# Local Government Energy Audit: Energy Audit Report

## Panzer Athletic Center

1 Normal Ave

Montclair, New Jersey 07043

Montclair State University

July 26, 2018

Final Report by:

**TRC Energy Services**

# Disclaimer

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

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

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

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

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# 1 EXECUTIVE SUMMARY

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

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

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

## 1.1 Facility Summary

Panzer Athletic Center is a 70,034 square foot facility constructed in 1955. The building is a two-story sports facility having several spaces including gymnasium, hallways, locker rooms, mechanical, and electrical rooms.

Lighting at Panzer Athletic Center consists of a combination of 32-Watt T8 fluorescent fixtures, 14-Watt T5 fluorescent fixtures, and 40-Watt T12 fluorescent fixtures; all of which are inefficient in performance when compared to the latest lighting technology available in the market. Exterior lighting is provided by a combination of 100-Watt, 150-Watt, and 400-Watt Metal Halide fixtures and compact fluorescent fixtures. Lighting control is provided by a combination of switches and occupancy sensors for interior fixtures and photocells for exterior fixtures.

Cooling is provided by package units and split system heat pumps. Steam is provided from the District Energy Plant to the Panzer Athletic Center's mechanical room, where it is converted to heating and domestic hot water by steam to water heat exchangers.

A thorough description of the facility and our observations are located in Section 2.

## 1.2 Your Cost Reduction Opportunities

### Energy Conservation Measures

TRC evaluated and recommended nine (9) measures that together represent an opportunity for Panzer Athletic Center to reduce annual energy costs by roughly $43,653 and annual greenhouse gas emissions by 261,656 lbs $CO_2e$. We estimate that if all high priority measures are implemented as recommended, the project will pay for itself in roughly 3.2 years. TRC has defined high priority measures as the evaluated measures that have a simple payback less than the typical equipment life of the proposed equipment. The breakdown of existing and potential utility costs after project implementation are illustrated in Figure 1 and Figure 2, respectively. Together these measures represent an opportunity to reduce Panzer Athletic Center's annual energy use by 8%.

*Figure 1 – Previous 12 Month Utility Costs*

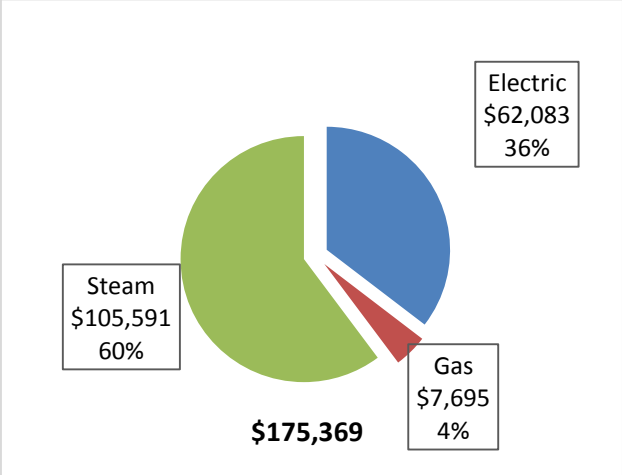
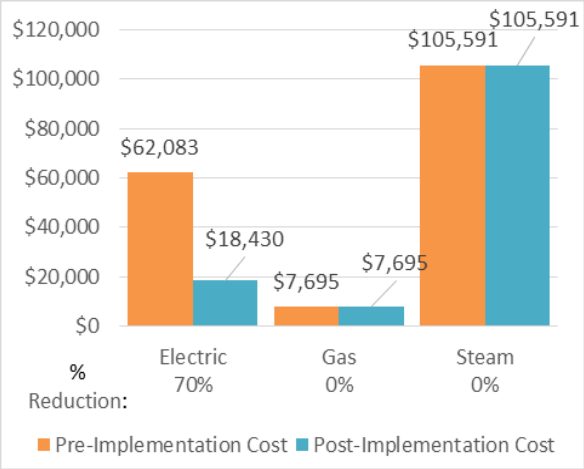



*Figure 2 – Potential Post-Implementation Costs*




A detailed description of Panzer Athletic Center's existing energy use can be found in Section 3.Estimates of the total cost, energy savings, and financial incentives for the evaluated energy efficient upgrades are summarized below in Figure 3. A brief description of each category can be found below and a description of savings opportunities can be found in Section 4.

*Figure 3 – Summary of Energy Reduction Opportunities*

| Energy Conservation Measure | | High Priority? | Annual Electric Savings (kWh) | Annual Electric Savings (kWh) | Chilled Water Savings (Ton-Hr) | 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** | | | **193,619** | **151,596** | **0** | **27.7** | **0.0** | **$32,527.91** | **$103,112.40** | **$12,425.00** | **$90,687.40** | **2.8** | **194,972** |
| ECM 1 | Install LED Fixtures | Yes | 77,217 | 77,217 | 0 | 11.3 | 0.0 | $12,972.39 | $25,750.00 | $8,150.00 | $17,600.00 | 1.4 | 77,757 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | Yes | 30,810 | | | 4.5 | 0.0 | $5,176.03 | $12,088.83 | $1,265.00 | $10,823.83 | 2.1 | 31,025 |
| ECM 3 | Retrofit Fixtures with LED Lamps | Yes | 74,379 | 74,379 | 0 | 11.0 | 0.0 | $12,495.74 | $58,390.04 | $3,010.00 | $55,380.04 | 4.4 | 74,899 |
| ECM 4 | Install LED Exit Signs | Yes | 11,213 | | | 0.8 | 0.0 | $1,883.75 | $6,883.52 | $0.00 | $6,883.52 | 3.7 | 11,291 |
| **Lighting Control Measures** | | | **36,958** | **36,958** | **0** | **5.4** | **0.0** | **$6,208.94** | **$17,240.00** | **$1,820.00** | **$15,420.00** | **2.5** | **37,216** |
| ECM 5 | Install Occupancy Sensor Lighting Controls | Yes | 33,985 | 33,985 | 0 | 5.0 | 0.0 | $5,709.45 | $14,040.00 | $1,820.00 | $12,220.00 | 2.1 | 34,222 |
| ECM 6 | Install High/Low Lighitng Controls | Yes | 2,973 | 2,973 | 0 | 0.4 | 0.0 | $499.49 | $3,200.00 | $0.00 | $3,200.00 | 6.4 | 2,994 |
| **Variable Frequency Drive (VFD) Measures** | | | **27,651** | **27,651** | **0** | **6.4** | **0.0** | **$4,645.33** | **$36,050.70** | **$4,000.00** | **$32,050.70** | **6.9** | **27,844** |
| ECM 7 | Install VFDs on Constant Volume (CV) HVAC | Yes | 14,615 | 14,615 | 0 | 4.8 | 0.0 | $2,455.32 | $18,004.80 | $4,000.00 | $14,004.80 | 5.7 | 14,717 |
| ECM 8 | Install VFDs on Hot Water Pumps | Yes | 13,036 | 13,036 | 0 | 1.6 | 0.0 | $2,190.02 | $18,045.90 | $0.00 | $18,045.90 | 8.2 | 13,127 |
| **Plug Load Equipment Control - Vending Machine** | | | **1,612** | **1,612** | **0** | **0.0** | **0.0** | **$270.79** | **$230.00** | **$0.00** | **$230.00** | **0.8** | **1,623** |
| ECM 9 | Vending Machine Control | Yes | 1,612 | 1,612 | 0 | 0.0 | 0.0 | $270.79 | $230.00 | $0.00 | $230.00 | 0.8 | 1,623 |
| **TOTALS FOR HIGH PRIORITY MEASURES** | | | **259,839** | **217,817** | **0** | **39.5** | **0.0** | **$43,652.97** | **$156,633.10** | **$18,245.00** | **$138,388.10** | **3.2** | **261,656** |
| **TOTALS FOR ALL EVALUATED MEASURES** | | | **259,839** | **217,817** | **0** | **39.5** | **0.0** | **$43,652.97** | **$156,633.10** | **$18,245.00** | **$138,388.10** | **3.2** | **261,656** |

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

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

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

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

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

## Energy Efficient Practices

TRC also identified nine (9) low cost or no cost energy efficient practices. A facility's energy performance can be significantly improved by employing certain behavioral or operational adjustments and by performing better routine maintenance on building systems. These practices can extend equipment lifetime, improve occupant comfort, provide better health and safety, as well as reduce annual energy and O&M costs. Potential opportunities identified at Panzer Athletic Center include:

- Close Doors and Windows
- Perform Proper Lighting Maintenance
- Develop a Lighting Maintenance Schedule
- Perform Routine Motor Maintenance
- Clean and/or Replace HVAC Filters
- Check for and Seal Duct Leakage
- Repair/Replace Steam Traps
- Install Plug Load Controls
- Water Conservation

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

## On-Site Generation Measures

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

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

## 1.3 Implementation Planning

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

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

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

- SmartStart
- Pay for Performance - Existing Building (P4P)
- Energy Savings Improvement Program (ESIP)

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

Larger facilities with an interest in a more comprehensive whole building approach to energy conservation should consider participating in the Pay for Performance (P4P) program. Projects eligible for this project program must meet minimum savings requirements. Final incentives are calculated based on actual measured performance achieved at the end of the project. The application process is more involved, and it requires working with a qualified P4P contractor, but the process may result in greater energy savings overall and more lucrative incentives, up to 50% of project's total cost.

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the Energy Savings Improvement Program (ESIP). Supported directly by the NJBPU, ESIP provides government agencies with project development, design, and implementation support services, as well as, attractive financing for implementing ECMs. An LGEA report (or other approved energy audit) is required for participation in ESIP. Please refer to Section 8.3 for additional information on the ESIP Program.

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

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

# 2 FACILITY INFORMATION AND EXISTING CONDITIONS

## 2.1 Project Contacts

*Figure 4 – Project Contacts*

| Name | Role | E-Mail | Phone # |
|---|---|---|---|
| **Customer** | | | |
| Ana Pinto | Director of Energy Management | pintoa@mail.montclair.edu | 973-655-3244 |
| **TRC Energy Services** | | | |
| Moussa Traore | Auditor | MTraore@trcsolutions.com | 732-855-0033 |

## 2.2 General Site Information

On July 26, 2017, TRC performed an energy audit at Panzer Athletic Center located in Montclair, New Jersey. TRC met with Ana Pinto to review the facility operations and help focus our investigation on specific energy-using systems.

Panzer Athletic Center is a 70,034 square foot facility constructed in 1955. The building is a two-story sports facility including a gymnasium, hallways, locker rooms, classrooms, mechanical, and electrical rooms.

Lighting at Panzer Athletic Center consists of a combination of 32-Watt, T8 fluorescent fixtures; 14-Watt T5 fluorescent fixtures; and 40-Watt, T12 fluorescent fixtures; all of which are inefficient in performance when compared to the latest lighting technology available in the market. Exterior lighting is provided by a combination of 100-Watt, 150-Watt, and 400-Watt metal halide fixtures and compact fluorescent fixtures. Lighting control is provided by a combination of switches and occupancy sensors for interior fixtures and photocells for exterior fixtures.

