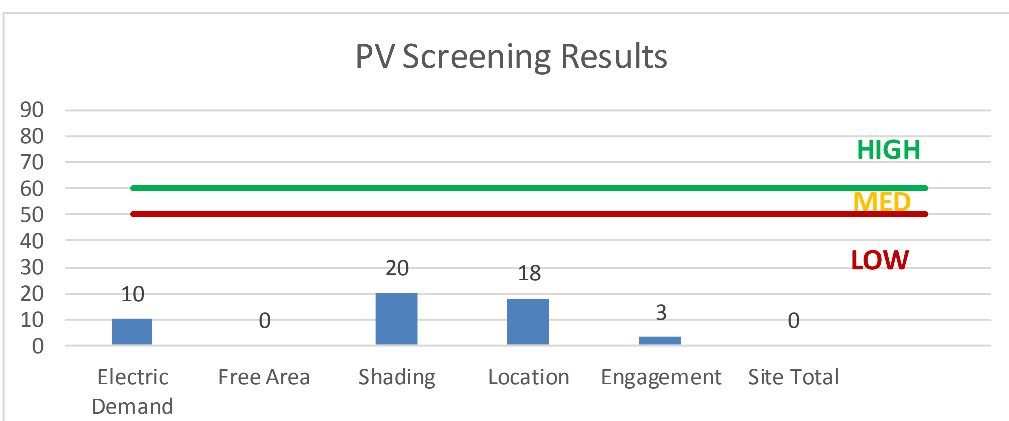
6.1 Photovoltaic

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 additional PV solar arrays.

The site already has 75-kW solar PV array installed on the roof of the ice rink building.

Figure 22 - Photovoltaic Screening



Owners of solar projects must register their projects in the SREC Registration Program prior to the start of construction in order to establish the project's eligibility to earn SRECs. Registration of the intent to participate in New Jersey's solar marketplace provides market participants with information about the pipeline of anticipated new solar capacity and insight into future SREC pricing. Refer to Section 8.3 for additional information.

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

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

6.2 Combined Heat and Power

Combined heat and power (CHP) is the on-site generation of electricity and recovery of heat which is put to beneficial use. Common prime movers in CHP applications include reciprocating engines, microturbines, fuel cells, and (at large facilities) gas turbines. Electricity is typically interconnected to the sites local distribution system. Heat is recovered from the exhaust stream and the ancillary cooling system and interconnected to the existing hot water (or steam) distribution system.

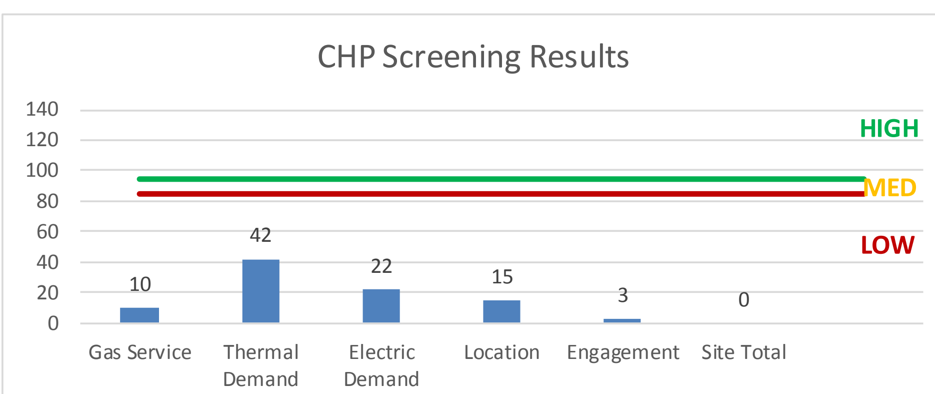
CHP systems are typically used to produce a portion of the electricity needed by a facility, with the balance of electric needs satisfied by purchase from the grid. The heat is used to supplement (or supplant) existing boilers for the purpose of space heating and/or domestic hot water heating. Waste 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 and/or infrequent hot water demand is the main reason the site has a low potential for CHP installation. 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 NJ specializing in commercial CHP cost assessment and installation, go tohttp://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/.