Cooling is provided by package units and split system heat pumps. Steam is provided from the District Energy Plant to the Panzer Athletic Center's mechanical room, where it is converted to heating and domestic hot water by steam to water heat exchangers.

## 2.3 Building Occupancy

The typical schedule is presented in the table below.

*Figure 5 - Building Schedule*

| Building Name | Weekday/Weekend | Operating Schedule |
|---|---|---|
| Panzer Athletic Center | Weekday | 8:00 AM - 8:00 PM |
| Panzer Athletic Center | Weekend | 8:00 AM - 8:00 PM |

## 2.4 Building Envelope

The Panzer Athletic Center is a two-story building. The construction is of concrete masonry block with finished painted exterior and double-paned, tinted windows with fixed frames. The sloped roof is constructed of roofing tile material.

*Figure 6 – Building Façade*


## 2.5 On-Site Generation

The campus has a central cogeneration plant. The cogeneration plant uses natural gas fired turbines to produce electricity. Waste heat from the turbines is used to produce steam. The steam is delivered to some of the buildings on campus and used to produce chilled water which is delivered to some of the buildings on campus. See the campus summary report for additional information regarding the campus cogeneration plant.

Panzer Athletic Center does not have any on-site electric generation capacity.

## 2.6 Energy-Using Systems

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

### Lighting System

Lighting at Panzer Athletic consists of a combination of 32-Watt, T8 fluorescent fixtures; 14-Watt, T5 fluorescent fixtures; and 40-Watt T12 fluorescent fixtures, which are inefficient in performance when compared to the latest lighting technology available in the market. Most of the fixtures are 2-foot, 3-foot, or 4-foot long troffers with diffusers in 1, 2, 3, and 4-lamp configurations. In addition to the fluorescent fixtures, the facility is also served by 26-Watt and 42-Watt compact fluorescent lamps and 100-Watt and 300-Watt incandescent lamps. Some areas in the building are illuminated with LED based fixtures.

Interior lighting control in the building is provided by a combination of manual switches and occupancy sensors. The occupancy sensors are either wall or ceiling mounted depending on the space layout.

*Figure 7 - Building Lighting Systems*

*Typical Fluorescent Fixture*

*Typical Compact Fluorescent Fixture*

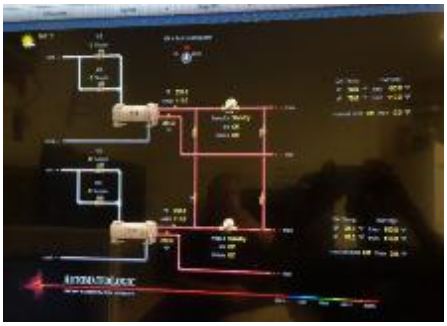
The building's exterior lighting consists primarily of 100-Watt, 150-Watt, and 400-Watt metal halide fixtures. The exterior lamps are controlled by photocells.

## Steam to Hot Water Heating System

The heating hot water (HHW) system consists of steam to water heat exchangers in the mechanical room that receive steam from the District Energy Plant. From there, the HHW is distributed to the building's air handling units (AHUs). The HHW is distributed by two (2) 3 hp hot water pumps operating at constant speed.

*Figure 8 – Hot Water Pumping System*

*Heat Exchanger EMS*



*Hot Water Pumps*

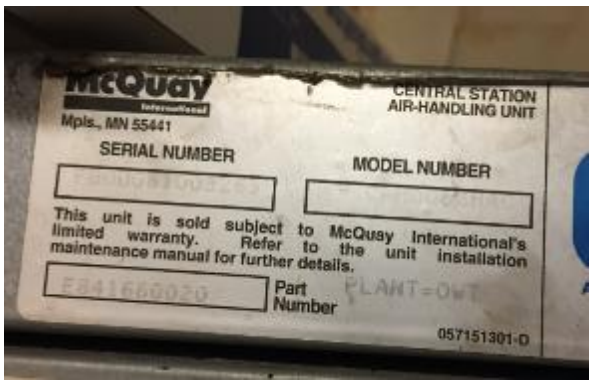
## Air Distribution System

Conditioned air at Panzer Athletic Center is provided by seven (7) constant volume air handling units. Three of the units have 7.5 hp supply fans, two (2) units each have 15 hp supply fans, one (1) unit has a 5 HP supply fan and one (1) unit has a 2 hp fan. Air distribution also incorporates return and exhaust fans, including a 30 hp exhaust fan serving the pool area. ERU-1 and ERU-2 supply and return fans are equipped with variable speed drives. Other fans operate at constant speed. Most units are equipped with DX coils for cooling and hot water coils for heating. Heating in some areas of the facility is provided by a gas-fired forced air furnace.

*Figure 9 – Air Distribution System*

*Air Handling Unit*

*AHU Supply Fan Nameplate*



## Direct Expansion Air Conditioning System (DX)

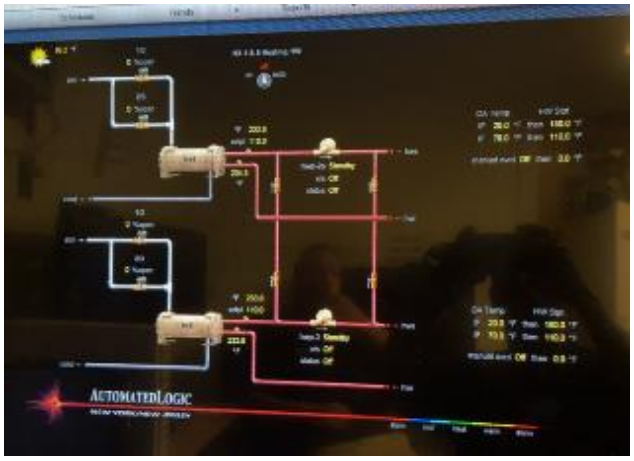
In addition to the main air handlers, the facility also has a package unit, split system AC, and split systems heat pumps with capacities ranging between 1.5 ton and 16 tons.

The units are constant air volume systems. The units each utilize a scroll compressor and a direct-expansion (DX) coil.

## Building Energy Management System (BEMS)

The facility is controlled by Automated Logic Corporation's WebCTRL building energy management system (BEMS). The BEMS provides controls the air handling units and pumps.

*Figure 10 – Building Energy Management System (BEMS)*



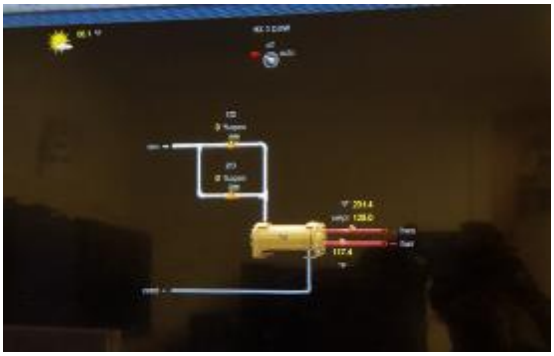

## Domestic Hot Water Heating System

Steam from the district energy plant produces domestic hot water through a dedicated steam to water heat exchanger located in the mechanical room. The facility also has a swimming pool that is served by steam to water heat exchanger system.

*Figure 11 – Domestic/Pool Hot Water System*

*Swimming Pool*

*Domestic Hot Water EMS*



## Building Plug Load

There are about 42 computer work stations throughout the facility. All the computers are desktop units with LCD monitors. There is no centralized PC power management software installed.

The facility contains other systems which contribute to plug load including printers, microwaves, and televisions at the facility. In addition to the typical plug load equipment, the facility also has a refrigerated vending machine.

# 3 SITE ENERGY USE AND COSTS

This building receives electricity and natural gas through master meters. It also receives electricity and steam from the campus central cogeneration plant. These utilities were prorated for individual buildings based on building size and function.

Prorated and direct purchase utility data were 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 3.5 for additional information.

## 3.1 Total Cost of Energy

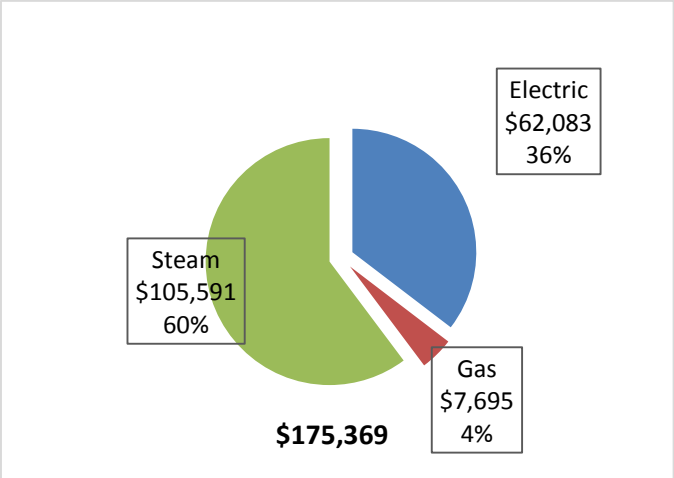
The following energy consumption and cost data is based on the last 12-month period of utility billing data that was provided for each utility. A profile of the annual energy consumption and energy cost of the facility was developed from this information.

*Figure 12 - Utility Summary*

| Utility Summary for Panzer Athletic Center | | |
|---|---|---|
| **Fuel** | **Usage** | **Cost** |
| Electricity | 907,199 kWh | $62,083 |
| Natural Gas | 10,470 Therms | $7,695 |
| Steam | 5,793 kLbs | $105,591 |
| **Total** | | **$175,369** |

The current annual energy cost for this facility is $175,369 as shown in the chart below.

*Figure 13 - Energy Cost Breakdown*



## 3.2 Electricity Usage

Electricity is provided by PSE&G and cogeneration plant. The average electric cost over the past 12 months was $0.168/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 14 - Electric Usage & Demand*

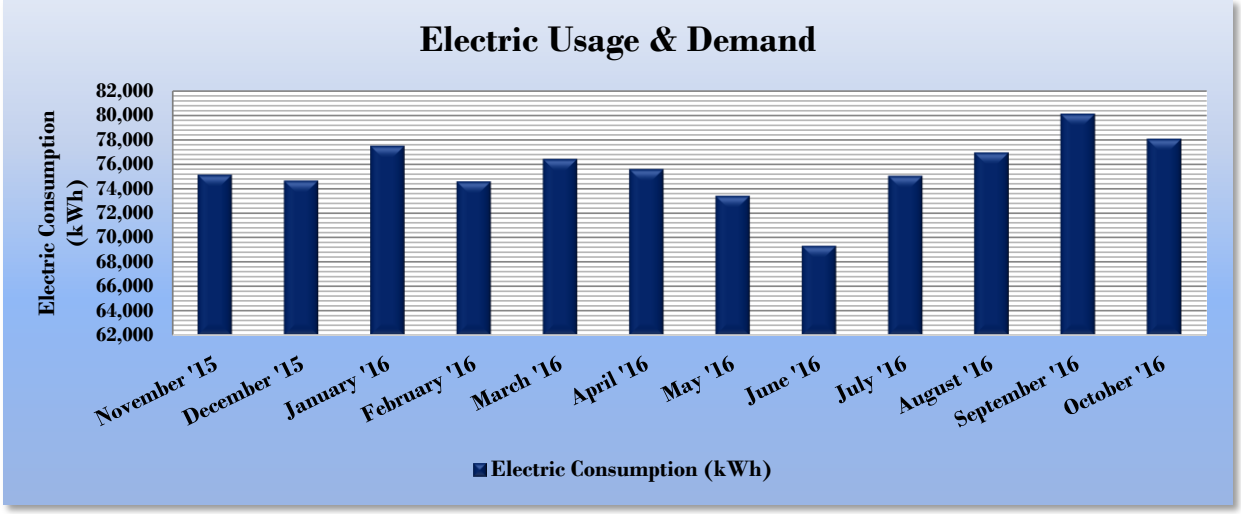



*Figure 15 - Electric Usage & Demand*

| Electric Billing Data for Panzer Athletic Center | | | | |
|---|---|---|---|---|
| Period Ending | Days in Period | Electric Usage (kWh) | Total Electric Cost | TRC Estimated Usage? |
| 11/30/15 | 30 | 75,155 | $4,431 | Yes |
| 12/31/15 | 31 | 74,688 | $5,611 | Yes |
| 1/31/16 | 31 | 77,545 | $4,618 | Yes |
| 2/28/16 | 28 | 74,610 | $10,716 | Yes |
| 3/31/16 | 31 | 76,444 | $4,293 | Yes |
| 4/30/16 | 30 | 75,631 | $4,284 | Yes |
| 5/31/16 | 31 | 73,447 | $4,193 | Yes |
| 6/30/16 | 30 | 69,352 | $4,513 | Yes |
| 7/31/16 | 31 | 75,068 | $4,772 | Yes |
| 8/31/16 | 31 | 76,979 | $5,063 | Yes |
| 9/30/16 | 30 | 80,160 | $4,939 | Yes |
| 10/31/16 | 31 | 78,121 | $4,651 | Yes |
| **Totals** | **365** | **907,199** | **$62,083** | 12 |
| **Annual** | **365** | **907,199** | **$62,083** | |

## 3.3 Natural Gas Usage

Natural gas is provided by PSE&G. The average gas cost for the past 12 months is $0.735/therm, which is the blended rate used throughout the analyses in this report. The monthly gas consumption is shown in the chart below.

*Figure 16 - Months Natural Gas Usage*

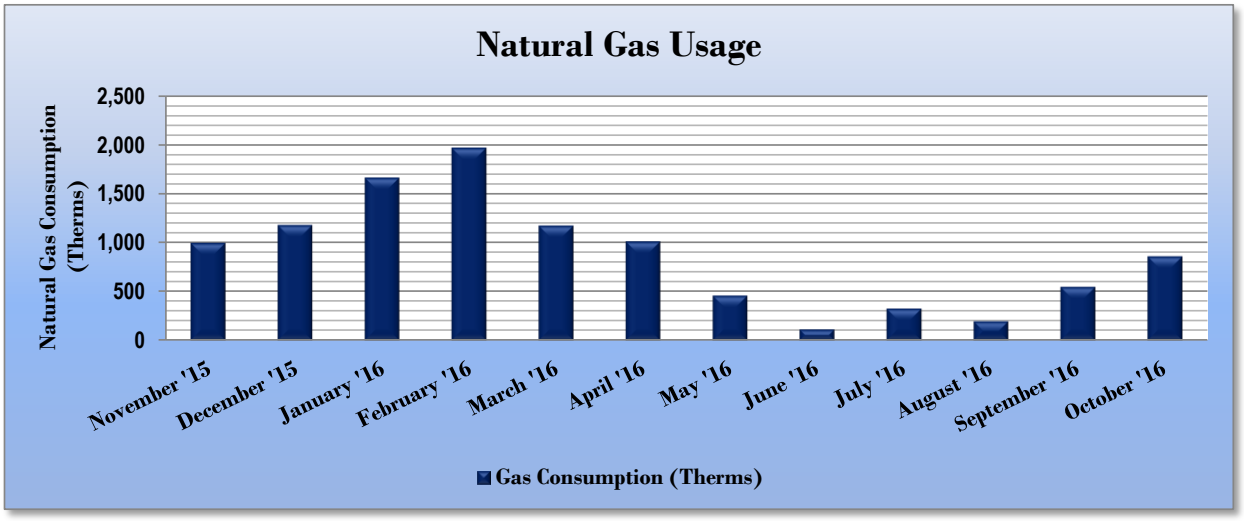



*Figure 17 - Natural Gas Usage*

| Gas Billing Data for Panzer Athletic Center | | | | |
|---|---|---|---|---|
| Period Ending | Days in Period | Natural Gas Usage (Therms) | Natural Gas Cost | TRC Estimated Usage? |
| 11/30/15 | 30 | 996 | $1,177 | Yes |
| 12/31/15 | 31 | 1,177 | $996 | Yes |
| 1/31/16 | 31 | 1,660 | $1,284 | Yes |
| 2/28/16 | 28 | 1,964 | $1,348 | Yes |
| 3/31/16 | 31 | 1,170 | $572 | Yes |
| 4/30/16 | 30 | 1,009 | $512 | Yes |
| 5/31/16 | 31 | 456 | $237 | Yes |
| 6/30/16 | 30 | 111 | $63 | Yes |
| 7/31/16 | 31 | 325 | $201 | Yes |
| 8/31/16 | 31 | 196 | $119 | Yes |
| 9/30/16 | 30 | 548 | $336 | Yes |
| 10/31/16 | 31 | 858 | $850 | Yes |
| **Totals** | **365** | **10,470** | **$7,695** | 12 |
| **Annual** | **365** | **10,470** | **$7,695** | |

## 3.4 Steam Usage

Steam is provided by campus CHP. The average steam cost for the past 12 months is $18.227/kLb, which is the blended rate used throughout the analyses in this report. The steam consumption is shown in the table below.

*Figure 18 - Steam Usage*

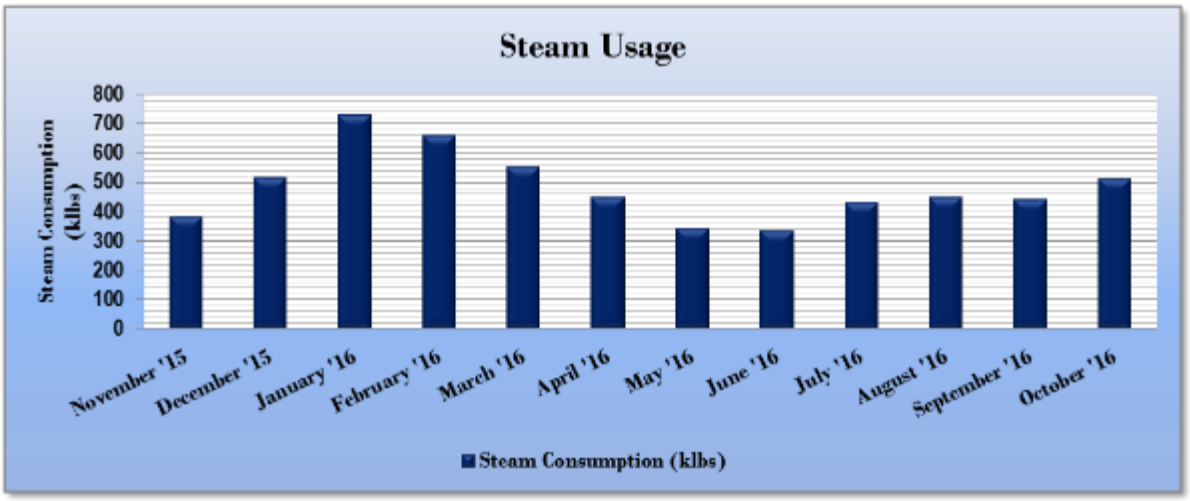



*Figure 19 – Steam Usage*

| Steam Billing Data for Panzer Athletic Center | | | | |
|---|---|---|---|---|
| Period Ending | Days in Period | Steam Usage (kLbs) | Fuel Cost | TRC Estimated Usage? |
| 11/30/15 | 30 | 383 | $6,981 | Yes |
| 12/31/15 | 31 | 514 | $9,369 | Yes |
| 1/31/16 | 31 | 730 | $13,306 | Yes |
| 2/28/16 | 28 | 659 | $12,012 | Yes |
| 3/31/16 | 31 | 551 | $10,043 | Yes |
| 4/30/16 | 30 | 450 | $8,202 | Yes |
| 5/31/16 | 31 | 342 | $6,234 | Yes |
| 6/30/16 | 30 | 334 | $6,088 | Yes |
| 7/31/16 | 31 | 430 | $7,838 | Yes |
| 8/31/16 | 31 | 448 | $8,166 | Yes |
| 9/30/16 | 30 | 441 | $8,038 | Yes |
| 10/31/16 | 31 | 511 | $9,314 | Yes |
| **Totals** | **365** | **5,793** | **$105,591** | 12 |
| **Annual** | **365** | **5,793** | **$105,591** | |

## 3.5 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 20 - Energy Use Intensity Comparison – Existing Conditions*

| Energy Use Intensity Comparison - Existing Conditions | | |
|---|---|---|
| | Panzer Athletic Center | National Median<br>Building Type: Higher Education - Public |
| Source Energy Use Intensity (kBtu/ft$^2$) | 273.0 | 262.6 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 157.9 | 130.7 |

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

*Figure 21 - Energy Use Intensity Comparison – Following Installation of Recommended Measures*

| Energy Use Intensity Comparison - Following Installation of Recommended Measures | | |
|---|---|---|
| | Panzer Athletic Center | National Median<br>Building Type: Higher Education - Public |
| Source Energy Use Intensity (kBtu/ft$^2$) | 237.5 | 262.6 |
| Site Energy Use Intensity (kBtu/ft$^2$) | 146.6 | 130.7 |

Many types of commercial buildings are also eligible to receive an ENERGY STAR® score. This score is a percentile ranking from 1 to 100. It compares your building's energy performance to similar buildings nationwide. A score of 50 represents median energy performance, while a score of 75 means your building performs better than 75 percent of all similar buildings nationwide and may be eligible for ENERGY STAR® certification.

As the electric and gas accounts were shared between various buildings, it was not possible to benchmark these buildings and provide a score individually. A campus wide Portfolio Manager Statement of Energy Performance (SEP) was generated.