Figure 23 - Combined Heat and Power Screening



7 Demand Response

Demand Response (DR) is a program designed to reduce consumer electric load when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. 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 locally.

By enabling grid operators to call upon Curtailment Service Providers and energy consumers 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 will receive payments whether or not their facility is called upon to curtail their load.

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 program often find it to be a valuable source of revenue for their facilities because the payments can significantly offset annual utility 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 event cycle. DR program participants often have to install smart meters and 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. Curtailment Service Providers typically offer free assessments to determine a facility's eligibility to participate in a DR program. They will provide details regarding the program rules and requirements for metering and controls, a facility's ability to temporarily reduce electric load, as well as the payments involved in participating in the program. Also, these providers usually offer multiple options for DR to larger facilities and may also install controls or remote monitoring equipment to help ensure compliance of all terms and conditions of a DR contract.

8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and others, 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 this charge on their monthly energy bills. As a contributor to the fund you were able to participate in the LGEA program and are also eligible to utilize the equipment incentive programs. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 24 for a list of the eligible programs identified for each recommended ECM.

Figure 24 - ECM Incentive Program Eligibility

Energy Conservation Measure		SmartStart Prescriptive	SmartStart Custom	Pay For Performance Existing Buildings
ECM 1	Install LED Fixtures	x		x
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers			x
ECM 3	Retrofit Fixtures with LED Lamps	x		x
ECM 4	Install LED Exit Signs			x
ECM 5	Install Occupancy Sensor Lighting Controls	x		x
ECM 6	Premium Efficiency Motors			x
ECM 7	Install VFDs on Hot Water Pumps			x
ECM 8	Install VFDs on Boiler Feedwater Pumps			x
ECM 9	Install High Efficiency Electric AC	x		x
ECM 10	Install High Efficiency Hot Water Boilers			x
ECM 11	Install Low-Flow Domestic Hot Water Devices			x

SmartStart is generally well suited for implementation of individual or small sets of measures, with the flexibility to install projects at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities to bundle measures and simplify participation, but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities and 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; applicants can use in-house staff or preferred contractor.

Generally, the incentive values provided throughout the report assume the SmartStart program is utilized because it provides a consistent comparison of available incentives.

Brief descriptions of all relevant alternative financing and incentive programs are located in the sections below or: www.njcleanenergy.com/ci.

8.1 SmartStart

Overview

The SmartStart program is comprised of new construction and retrofit components that offer incentives for installing prescriptive and custom energy efficiency measures at your facility. Routinely the program adds, removes or modifies incentives for various energy efficiency equipment based on national/market trends, new technologies or changes in efficiency baselines.

Prescriptive Equipment Incentives 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

All customer sizes and types may be served by this program. This program provides an effective mechanism for securing incentives for individual projects that may be completed at once or over several years.

Incentives

The prescriptive path provides fixed incentives for specific energy efficiency measures whereas the custom measure path provides incentives for unique or specialized technologies that are not addressed through prescriptive offerings.

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 the lesser of 50% of the total installed incremental project cost, or a buy down to a one year payback. 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 Pay for Performance - Existing Buildings

Overview

The Pay for Performance – Existing Buildings (P4P EB) program is designed for larger customers with a peak demand over 200 kW in any of the preceding 12 months. Under this program the minimum installed scope of work must include at least two unique measures resulting in at least 15% energy savings, where lighting cannot make up the majority of the savings. P4P is a generally a good option for medium to large sized facilities looking to implement as many measures as possible under a single project in order to achieve deep energy savings. This program has an added benefit of evaluating a broad spectrum of measures that may not otherwise qualify under other programs. Many facilities pursuing ESIP also utilize the P4P program.

Incentives

Incentives are calculated based on estimated and achieved energy savings ranging from $0.18-$0.22/kWh and $1.80-$2.50/therm, capped at the lesser of 50% total project cost, or $1 million per electric account and $1 million per natural gas account, per fiscal year, not to exceed $2 million per project. An incentive of $0.15/square foot is also available to offset the cost of developing the Energy Reduction Plan (see below) contingent on the project moving forward with measure installation.