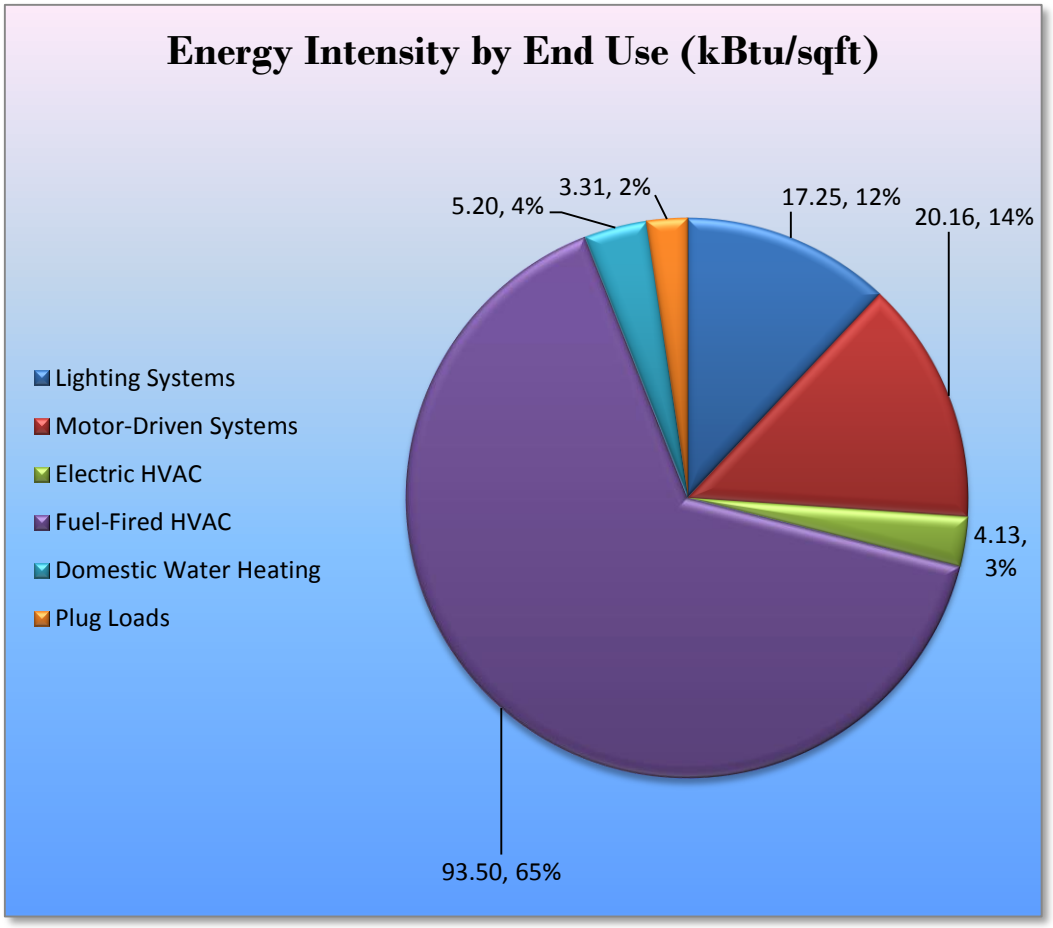
For more information on ENERGY STAR® certification go to: https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1.

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

## 3.6 Energy End-Use Breakdown

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

*Figure 22 - Energy Balance (% and kBtu/SF)*



# 4 ENERGY CONSERVATION MEASURES

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

## 4.1 High Priority ECMs

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

*Figure 23 – Summary of High Priority ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Annual Electric Savings (kWh) | Chilled Water Savings (Ton-Hr) | 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** | | **193,619** | **151,596** | **0** | **27.7** | **0.0** | **$32,527.91** | **$103,112.40** | **$12,425.00** | **$90,687.40** | **2.8** | **194,972** |
| ECM 1 | Install LED Fixtures | 77,217 | 77,217 | 0 | 11.3 | 0.0 | $12,972.39 | $25,750.00 | $8,150.00 | $17,600.00 | 1.4 | 77,757 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 30,810 | | | 4.5 | 0.0 | $5,176.03 | $12,088.83 | $1,265.00 | $10,823.83 | 2.1 | 31,025 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 74,379 | 74,379 | 0 | 11.0 | 0.0 | $12,495.74 | $58,390.04 | $3,010.00 | $55,380.04 | 4.4 | 74,899 |
| ECM 4 | Install LED Exit Signs | 11,213 | | | 0.8 | 0.0 | $1,883.75 | $6,883.52 | $0.00 | $6,883.52 | 3.7 | 11,291 |
| **Lighting Control Measures** | | **36,958** | **36,958** | **0** | **5.4** | **0.0** | **$6,208.94** | **$17,240.00** | **$1,820.00** | **$15,420.00** | **2.5** | **37,216** |
| ECM 5 | Install Occupancy Sensor Lighting Controls | 33,985 | 33,985 | 0 | 5.0 | 0.0 | $5,709.45 | $14,040.00 | $1,820.00 | $12,220.00 | 2.1 | 34,222 |
| ECM 6 | Install High/Low Lighitng Controls | 2,973 | 2,973 | 0 | 0.4 | 0.0 | $499.49 | $3,200.00 | $0.00 | $3,200.00 | 6.4 | 2,994 |
| **Variable Frequency Drive (VFD) Measures** | | **27,651** | **27,651** | **0** | **6.4** | **0.0** | **$4,645.33** | **$36,050.70** | **$4,000.00** | **$32,050.70** | **6.9** | **27,844** |
| ECM 7 | Install VFDs on Constant Volume (CV) HVAC | 14,615 | 14,615 | 0 | 4.8 | 0.0 | $2,455.32 | $18,004.80 | $4,000.00 | $14,004.80 | 5.7 | 14,717 |
| ECM 8 | Install VFDs on Hot Water Pumps | 13,036 | 13,036 | 0 | 1.6 | 0.0 | $2,190.02 | $18,045.90 | $0.00 | $18,045.90 | 8.2 | 13,127 |
| **Plug Load Equipment Control - Vending Machine** | | **1,612** | **1,612** | **0** | **0.0** | **0.0** | **$270.79** | **$230.00** | **$0.00** | **$230.00** | **0.8** | **1,623** |
| ECM 9 | Vending Machine Control | 1,612 | 1,612 | 0 | 0.0 | 0.0 | $270.79 | $230.00 | $0.00 | $230.00 | 0.8 | 1,623 |
| **TOTALS FOR HIGH PRIORITY MEASURES** | | **259,839** | **217,817** | **0** | **39.5** | **0.0** | **$43,652.97** | **$156,633.10** | **$18,245.00** | **$138,388.10** | **3.2** | **261,656** |
| **TOTALS FOR ALL EVALUATED MEASURES** | | **259,839** | **217,817** | **0** | **39.5** | **0.0** | **$43,652.97** | **$156,633.10** | **$18,245.00** | **$138,388.10** | **3.2** | **261,656** |

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

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

## 4.2 Lighting Upgrades

Our recommendations for upgrades to existing lighting fixtures are summarized in Figure 24 below.

*Figure 24 – 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** | | **193,619** | **27.7** | **0.0** | **$32,527.91** | **$103,112.40** | **$12,425.00** | **$90,687.40** | **2.8** | **194,972** |
| ECM 1 | Install LED Fixtures | 77,217 | 11.3 | 0.0 | $12,972.39 | $25,750.00 | $8,150.00 | $17,600.00 | 1.4 | 77,757 |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | 30,810 | 4.5 | 0.0 | $5,176.03 | $12,088.83 | $1,265.00 | $10,823.83 | 2.1 | 31,025 |
| ECM 3 | Retrofit Fixtures with LED Lamps | 74,379 | 11.0 | 0.0 | $12,495.74 | $58,390.04 | $3,010.00 | $55,380.04 | 4.4 | 74,899 |
| ECM 4 | Install LED Exit Signs | 11,213 | 0.8 | 0.0 | $1,883.75 | $6,883.52 | $0.00 | $6,883.52 | 3.7 | 11,291 |

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

### ECM 1: Install LED Fixtures

*Summary of Measure Economics*

| Interior/ Exterior | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| Interior | 64,479 | 9.4 | 0.0 | $10,832.42 | $20,550.00 | $7,050.00 | $13,500.00 | 1.2 | 64,930 |
| Exterior | 12,738 | 1.9 | 0.0 | $2,139.98 | $5,200.00 | $1,100.00 | $4,100.00 | 1.9 | 12,827 |

*Measure Description*

We recommend replacing existing both interior and exterior metal halide fixtures with new high-performance LED light fixtures. This measure saves energy by installing LEDs that 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 HID lamp.

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

*Summary of Measure Economics*

| Interior/ Exterior | Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|
| Interior | 30,810 | 4.5 | 0.0 | $5,176.03 | $12,088.83 | $1,265.00 | $10,823.83 | 2.1 | 31,025 |
| Exterior | 0 | 0.0 | 0.0 | $0.00 | $0.00 | $0.00 | $0.00 | 0.0 | 0 |

*Measure Description*

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

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

## 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 | 72,241 | 10.7 | 0.0 | $12,136.46 | $55,809.90 | $3,010.00 | $52,799.90 | 4.4 | 72,746 |
| Exterior | 2,139 | 0.3 | 0.0 | $359.28 | $2,580.14 | $0.00 | $2,580.14 | 7.2 | 2,154 |

*Measure Description*

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

Additional savings from lighting maintenance can be anticipated since LEDs have lifetimes that are more than twice that of fluorescent tubes and more than 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 | 11,213 | 0.8 | 0.0 | $1,883.75 | $6,883.52 | $0.00 | $6,883.52 | 3.7 | 11,291 |
| Exterior | 0 | 0.0 | 0.0 | $0.00 | $0.00 | $0.00 | $0.00 | 0.0 | 0 |

*Measure Description*

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

## 4.3 Lighting Control Measures

Our recommendations for lighting control measures are summarized in Figure 25 below.

***Figure 25 – 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** | | **36,958** | **5.4** | **0.0** | **$6,208.94** | **$17,240.00** | **$1,820.00** | **$15,420.00** | **2.5** | **37,216** |
| ECM 5 | Install Occupancy Sensor Lighting Controls | 33,985 | 5.0 | 0.0 | $5,709.45 | $14,040.00 | $1,820.00 | $12,220.00 | 2.1 | 34,222 |
| ECM 6 | Install High/Low Lighitng Controls | 2,973 | 0.4 | 0.0 | $499.49 | $3,200.00 | $0.00 | $3,200.00 | 6.4 | 2,994 |

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

### ECM 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) |
|---|---|---|---|---|---|---|---|---|
| 33,985 | 5.0 | 0.0 | $5,709.45 | $14,040.00 | $1,820.00 | $12,220.00 | 2.1 | 34,222 |

*Measure Description*

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

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

## ECM 6: Install High/Low Lighting Controls

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 2,973 | 0.4 | 0.0 | $499.49 | $3,200.00 | $0.00 | $3,200.00 | 6.4 | 2,994 |

*Measure Description*

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

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

For this type of measure the occupancy sensors will generally be ceiling or fixture mounted. Sufficient sensor coverage needs to be provided to ensure that lights turn on in each area as an occupant approaches.