How to Participate

To participate in the P4B EB program you will need to contact one of the pre-approved consultants and contractors ("Partners"). Under direct contract to you, the Partner will help further evaluate the measures identified in this report through development of the Energy Reduction Plan (ERP), assist you in implementing selected measures, and verify actual savings one year after the installation. At each of these three (3) milestones your Partner will also facilitate securing program incentives.

Approval of the final scope of work is required by the program prior to installation completion. Although installation can be accomplished by a contractor of your choice (some P4P Partners are also contractors) or by internal personnel, the Partner must remain involved to ensure compliance with the program guidelines and requirements.

Detailed program descriptions, instructions for applying, applications and list of Partners can be found at: www.njcleanenergy.com/P4P.

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 the incentive programs to help further reduce costs when compiling 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
Exterior Perimeter	14	Metal Halide Wall Pack: (1) 250W Lamp	Daylight Dimming	250	2,288	Fixture Replacement	No	14	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Daylight Dimming	46	2,288	2.32	7,384	0.0	$772.98	$5,469.48	$1,400.00	5.26
Rink Entrance	6	Metal Halide: (1) 150W Lamp HPS	Wall Switch	150	1,500	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Wall Switch	46	1,500	0.51	1,058	0.0	$110.72	$2,344.06	$600.00	15.75
Reception Area	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$8.29	$107.56	$0.00	12.97
Reception Area	1	CFL Screw-In Lamps: 32W Ceiling Mounted	Wall Switch	32	1,500	Fixture Replacement	No	1	LED - Fixtures: Downlight Solid State Retrofit	Wall Switch	7	1,500	0.02	42	0.0	$4.44	$63.65	$0.00	14.35
Reception Area	2	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	176	1,500	Relamp & Reballast	No	2	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,500	0.19	400	0.0	$41.88	$323.67	$0.00	7.73
Men's Locker Room	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,500	Relamp	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.39	806	0.0	$84.41	$174.50	$30.00	1.71
Men's Locker Room	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$8.29	$107.56	$0.00	12.97
Men's Bathroom	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.28	574	0.0	$60.06	$701.00	$20.00	11.34
Men's Bathroom	2	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	158	0.0	$16.58	$215.11	$0.00	12.97
Men's Bathroom	3	Compact Fluorescent: 32W Circular Fluorescent Recessed Light	Wall Switch	32	1,500	Fixture Replacement	No	3	LED - Fixtures: Downlight Solid State Retrofit	Wall Switch	7	1,500	0.06	127	0.0	$13.31	$190.95	$0.00	14.35
Main Office	2	Linear Fluorescent - T12: 4' T12 (40W) - 3L	Wall Switch	127	1,500	Relamp & Reballast	Yes	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	1,050	0.16	327	0.0	$34.26	$379.00	$20.00	10.48
Bathroom- Unisex	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	62	1,500	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.07	141	0.0	$14.80	$233.00	$40.00	13.04
Corridor	4	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	4	LED Exit Signs: 2 W Lamp	None	6	8,760	0.03	317	0.0	$33.16	$430.22	$0.00	12.97
Corridor	6	Halogen Incandescent: PAR30 60W Recessed Light	Wall Switch	60	1,500	Fixture Replacement	Yes	6	LED - Fixtures: Downlight Solid State Retrofit	Occupancy Sensor	7	1,050	0.27	560	0.0	$58.66	$497.91	$50.00	7.64
Storage	1	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	114	1,500	Relamp	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,500	0.05	95	0.0	$9.94	$95.13	$20.00	7.56
Pool Supply Room	1	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	79	0.0	$8.29	$107.56	$0.00	12.97
Pool Supply Room	1	Halogen Incandescent: PAR30 60W Recessed Light	Wall Switch	60	1,500	Fixture Replacement	No	1	LED - Fixtures: Downlight Solid State Retrofit	Wall Switch	19	1,500	0.03	69	0.0	$7.27	$63.65	$5.00	8.06
Boiler Room	3	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	No	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.14	300	0.0	$31.41	$351.00	$0.00	11.18
Boiler Room	1	Linear Fluorescent - T12: 8' T12 (75W) - 1L	Wall Switch	70	1,500	Relamp & Reballast	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.05	94	0.0	$9.85	$98.00	$0.00	9.95
Boiler Room	1	Linear Fluorescent - T12: 4' T12 (40W) - 1L	Wall Switch	46	1,500	Relamp & Reballast	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.03	53	0.0	$5.59	$98.00	$0.00	17.53
Girls Locker Room	11	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.75	1,572	0.0	$164.56	$466.00	$40.00	2.59
Girls Locker Room	2	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.01	158	0.0	$16.58	$215.11	$0.00	12.97
Girls Locker Room	3	Halogen Incandescent: PAR30 60W Recessed Light	Wall Switch	60	1,500	Fixture Replacement	No	3	LED - Fixtures: Downlight Solid State Retrofit	Wall Switch	7	1,500	0.13	270	0.0	$28.21	$190.95	$15.00	6.24
Padeo Area Ext Light	3	Halogen Incandescent: PAR30 60W Recessed Light	Daylight Dimming	72	1,500	Fixture Replacement	No	3	LED - Fixtures: Downlight Solid State Retrofit	Daylight Dimming	7	1,500	0.16	331	0.0	$34.60	$190.95	$15.00	5.09
Pool	18	Metal Halide Uplight: 750W Hanging Pendant	Wall Switch	750	1,500	Fixture Replacement	No	3	LED - Fixtures: Downlight Pendant	Wall Switch	200	1,500	10.50	21,866	0.0	$2,288.95	$1,825.74	$15.00	0.79

	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
Pool	3	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	3	LED Exit Signs: 2 W Lamp	None	6	8,760	0.02	238	0.0	$24.87	$322.67	$0.00	12.97
Pool	6	Metal Halide: (1) 400W Flood Light	Wall Switch	400	1,500	Fixture Replacement	No	6	LED - Fixtures: Downlight Pendant	Wall Switch	146	1,500	1.24	2,583	0.0	$270.42	$3,651.48	$30.00	13.39
Rink	3	Exit Signs: Incandescent	None	14	8,760	Fixture Replacement	No	3	LED Exit Signs: 2 W Lamp	None	6	8,760	0.02	238	0.0	$24.87	$322.67	$0.00	12.97
Rink	15	Metal Halide: (1) 1500W Lamp	Wall Switch	1,500	1,500	Fixture Replacement	No	15	LED - Fixtures: High-Bay	Wall Switch	250	1,500	15.26	31,781	0.0	$3,326.96	$40,278.00	$2,250.00	11.43
Rink	22	Metal Halide: (1) 1500W Low Bay (Hanging Pendant)	Wall Switch	1,500	1,500	Fixture Replacement	No	22	LED - Fixtures: Low-Bay	Wall Switch	250	1,500	22.37	46,613	0.0	$4,879.54	$31,235.05	$3,300.00	5.72
Rink Locker Room1	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.28	574	0.0	$60.06	$701.00	$20.00	11.34
Rink Locker Room2	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.28	574	0.0	$60.06	$701.00	$20.00	11.34
Rink Locker Room3	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.28	574	0.0	$60.06	$701.00	$20.00	11.34
Rink Locker Room4	5	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.28	574	0.0	$60.06	$701.00	$20.00	11.34
Bathroom Locker Room1	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.05	100	0.0	$10.47	$117.00	$0.00	11.18
Bathroom Locker Room2	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.05	100	0.0	$10.47	$117.00	$0.00	11.18
Bathroom Locker Room3	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.05	100	0.0	$10.47	$117.00	$0.00	11.18
Bathroom Locker Room4	1	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,500	0.05	100	0.0	$10.47	$117.00	$0.00	11.18
Roof Light	8	Metal Halide: (1) 175W Lamp	Daylight Dimming	215	1,500	Fixture Replacement	No	8	LED - Fixtures: Outdoor Post-Mount	Daylight Dimming	46	1,500	1.10	2,292	0.0	$239.90	$4,586.40	$40.00	18.95
Zamboni Room	24	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	1.32	2,754	0.0	$288.30	$3,040.00	$40.00	10.41
Bathroom	2	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	88	1,500	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,050	0.11	230	0.0	$24.03	$350.00	$20.00	13.74
Rink Perimeter (Inside)	28	Metal Halide: (1) 250W Lamp	Wall Switch	295	1,500	Fixture Replacement	No	28	LED - Fixtures: Ceiling Mount	Wall Switch	46	1,500	5.67	11,818	0.0	$1,237.10	$6,311.20	$0.00	5.10
Rink Perimeter (Outside)	14	Metal Halide: (1) 250W Lamp	Wall Switch	295	1,500	Fixture Replacement	No	14	LED - Fixtures: Ceiling Mount	Wall Switch	46	1,500	2.84	5,909	0.0	$618.55	$3,155.60	$0.00	5.10