Additional savings from reduced lighting maintenance may also result from this measure, due to reduced lamp operation.

## 4.4 Variable Frequency Drive (VFD) Measures

Our recommendations for VFD measures are summarized in Figure 26 below.

*Figure 26 – Summary of Variable Frequency Drive ECMs*

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Annual Electric Savings (kWh) | Chilled Water Savings (Ton-Hr) | 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** | | **27,651** | **27,651** | **0** | **6.4** | **0.0** | **$4,645.33** | **$36,050.70** | **$4,000.00** | **$32,050.70** | **6.9** | **27,844** |
| ECM 7 | Install VFDs on Constant Volume (CV) HVAC | 14,615 | 14,615 | 0 | 4.8 | 0.0 | $2,455.32 | $18,004.80 | $4,000.00 | $14,004.80 | 5.7 | 14,717 |
| ECM 8 | Install VFDs on Hot Water Pumps | 13,036 | 13,036 | 0 | 1.6 | 0.0 | $2,190.02 | $18,045.90 | $0.00 | $18,045.90 | 8.2 | 13,127 |

### ECM 7: Install VFDs on Constant Volume (CV) HVAC

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Annual Electric Savings (kWh) | Chilled Water Savings (Ton-Hr) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 14,615 | 14,615 | 0 | 4.8 | 0.0 | $2,455.32 | $18,004.80 | $4,000.00 | $14,004.80 | 5.7 | 14,717 |

*Measure Description*

We recommend installing VFDs to control two (2) 15 hp supply fan motors and two (2) 10 hp return fan motors speeds to convert a constant-volume, single-zone air handling system into a variable-air-volume (VAV) system. A separate VFD is usually required to control the return fan motor or dedicated exhaust fan motor, if the air handler has one. Zone thermostats will cause the VFD to modulate fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature. Energy savings result from reducing fan speed (and power) when there is a reduced load required for the zone. The magnitude of energy savings is based on the estimated amount of time that fan motors operate at partial load.

VAV systems should not be controlled such that the supply air temperature is raised at the expense of the fan power. A common mistake is to reset the supply air temperature to achieve chiller energy savings, which can lead to additional air flow requirements. Supply air temperature should be kept low, e.g. 55°F, until the minimum fan speed (typically about 50%) is met. At this point, it is efficient to raise the supply air temperature as the load decreases, but not such that additional air flow and thus fan energy is required.

## ECM 8: Install VFDs on Hot Water Pumps

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Annual Electric Savings (kWh) | Chilled Water Savings (Ton-Hr) | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| 13,036 | 0 | 0 | 1.6 | 0.0 | $2,190.02 | $18,045.90 | $0.00 | $18,045.90 | 8.2 | 13,127 |

*Measure Description*

We recommend installing VFDs to control all six (6) 3 hp hot water pumps. 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 results from reducing pump motor speed (and power) as hot water valves close. The magnitude of energy savings is based on the estimated amount of time that the system will operate at reduced load.

## 4.5 Plug Load Equipment Control - Vending Machines

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

***Figure 27 – Summary of Plug Load Equipment Control ECMs***

| Energy Conservation Measure | | Annual Electric Savings (kWh) | Chilled Water Savings (Ton-Hr) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($)* | Estimated Net Cost ($) | Simple Payback Period (yrs)** | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plug Load Equipment Control - Vending Machine** | | **1,612** | **0** | **0.0** | **0.0** | **$270.79** | **$230.00** | **$0.00** | **$230.00** | **0.8** | **1,623** |
| ECM 9 | Vending Machine Control | 1,612 | 0 | 0.0 | 0.0 | $270.79 | $230.00 | $0.00 | $230.00 | 0.8 | 1,623 |

### ECM 9: Vending Machine Control

*Summary of Measure Economics*

| Annual Electric Savings (kWh) | Peak Demand Savings (kW) | Annual Fuel Savings (MMBtu) | Annual Energy Cost Savings ($) | Estimated Install Cost ($) | Estimated Incentive ($) | Estimated Net Cost ($) | Simple Payback Period (yrs) | $CO_2e$ Emissions Reduction (lbs) |
|---|---|---|---|---|---|---|---|---|
| 1,612 | 0.0 | 0.0 | $270.79 | $230.00 | $0.00 | $230.00 | 0.8 | 1,623 |

*Measure Description*

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

# 5 ENERGY EFFICIENT PRACTICES

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

## Close Doors and Windows

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

## Perform Proper Lighting Maintenance

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

## Develop a Lighting Maintenance Schedule

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

## Perform Routine Motor Maintenance

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

## Clean and/or Replace HVAC Filters

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

## Check for and Seal Duct Leakage

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

## Repair/Replace Steam Traps

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

## Plug Load Controls

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

## Water Conservation

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

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

# 6 On-Site Generation Measures

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

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

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

## 6.1 Photovoltaic

Sunlight can be converted into electricity using photovoltaics (PV) modules. Modules are racked together into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is interconnected to the facility's electrical distribution system. The amount of unobstructed area available determines how large of a solar array can be installed. The size of the array combined with the orientation, tilt, and shading elements determines the energy produced. A preliminary screening based on the campus' electric demand and the size and location of free areas on campus was performed and is addressed in the campus level summary report.

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

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

## 6.2 Combined Heat and Power

Combined heat and power (CHP) is the on-site generation of electricity along with the recovery of heat energy, which is put to beneficial use. Common technologies for CHP include reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines. Electric generation from a CHP system is typically interconnected to local power distribution systems. Heat is recovered from exhaust and ancillary cooling systems and interconnected to the existing hot water (or steam) distribution systems. The campus has a CHP plant that uses natural gas fired turbines to generate electricity. Waste heat from the turbines is used to produce steam which is either delivered to buildings on campus or used to produce chilled water which is delivered to buildings on campus. Since the campus has a CHP that serves a significant portion of the campus further evaluation of individual building CHP applications were not done.

# 7 DEMAND RESPONSE

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

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

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

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

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

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

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

**In our opinion this building is not a good candidate for DR**.

# 8 PROJECT FUNDING / INCENTIVES

The NJCEP is able to provide the incentive programs described below, and other benefits to ratepayers, because of the Societal Benefits Charge (SBC) Fund. The SBC was created by the State of New Jersey's Electricity Restructuring Law (1999), which requires all customers of investor-owned electric and gas utilities to pay a surcharge on their monthly energy bills. As a customer of a state-regulated electric or gas utility and therefore a contributor to the fund your organization is eligible to participate in the LGEA program and also eligible to receive incentive payment for qualifying energy efficiency measures. Also available through the NJBPU are some alternative financing programs described later in this section. Please refer to Figure 28 for a list of the eligible programs identified for each recommended ECM.

*Figure 28 - ECM Incentive Program Eligibility*

| Energy Conservation Measure | | SmartStart Prescriptive | SmartStart Custom | Direct Install | Pay For Performance Existing Buildings | Large Energy Users Program | Combined Heat & Power and Fuel Cell |
|---|---|---|---|---|---|---|---|
| ECM 1 | Install LED Fixtures | X | | | X | | |
| ECM 2 | Retrofit Fluorescent Fixtures with LED Lamps and Drivers | X | | | X | | |
| ECM 3 | Retrofit Fixtures with LED Lamps | X | | | X | | |
| ECM 4 | Install LED Exit Signs | | | | X | | |
| ECM 5 | Install Occupancy Sensor Lighting Controls | X | | | X | | |
| ECM 6 | Install High/Low Lighitng Controls | | | | X | | |
| ECM 7 | Vending Machine Control | | | | X | | |

SmartStart is generally well-suited for implementation of individual measures or small group of measures. It provides flexibility to install measures at your own pace using in-house staff or a preferred contractor. Direct Install caters to small to mid-size facilities that can bundle multiple ECMs together. This can greatly simplify participation and may lead to higher incentive amounts but requires the use of pre-approved contractors. The Pay for Performance (P4P) program is a "whole-building" energy improvement program designed for larger facilities. It requires implementation of multiple measures meeting minimum savings thresholds, as well as use of pre-approved consultants. This facility does not meet all of the criteria for participating in the P4P program based on the measures identified in this study. However, since additional measures may be identified during the P4P evaluation and the facility is close to meeting the P4P program criteria it is worth considering the P4P program for this site. The Large Energy Users Program (LEUP) is available to New Jersey's largest energy users giving them flexibility to install as little or as many measures, in a single facility or several facilities, with incentives capped based on the entity's annual energy consumption. LEUP applicants can use in-house staff or a preferred contractor.

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

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

## 8.1 SmartStart

**Overview**

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

**Equipment with Prescriptive Incentives Currently Available:**

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

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

**Incentives**

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

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

**How to Participate**

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

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

## 8.2 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 an Energy Savings Improvement Program (ESIP) loan 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 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 NJCEP incentive programs to help further reduce costs when developing the ESP. You should refer to the ESIP guidelines at the link above for further information and guidance on next steps.*