Motor Inventory & Recommendations

		Existing Conditions						Proposed Conditions				Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Full Load Efficiency	VFD Control?	Annual Operating Hours	Install High Efficiency Motors?	Full Load Efficiency	Install VFDs?	Number of VFDs	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Boiler Room	Boiler room	2	Heating Hot Water Pump	15.0	84.0%	No	1,500	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler Room	1	Heating Hot Water Pump	3.0	69.0%	No	1,500	Yes	89.5%	Yes	1	1.00	2,928	0.0	$306.48	$3,884.01	$0.00	12.67
Boiler Room	Pool	1	Other	1.5	78.0%	No	1,500	No	78.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler Room	1	Heating Hot Water Pump	2.0	70.5%	No	1,500	Yes	85.5%	Yes	1	0.60	1,894	0.0	$198.28	$3,493.46	$0.00	17.62
Boiler Room	Boiler water circuling Pump	1	Other	0.3	73.0%	No	1,500	No	73.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Zamboni Room	Chiller Circulator Pump	2	Air Compressor	1.5	65.6%	No	1,500	Yes	86.5%	No		0.61	927	0.0	$97.08	$1,516.29	$0.00	15.62
Zamboni Room	Chiller R-22 Circulator Pump	2	Other	1.5	65.7%	No	1,500	Yes	86.5%	No		0.61	921	0.0	$96.47	$1,516.29	$0.00	15.72
Boiler Room	Pool	1	Water Supply Pump	15.0	84.0%	No	1,500	Yes	93.0%	No		0.95	1,450	0.0	$151.82	$1,846.72	$0.00	12.16
Boiler Room	Pool	1	Water Supply Pump	15.0	85.0%	No	1,500	No	85.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler Room	1	Heating Hot Water Pump	3.0	68.8%	No	1,500	Yes	89.5%	Yes	1	1.00	2,937	0.0	$307.48	$3,884.01	$0.00	12.63
Zamboni Room	Snow Melt Circulator Pump	1	Other	1.0	80.0%	No	1,500	No	80.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Pool & Space Heat	1	Heating Hot Water Pump	0.3	76.0%	No	1,500	No	76.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Zamboni Room	Trane Compressor	1	Air Compressor	2.0	81.0%	No	1,500	No	81.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Zamboni Room	Trane Compressor	1	Air Compressor	7.5	84.0%	No	1,500	No	84.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Zamboni Room	Trane Compressor	1	Air Compressor	15.0	85.0%	No	1,500	No	85.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Zamboni Room	Trane Compressor	1	Air Compressor	60.0	92.0%	No	1,500	No	92.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Rear Indoor Pool	Indoor Pool	1	Other	7.5	86.0%	No	1,500	No	86.0%	No		0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric HVAC Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (kBtu/hr)	Cooling Mode Efficiency (SEER/EER)	Heating Mode Efficiency (COP)	Install Dual Enthalpy Economizer?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Roof Top	Main office	1	Ductless Mini-Split HP	0.75	9.00	Yes	1	Ductless Mini-Split AC	0.75		18.00		No	0.13	836	0.0	$87.54	$2,054.62	$0.00	23.47
Roof Top	Locker Rooms	2	Packaged AC	3.00		No							No	0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Electric Chiller Inventory & Recommendations

		Existing Conditions			Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Chiller Quantity	System Type	Cooling Capacity per Unit (Tons)	Install High Efficiency Chillers?	Chiller Quantity	System Type	Constant/ Variable Speed	Cooling Capacity (Tons)	Full Load Efficiency (kW/Ton)	IPLV Efficiency (kW/Ton)	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
Zambroni Room	Rink Building	2	Air-Cooled Centrifugal Chiller	145.00	No							0.00	0	0.0	$0.00	$0.00	$0.00	0.00

Fuel Heating Inventory & Recommendations

		Existing Conditions			Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Output Capacity per Unit (MBh)	Install High Efficiency System?	System Quantity	System Type	Output Capacity per Unit (MBh)	Heating Efficiency	Heating Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Compressor Area	Ceiling Compressor	1	Warm Air Unit Heater	50.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Zamboni Room	Zambroni Room	1	Warm Air Unit Heater	50.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Compressor Area	Compressor	1	Furnace	50.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Corridor	Corridor	2	Warm Air Unit Heater	50.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Boiler Room	2	Warm Air Unit Heater	50.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
New Boiler Room	Pool and space heat	3	Non-Condensing Hot Water Boiler	843.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Zamboni Room	Rink	1	Non-Condensing Hot Water Boiler	523.00	Yes	1	Non-Condensing Hot Water Boiler	523.00	85.00%	Et	0.00	0	27.0	$205.08	$11,733.63	$915.25	52.75
Staff Toilet	Staff Toilet	1	Infrared Unit Heater	50.00	No						0.00	0	0.0	$0.00	$0.00	$0.00	0.00
Boiler Room	Main Office & Locker Rooms	1	Non-Condensing Hot Water Boiler	842.00	Yes	1	Non-Condensing Hot Water Boiler	680.00	85.00%	Et	0.00	0	63.3	$480.09	$15,255.96	$1,190.00	29.30

DHW Inventory & Recommendations

		Existing Conditions		Proposed Conditions						Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Zamboni Room	Zamboni Room	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

	Recommendation 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
Men's Bathroom	2	Faucet Aerator (Lavatory)	2.50	1.00	0.00	0	17.1	$129.37	$14.34	$0.00	0.11
Bathroom Unisex	2	Pre-Rinse Spray Valve	2.50	1.15	0.00	0	128.9	$978.07	$248.70	$0.00	0.25
Bathroom Unisex	1	Faucet Aerator (Lavatory)	2.50	1.00	0.00	0	8.5	$64.69	$7.17	$0.00	0.11
Women's Bathroom	2	Faucet Aerator (Lavatory)	2.50	1.00	0.00	0	17.1	$129.37	$14.34	$0.00	0.11
Rink Bathroom	8	Faucet Aerator (Lavatory)	2.50	1.00	0.00	0	68.2	$517.50	$57.36	$0.00	0.11
Rink Bathroom	4	Pre-Rinse Spray Valve	2.50	1.15	0.00	0	257.9	$1,956.15	$497.40	$0.00	0.25
Rink Bathroom	8	Faucet Aerator (Lavatory)	2.50	1.00	0.00	0	68.2	$517.50	$57.36	$0.00	0.11
Rink Bathroom	4	Pre-Rinse Spray Valve	2.50	1.15	0.00	0	257.9	$1,956.15	$497.40	$0.00	0.25

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Reception Area	1	Office MultiFunction Printer	1,440.0	Yes
Reception Area	1	Desktop Computer	110.0	Yes
Mian Office	3	Desktop Computer	110.0	Yes
Mian Office	1	Fax Machine	45.0	Yes
Mian Office	1	Microwave	1,000.0	No
Storage Room	1	Refrigerator	560.0	Yes