# 9 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

## 9.1 Retail Electric Supply Options

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

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

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

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

## 9.2 Retail Natural Gas Supply Options

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

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

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

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

# APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

## Lighting Inventory & Recommendations

| | Existing Conditions | | | | | Proposed Conditions | | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Fixture Recommendation | Add Controls? | Fixture Quantity | Fixture Description | Control System | Watts per Fixture | Annual Operating Hours | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Main Lobby | 10 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | Yes | 10 | LED Screw-In Lamps: LED - 36 W | Occupancy Sensor | 36 | 3,058 | 0.17 | 1,158 | 0.0 | $194.61 | $1,615.06 | $70.00 | 7.94 |
| Main Lobby | 3 | Incandescent: INC-300W | Wall Switch | 300 | 4,368 | Relamp | No | 3 | LED Screw-In Lamps: LED - 45 W | Wall Switch | 45 | 4,368 | 0.56 | 3,843 | 0.0 | $645.58 | $161.26 | $15.00 | 0.23 |
| Main Lobby | 3 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 3 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.04 | 604 | 0.0 | $101.55 | $322.67 | $0.00 | 3.18 |
| Main Lobby | 7 | Metal Halide: (1) 100W Lamp | Wall Switch | 128 | 4,368 | Fixture Replacement | No | 7 | LED - Fixtures: LED - 38 W | Wall Switch | 38 | 4,368 | 0.46 | 3,151 | 0.0 | $529.29 | $1,750.00 | $0.00 | 3.31 |
| Men's Restroom | 3 | Linear Fluorescent - T5: 2' T5 (14W) - 2L | Wall Switch | 34 | 4,368 | Relamp | No | 3 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.04 | 256 | 0.0 | $43.04 | $144.60 | $30.00 | 2.66 |
| Women's Restroom | 3 | Linear Fluorescent - T5: 2' T5 (14W) - 2L | Wall Switch | 34 | 4,368 | Relamp | No | 3 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.04 | 256 | 0.0 | $43.04 | $144.60 | $30.00 | 2.66 |
| Fire room | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 4,368 | 0.04 | 249 | 0.0 | $41.77 | $75.20 | $15.00 | 1.44 |
| Gymnasium | 54 | Compact Fluorescent: CFL - 4-Pin - 26W - 8L | Wall Switch | 208 | 4,368 | Relamp | Yes | 54 | LED Screw-In Lamps: LED - 146 W | Occupancy Sensor | 146 | 3,058 | 4.22 | 28,774 | 0.0 | $4,834.12 | $24,301.30 | $140.00 | 5.00 |
| Gymnasium | 7 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 7 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.10 | 1,410 | 0.0 | $236.94 | $752.89 | $0.00 | 3.18 |
| Storage | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $58.50 | $10.00 | 1.74 |
| Storage | 3 | Linear Fluorescent - T5: 3' T5 (21W) - 2L | Wall Switch | 50 | 4,368 | Relamp | No | 3 | LED - Linear Tubes: (2) 3' Lamps | Wall Switch | 21 | 4,368 | 0.06 | 437 | 0.0 | $73.42 | $160.20 | $0.00 | 2.18 |
| 111A | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.12 | 838 | 0.0 | $140.76 | $504.00 | $75.00 | 3.05 |
| 110 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 3 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.09 | 628 | 0.0 | $105.57 | $445.50 | $65.00 | 3.60 |
| 111B | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.25 | 1,676 | 0.0 | $281.52 | $738.00 | $115.00 | 2.21 |
| Corridor | 3 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 3 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.04 | 604 | 0.0 | $101.55 | $322.67 | $0.00 | 3.18 |
| Corridor | 10 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 10 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 3,058 | 0.31 | 2,095 | 0.0 | $351.91 | $785.00 | $100.00 | 1.95 |
| 115 | 18 | Compact Fluorescent: CFL - 4-Pin - 26W - 8L | Wall Switch | 208 | 4,368 | Relamp | Yes | 18 | LED Screw-In Lamps: LED - 146 W | Occupancy Sensor | 146 | 3,058 | 1.41 | 9,591 | 0.0 | $1,611.37 | $8,280.43 | $70.00 | 5.10 |
| 115 | 2 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 2 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.03 | 403 | 0.0 | $67.70 | $215.11 | $0.00 | 3.18 |
| 118 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 3,058 | 0.14 | 943 | 0.0 | $158.36 | $495.60 | $80.00 | 2.62 |
| 118 | 10 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 10 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.31 | 2,095 | 0.0 | $351.91 | $855.00 | $135.00 | 2.05 |
| 118 | 3 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 3 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.04 | 604 | 0.0 | $101.55 | $322.67 | $0.00 | 3.18 |
| 118A | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |
| Corridor | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $58.50 | $10.00 | 1.74 |
| Corridor | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.04 | 296 | 0.0 | $49.79 | $117.00 | $10.00 | 2.15 |
| Corridor | 4 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | Yes | 4 | LED Screw-In Lamps: LED - 36 W | High/Low Control | 36 | 3,058 | 0.08 | 533 | 0.0 | $89.52 | $630.02 | $0.00 | 7.04 |

| | 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 |
| 130 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 4,368 | 0.01 | 88 | 0.0 | $14.77 | $35.90 | $5.00 | 2.09 |
| Equipment Rm | 12 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | Yes | 12 | LED Screw-In Lamps: LED - 29 W | Occupancy Sensor | 29 | 3,058 | 0.19 | 1,291 | 0.0 | $216.92 | $915.04 | $35.00 | 4.06 |
| 141 | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.18 | 1,257 | 0.0 | $211.14 | $621.00 | $95.00 | 2.49 |
| 145 | 5 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 5 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.15 | 1,047 | 0.0 | $175.95 | $562.50 | $85.00 | 2.71 |
| 145 | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| 143 | 6 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 4,368 | Relamp & Reballast | Yes | 6 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 3,058 | 0.60 | 4,081 | 0.0 | $685.58 | $1,241.00 | $155.00 | 1.58 |
| Office | 9 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 9 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.28 | 1,885 | 0.0 | $316.71 | $796.50 | $125.00 | 2.12 |
| Office | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Corridor | 7 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 7 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 3,058 | 0.21 | 1,466 | 0.0 | $246.33 | $609.50 | $70.00 | 2.19 |
| Corridor | 2 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 2 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.03 | 403 | 0.0 | $67.70 | $215.11 | $0.00 | 3.18 |
| 159 | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $161.83 | $20.00 | 1.42 |
| 155 | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 4,368 | Relamp & Reballast | Yes | 2 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 3,058 | 0.20 | 1,360 | 0.0 | $228.53 | $593.67 | $75.00 | 2.27 |
| 151 | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $161.83 | $20.00 | 1.42 |
| 156 | 24 | Metal Halide: (1) 400W Lamp | Wall Switch | 458 | 4,368 | Fixture Replacement | Yes | 24 | LED - Fixtures: Low-Bay | Occupancy Sensor | 137 | 3,058 | 6.39 | 43,620 | 0.0 | $7,328.14 | $10,140.00 | $3,670.00 | 0.88 |
| 156 | 3 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 3 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.04 | 604 | 0.0 | $101.55 | $322.67 | $0.00 | 3.18 |
| Stairwell F | 2 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | Yes | 2 | LED Screw-In Lamps: LED - 36 W | High/Low Control | 36 | 3,058 | 0.04 | 266 | 0.0 | $44.76 | $415.01 | $0.00 | 9.27 |
| Stairwell F | 4 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 4 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.04 | 253 | 0.0 | $42.53 | $215.01 | $0.00 | 5.06 |
| Stairwell F | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| 25 | 3 | Linear Fluorescent - T12: 4' T12 (40W) - 1L | Wall Switch | 46 | 4,368 | Relamp & Reballast | No | 3 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 4,368 | 0.07 | 475 | 0.0 | $79.75 | $294.00 | $15.00 | 3.50 |
| Corridor | 16 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 16 | LED - Linear Tubes: (1) 4' Lamp | High/Low Control | 15 | 3,058 | 0.26 | 1,756 | 0.0 | $295.03 | $974.40 | $80.00 | 3.03 |
| Corridor | 4 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 4 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.06 | 806 | 0.0 | $135.39 | $430.22 | $0.00 | 3.18 |
| Electrical Room | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 4 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.10 | 663 | 0.0 | $111.39 | $234.00 | $40.00 | 1.74 |
| 24 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 8 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 3,058 | 0.13 | 878 | 0.0 | $147.51 | $557.20 | $75.00 | 3.27 |
| 22 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.25 | 1,676 | 0.0 | $281.52 | $738.00 | $115.00 | 2.21 |
| Restroom | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |

| | 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 |
| Restroom | 3 | U-Bend Fluorescent - T8: U T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 3 | LED - Linear Tubes: (2) U-Lamp | Occupancy Sensor | 33 | 3,058 | 0.09 | 586 | 0.0 | $98.48 | $459.60 | $35.00 | 4.31 |
| Shower Room | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.05 | 332 | 0.0 | $55.70 | $117.00 | $20.00 | 1.74 |
| 21 | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.12 | 838 | 0.0 | $140.76 | $504.00 | $75.00 | 3.05 |
| 20 | 10 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 10 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 3,058 | 0.16 | 1,098 | 0.0 | $184.39 | $629.00 | $85.00 | 2.95 |
| Stairwell E | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | High/Low Control | 44 | 3,058 | 0.09 | 628 | 0.0 | $105.57 | $350.40 | $30.00 | 3.03 |
| Stairwell E | 2 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 36 W | Wall Switch | 36 | 4,368 | 0.02 | 157 | 0.0 | $26.33 | $215.01 | $0.00 | 8.17 |
| Equipment Rm | 23 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 23 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 3,058 | 0.37 | 2,524 | 0.0 | $424.10 | $1,365.70 | $185.00 | 2.78 |
| Corridor Basement | 17 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 17 | LED - Linear Tubes: (1) 4' Lamp | High/Low Control | 15 | 3,058 | 0.27 | 1,866 | 0.0 | $313.47 | $1,010.30 | $85.00 | 2.95 |
| Stairwell D | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | High/Low Control | 44 | 3,058 | 0.09 | 628 | 0.0 | $105.57 | $350.40 | $30.00 | 3.03 |
| Stairwell D | 2 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 36 W | Wall Switch | 36 | 4,368 | 0.02 | 157 | 0.0 | $26.33 | $215.01 | $0.00 | 8.17 |
| 1 | 1 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | No | 1 | LED Screw-In Lamps: LED - 36 W | Wall Switch | 36 | 4,368 | 0.01 | 78 | 0.0 | $13.16 | $107.51 | $0.00 | 8.17 |
| 2 | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |
| Mechanical Room | 14 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 14 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.34 | 2,321 | 0.0 | $389.88 | $819.00 | $140.00 | 1.74 |
| Mechanical Room | 1 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 1 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.01 | 63 | 0.0 | $10.63 | $53.75 | $0.00 | 5.06 |
| Mechanical Room | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| 10 | 2 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 2 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.03 | 403 | 0.0 | $67.70 | $215.11 | $0.00 | 3.18 |
| 10 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $58.50 | $10.00 | 1.74 |
| 10 | 19 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 4,368 | Relamp & Reballast | Yes | 19 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 3,058 | 1.89 | 12,923 | 0.0 | $2,171.01 | $3,614.83 | $450.00 | 1.46 |
| 10 | 6 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | Yes | 6 | LED - Linear Tubes: (4) 2' Lamps | Occupancy Sensor | 34 | 3,058 | 0.05 | 307 | 0.0 | $51.65 | $270.00 | $35.00 | 4.55 |
| 10A | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 8 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 3,058 | 0.13 | 878 | 0.0 | $147.51 | $557.20 | $75.00 | 3.27 |
| 10C | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | No | 4 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 4,368 | 0.05 | 352 | 0.0 | $59.07 | $143.60 | $20.00 | 2.09 |
| 15 | 44 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 44 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 1.35 | 9,217 | 0.0 | $1,548.38 | $3,654.00 | $580.00 | 1.99 |
| 15 | 3 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 3 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.04 | 604 | 0.0 | $101.55 | $322.67 | $0.00 | 3.18 |
| 15A | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| 18 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Occupancy Sensor | 32 | 3,058 | Relamp | No | 2 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 3,058 | 0.03 | 123 | 0.0 | $20.68 | $71.80 | $10.00 | 2.99 |

| | 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 |
| 18B | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 3,058 | Relamp | No | 4 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 3,058 | 0.15 | 696 | 0.0 | $116.96 | $300.80 | $60.00 | 2.06 |
| 18A | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Occupancy Sensor | 93 | 3,058 | Relamp | No | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 3,058 | 0.11 | 522 | 0.0 | $87.72 | $225.60 | $45.00 | 2.06 |
| 29 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 8 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 3,058 | 0.13 | 878 | 0.0 | $147.51 | $557.20 | $75.00 | 3.27 |
| 30 | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $58.50 | $10.00 | 1.74 |
| 31 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.05 | 332 | 0.0 | $55.70 | $117.00 | $20.00 | 1.74 |
| 31 | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | No | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Closet | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| Mens Locker Room | 14 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | Yes | 14 | LED - Linear Tubes: (1) 4' Lamp | Occupancy Sensor | 15 | 3,058 | 0.23 | 1,537 | 0.0 | $258.15 | $772.60 | $105.00 | 2.59 |
| 31 | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |
| Corridor | 11 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 11 | LED - Linear Tubes: (2) 4' Lamps | High/Low Control | 29 | 3,058 | 0.34 | 2,304 | 0.0 | $387.10 | $843.50 | $110.00 | 1.89 |
| Corridor | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (3) 4' Lamps | Wall Switch | 44 | 4,368 | 0.04 | 249 | 0.0 | $41.77 | $75.20 | $15.00 | 1.44 |
| Corridor | 6 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 6 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.09 | 1,209 | 0.0 | $203.09 | $645.33 | $0.00 | 3.18 |
| Restroom | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |
| Restroom | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | No | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 42 | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Occupancy Sensor | 62 | 3,058 | Relamp | No | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.15 | 696 | 0.0 | $116.96 | $351.00 | $60.00 | 2.49 |
| Shower Room | 6 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 6 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.18 | 1,257 | 0.0 | $211.14 | $621.00 | $95.00 | 2.49 |
| 44 | 1 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 1 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.01 | 63 | 0.0 | $10.63 | $53.75 | $0.00 | 5.06 |
| 44 | 7 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 4,368 | Relamp & Reballast | Yes | 7 | LED - Linear Tubes: (4) 4' Lamps | Occupancy Sensor | 58 | 3,058 | 0.70 | 4,761 | 0.0 | $799.85 | $1,402.83 | $175.00 | 1.54 |
| 44 | 2 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 2 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.03 | 403 | 0.0 | $67.70 | $215.11 | $0.00 | 3.18 |
| 45 | 10 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | Yes | 10 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.50 | 3,401 | 0.0 | $571.32 | $1,440.00 | $135.00 | 2.28 |
| 45 | 2 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 2 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.03 | 403 | 0.0 | $67.70 | $215.11 | $0.00 | 3.18 |
| 45A | 1 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 1 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.01 | 63 | 0.0 | $10.63 | $53.75 | $0.00 | 5.06 |
| 45B | 1 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 1 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.01 | 63 | 0.0 | $10.63 | $53.75 | $0.00 | 5.06 |
| 46 | 8 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.25 | 1,676 | 0.0 | $281.52 | $738.00 | $115.00 | 2.21 |
| Custodial | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |

| | 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 |
| 43 | 8 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | Yes | 8 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.40 | 2,721 | 0.0 | $457.05 | $1,206.00 | $115.00 | 2.39 |
| 47 | 3 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | No | 3 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Pump Room | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | No | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Pump Room | 4 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 4 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.04 | 253 | 0.0 | $42.53 | $215.01 | $0.00 | 5.06 |
| Mechanical Room | 4 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 4 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.04 | 253 | 0.0 | $42.53 | $215.01 | $0.00 | 5.06 |
| Mezzanine | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| Stairwell B | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | High/Low Control | 44 | 3,058 | 0.09 | 628 | 0.0 | $105.57 | $350.40 | $30.00 | 3.03 |
| Stairwell B | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| Stairwell B | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Stairwell A | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | High/Low Control | 44 | 3,058 | 0.09 | 628 | 0.0 | $105.57 | $350.40 | $30.00 | 3.03 |
| Stairwell A | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| Stairwell A | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Conference Room | 10 | LED - Linear Tubes: (4) 2' Lamps | Occupancy Sensor | 34 | 3,058 | None | No | 10 | LED - Linear Tubes: (4) 2' Lamps | Occupancy Sensor | 34 | 3,058 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Conference Room | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Lobby Area | 6 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | Yes | 6 | LED - Linear Tubes: (4) 2' Lamps | Occupancy Sensor | 34 | 3,058 | 0.05 | 307 | 0.0 | $51.65 | $270.00 | $35.00 | 4.55 |
| Corridor | 7 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | Yes | 7 | LED - Linear Tubes: (4) 2' Lamps | High/Low Control | 34 | 3,058 | 0.05 | 359 | 0.0 | $60.25 | $200.00 | $0.00 | 3.32 |
| Corridor | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| 71 | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |
| 72 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 69 | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |
| 70 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 67 | 2 | Linear Fluorescent - T12: 4' T12 (40W) - 2L | Wall Switch | 88 | 4,368 | Relamp & Reballast | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $234.00 | $20.00 | 2.15 |
| 68 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 66 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| Women's Restroom | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 4,368 | 0.01 | 88 | 0.0 | $14.77 | $35.90 | $5.00 | 2.09 |

| | 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 |
| Women's Restroom | 2 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 36 W | Wall Switch | 36 | 4,368 | 0.02 | 157 | 0.0 | $26.33 | $215.01 | $0.00 | 8.17 |
| Corridor | 4 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | No | 4 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 63 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 61 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 59 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 60 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 57 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 58 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 55 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 56 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 53 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 54 | 1 | Linear Fluorescent - T12: 2' T12 (20W) - 2L | Wall Switch | 50 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (2) 2' Lamps | Wall Switch | 17 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $107.00 | $10.00 | 3.48 |
| 51 | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 3 | LED - Linear Tubes: (3) 4' Lamps | Occupancy Sensor | 44 | 3,058 | 0.14 | 943 | 0.0 | $158.36 | $495.60 | $80.00 | 2.62 |
| 51 | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Men's Restroom | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| Men's Restroom | 1 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | No | 1 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Women's Restroom | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.02 | 166 | 0.0 | $27.85 | $58.50 | $10.00 | 1.74 |
| Women's Restroom | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| Pool | 6 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | Yes | 6 | LED Screw-In Lamps: LED - 29 W | Occupancy Sensor | 29 | 3,058 | 0.09 | 646 | 0.0 | $108.46 | $592.52 | $35.00 | 5.14 |
| Pool | 23 | Metal Halide: (1) 350W Lamp | Wall Switch | 400 | 4,368 | Fixture Replacement | Yes | 23 | LED - Fixtures: High-Bay | Occupancy Sensor | 120 | 3,058 | 5.35 | 36,509 | 0.0 | $6,133.45 | $9,740.00 | $3,520.00 | 1.01 |
| Pool | 3 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 3 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.04 | 604 | 0.0 | $101.55 | $322.67 | $0.00 | 3.18 |
| 76 | 9 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | Yes | 9 | LED Screw-In Lamps: LED - 29 W | Occupancy Sensor | 29 | 3,058 | 0.14 | 968 | 0.0 | $162.69 | $753.78 | $35.00 | 4.42 |
| 76 | 16 | LED Screw-In Lamps: LED - 9W | Wall Switch | 9 | 4,368 | None | No | 16 | LED Screw-In Lamps: LED - 9W | Wall Switch | 9 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 76 | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | None | No | 2 | LED - Linear Tubes: (4) 2' Lamps | Wall Switch | 34 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 76 | 2 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 2 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.03 | 403 | 0.0 | $67.70 | $215.11 | $0.00 | 3.18 |

| | 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 |
| 108 | 9 | LED Screw-In Lamps: LED - 9W | Wall Switch | 9 | 4,368 | None | No | 9 | LED Screw-In Lamps: LED - 9W | Wall Switch | 9 | 4,368 | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| 108 | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | No | 2 | LED - Linear Tubes: (2) 4' Lamps | Wall Switch | 29 | 4,368 | 0.05 | 332 | 0.0 | $55.70 | $117.00 | $20.00 | 1.74 |
| 108 | 4 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 4 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.04 | 253 | 0.0 | $42.53 | $215.01 | $0.00 | 5.06 |
| 108 | 4 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 4 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.06 | 806 | 0.0 | $135.39 | $430.22 | $0.00 | 3.18 |
| 90A | 1 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 1 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.01 | 63 | 0.0 | $10.63 | $53.75 | $0.00 | 5.06 |
| 10A | 12 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 12 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.37 | 2,514 | 0.0 | $422.29 | $972.00 | $155.00 | 1.93 |
| 10A | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Elevator Rioom | 3 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | No | 3 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 4,368 | 0.04 | 264 | 0.0 | $44.30 | $107.70 | $15.00 | 2.09 |
| Basement Entrance | 4 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | Yes | 4 | LED Screw-In Lamps: LED - 36 W | Occupancy Sensor | 36 | 3,058 | 0.08 | 533 | 0.0 | $89.52 | $700.02 | $35.00 | 7.43 |
| Basement Entrance | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Storage | 2 | Incandescent: INC-100W | Wall Switch | 100 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 15 W | Wall Switch | 15 | 4,368 | 0.13 | 854 | 0.0 | $143.46 | $107.51 | $10.00 | 0.68 |
| Stairwell C | 1 | Linear Fluorescent - T8: 4' T8 (32W) - 1L | Wall Switch | 32 | 4,368 | Relamp | No | 1 | LED - Linear Tubes: (1) 4' Lamp | Wall Switch | 15 | 4,368 | 0.01 | 88 | 0.0 | $14.77 | $35.90 | $5.00 | 2.09 |
| Stairwell C | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| Mezzanine | 2 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 2 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.02 | 127 | 0.0 | $21.27 | $107.51 | $0.00 | 5.06 |
| Mezzanine | 4 | Linear Fluorescent - T8: 4' T8 (32W) - 2L | Wall Switch | 62 | 4,368 | Relamp | Yes | 4 | LED - Linear Tubes: (2) 4' Lamps | Occupancy Sensor | 29 | 3,058 | 0.12 | 838 | 0.0 | $140.76 | $504.00 | $75.00 | 3.05 |
| Stairwell D | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | High/Low Control | 44 | 3,058 | 0.09 | 628 | 0.0 | $105.57 | $350.40 | $30.00 | 3.03 |
| Stairwell D | 1 | Compact Fluorescent: CFL - 4-Pin - 42W - 1L | Wall Switch | 42 | 4,368 | Relamp | No | 1 | LED Screw-In Lamps: LED - 29 W | Wall Switch | 29 | 4,368 | 0.01 | 63 | 0.0 | $10.63 | $53.75 | $0.00 | 5.06 |
| Stairwell D | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Stairwell E | 2 | Linear Fluorescent - T8: 4' T8 (32W) - 3L | Wall Switch | 93 | 4,368 | Relamp | Yes | 2 | LED - Linear Tubes: (3) 4' Lamps | High/Low Control | 44 | 3,058 | 0.09 | 628 | 0.0 | $105.57 | $350.40 | $30.00 | 3.03 |
| Stairwell E | 1 | Linear Fluorescent - T12: 4' T12 (40W) - 4L | Wall Switch | 176 | 4,368 | Relamp & Reballast | No | 1 | LED - Linear Tubes: (4) 4' Lamps | Wall Switch | 58 | 4,368 | 0.09 | 593 | 0.0 | $99.58 | $161.83 | $20.00 | 1.42 |
| Stairwell E | 1 | Exit Signs: CFL-26W | None | 26 | 8,760 | Fixture Replacement | No | 1 | LED Exit Signs: 2 W Lamp | None | 6 | 8,760 | 0.01 | 201 | 0.0 | $33.85 | $107.56 | $0.00 | 3.18 |
| Wallpack | 3 | Metal Halide: (1) 400W Lamp | Wall Switch | 458 | 4,368 | Fixture Replacement | No | 3 | LED - Fixtures: Outdoor Wall-Mounted Area Fixture | Wall Switch | 137 | 4,368 | 0.71 | 4,831 | 0.0 | $811.66 | $1,200.00 | $300.00 | 1.11 |
| Exterior Recessed | 12 | Compact Fluorescent: CFL - 4-Pin - 26W - 2L | Wall Switch | 52 | 4,368 | Relamp | No | 12 | LED Screw-In Lamps: LED - 36 W | Wall Switch | 36 | 4,368 | 0.14 | 940 | 0.0 | $157.98 | $1,290.07 | $0.00 | 8.17 |
| Wallpack | 4 | Compact Fluorescent: CFL - 4-Pin - 42W - 3L | Wall Switch | 126 | 4,368 | Relamp | No | 4 | LED Screw-In Lamps: LED - 88 W | Wall Switch | 88 | 4,368 | 0.11 | 760 | 0.0 | $127.60 | $645.04 | $0.00 | 5.06 |
| Exterior Recessed | 12 | Metal Halide: (1) 150W Lamp | Wall Switch | 190 | 4,368 | Fixture Replacement | No | 12 | LED - Fixtures: Architectural Flood/Spot Luminaire | Wall Switch | 57 | 4,368 | 1.17 | 8,017 | 0.0 | $1,346.86 | $3,000.00 | $600.00 | 1.78 |

| | 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 |
| Front Entrance | 6 | Compact Fluorescent: CFL - 4-Pin - 42W - 2L | Wall Switch | 84 | 4,368 | Relamp | No | 6 | LED Screw-In Lamps: LED - 59 W | Wall Switch | 59 | 4,368 | 0.11 | 760 | 0.0 | $127.60 | $645.04 | $0.00 | 5.06 |
| Front Entrance | 4 | Metal Halide: (1) 100W Lamp | Wall Switch | 128 | 4,368 | Fixture Replacement | No | 4 | LED - Fixtures: Architectural Flood/Spot Luminaire | Wall Switch | 38 | 4,368 | 0.26 | 1,800 | 0.0 | $302.45 | $1,000.00 | $200.00 | 2.65 |

## 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 |
| Mechanical Room 1 | Hot Water System | 2 | Heating Hot Water Pump | 3.0 | 90.2% | No | 2,745 | No | 90.2% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 1 | Mechanical Room | 2 | Other | 1.0 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 1 | Men's Locker Room | 1 | Supply Fan | 7.5 | 91.7% | No | 2,745 | No | 91.7% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 1 | Women's Locker Room | 1 | Supply Fan | 5.0 | 90.2% | No | 2,745 | No | 90.2% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 1 | Training Room | 1 | Supply Fan | 3.0 | 90.2% | No | 2,745 | No | 90.2% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 1 | Gym | 1 | Supply Fan | 3.0 | 90.2% | No | 2,745 | No | 90.2% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 1 | Mechanical Room | 2 | Exhaust Fan | 3.0 | 89.5% | No | 2,745 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Pump Room | Pool | 1 | Other | 0.8 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Pump Room | Pump Room | 2 | Exhaust Fan | 0.8 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Pump Room | Locker Room | 1 | Exhaust Fan | 0.8 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Pump Room | Pool | 2 | Water Supply Pump | 7.5 | 89.5% | No | 3,391 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Locker Room | Locker Room | 4 | Other | 0.8 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 2 | Women's Locker Room | 1 | Supply Fan | 5.0 | 89.5% | No | 2,745 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 2 | Women's Locker Room | 1 | Return Fan | 3.0 | 89.5% | No | 2,745 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 2 | Pool | 1 | Supply Fan | 7.5 | 91.7% | No | 2,745 | No | 91.7% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 2 | Pool | 1 | Return Fan | 5.0 | 89.5% | No | 2,745 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 2 | Offices | 1 | Supply Fan | 7.5 | 91.7% | No | 2,745 | No | 91.7% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mechanical Room 2 | Offices | 1 | Return Fan | 5.0 | 89.5% | No | 2,745 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mezzanine | Aux Gym | 1 | Supply Fan | 7.5 | 91.7% | No | 2,745 | No | 91.7% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mezzanine | Aux Gym | 1 | Return Fan | 5.0 | 89.5% | No | 2,745 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

| | | Existing Conditions | | | | | | Proposed Conditions | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | 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 |
| Elevator Room | Elevator | 1 | Other | 25.0 | 75.5% | No | 1,460 | No | 75.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Mezzanine | Mezzanine | 1 | Exhaust Fan | 5.0 | 89.5% | No | 2,745 | No | 89.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rooftop | ERU | 8 | Other | 10.0 | 91.7% | No | 3,391 | No | 91.7% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rooftop | ERU | 8 | Other | 1.0 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rooftop | ERU 1 and 2 | 2 | Supply Fan | 15.0 | 93.0% | Yes | 2,745 | No | 93.0% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rooftop | ERU 1 and 2 | 2 | Return Fan | 10.0 | 91.7% | Yes | 2,745 | No | 91.7% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rooftop | ERU 1 and 2 | 2 | Other | 0.8 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rooftop | Pool | 1 | Exhaust Fan | 30.0 | 87.5% | No | 4,067 | No | 87.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rm 010 | Rm 010 | 2 | Other | 1.0 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Men's Locker Rm | Men's Locker Rm | 2 | Other | 0.8 | 85.5% | No | 2,745 | No | 85.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Equipment Rm | DX System Carrier Unit | 1 | Supply Fan | 2.0 | 86.5% | No | 2,745 | No | 86.5% | No | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## 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 |
| Ground Floor | Main Lobby | 1 | Packaged AC | 6.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Office | 1 | Split-System Air-Source HP | 3.50 | 42.00 | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Office | 1 | Split-System Air-Source HP | 1.25 | 18.00 | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Office | 1 | Split-System AC | 5.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Office | 1 | Split-System AC | 10.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Fitness Room | 2 | Split-System AC | 16.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Office | 1 | Split-System Air-Source HP | 2.62 | 33.60 | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Office | 1 | Split-System AC | 2.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Ground Floor | Office | 1 | Split-System Air-Source HP | 1.50 | 0.41 | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Rooftop | Office | 1 | Split-System AC | 2.00 | | No | | | | | | | No | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Fuel Heating Inventory & Recommendations

| | | Existing Conditions | | | Proposed Conditions | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Output Capacity per Unit (MBh) | Install High Efficiency System? | System Quantity | System Type | Output Capacity per Unit (MBh) | Heating Efficiency | Heating Efficiency Units | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Central Plant | Panzer Athletic | 1 | Forced Draft Steam Boiler | 4,200.00 | No | | | | | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |
| Panzer Athletic | Panzer Athletic | 1 | Furnace | 640.00 | No | | | | | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## DHW Inventory & Recommendations

| | | Existing Conditions | | Proposed Conditions | | | | | | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location | Area(s)/System(s) Served | System Quantity | System Type | Replace? | System Quantity | System Type | Fuel Type | System Efficiency | Efficiency Units | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Mechanical Room | Panzer | 1 | Indirect System | No | | | | | | 0.00 | 0 | 0.0 | $0.00 | $0.00 | $0.00 | 0.00 |

## Plug Load Inventory

| | Existing Conditions | | | |
|---|---|---|---|---|
| Location | Quantity | Equipment Description | Energy Rate (W) | ENERGY STAR Qualified? |
| Panzer | 42 | Desktop Computer and LCD Monitor | 191.0 | Yes |
| Panzer | 10 | Microwave | 1,000.0 | No |
| Panzer | 5 | Small Freezer | 1,000.0 | No |
| Panzer | 7 | Coffee Machine | 400.0 | No |
| Panzer | 18 | Television | 120.0 | No |
| Panzer | 27 | Printer | 515.0 | No |
| Panzer | 7 | Copier | 515.0 | No |
| Panzer | 3 | Refrigerator | 600.0 | No |
| Panzer | 2 | Dryer Machine | 5,750.0 | No |
| Panzer | 3 | Washing Machine | 900.0 | No |
| Panzer | 1 | Ice Machine | 1,000.0 | No |
| Panzer | 1 | Ice Machine | 1,000.0 | No |

## Vending Machine Inventory & Recommendations

| | Existing Conditions | | Proposed Conditions | Energy Impact & Financial Analysis | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Quantity | Vending Machine Type | Install Controls? | Total Peak kW Savings | Total Annual kWh Savings | Total Annual MMBtu Savings | Total Annual Energy Cost Savings | Total Installation Cost | Total Incentives | Simple Payback w/ Incentives in Years |
| Storage Room | 1 | Refrigerated | Yes | 0.00 | 1,612 | 0.0 | $270.79 | $230.00 | $0.00 | 0.85 |

# APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

## ENERGY STAR® Statement of Energy Performance

LEARN MORE AT energystar.gov

# N/A

ENERGY STAR® Score[1]

**Montclair State University Campus (Buildings 1-41)**

**Primary Property Type:** College/University
**Gross Floor Area (ft²):** 2,925,896
**Built:** 1908

**For Year Ending:** October 31, 2016
**Date Generated:** October 10, 2017

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

### Property & Contact Information

| Property Address | Property Owner | Primary Contact |
|---|---|---|
| Montclair State University Campus (Buildings 1-41)<br>1 Normal Avenue<br>Montclair, New Jersey 07043 | Montclair Statet University<br>1 Normal Avenue<br>Montclair, NJ 07043<br>973-655-3244 | Ana Pinto<br>1 Normal Avenue<br>Montclair, NJ 07043<br>973-655-3244<br>pintoa@montclair.edu |

**Property ID:** 6069294

### Energy Consumption and Energy Use Intensity (EUI)

**Site EUI**
172.3 kBtu/ft²

**Source EUI**
306.4 kBtu/ft²

| Annual Energy by Fuel | |
|---|---|
| District Chilled Water - | 81,507,530 (16%) |
| Other (kBtu) | |
| District Steam (kBtu) | 223,798,259 (44%) |
| Electric - Grid (kBtu) | 161,334,839 (32%) |
| Natural Gas (kBtu) | 37,406,141 (7%) |

| National Median Comparison | |
|---|---|
| National Median Site EUI (kBtu/ft²) | 147.6 |
| National Median Source EUI (kBtu/ft²) | 262.6 |
| % Diff from National Median Source EUI | 17% |

| Annual Emissions | |
|---|---|
| Greenhouse Gas Emissions (Metric Tons CO2e/year) | N/A |

### Signature & Stamp of Verifying Professional

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

Signature: _____ Date: _____

**Licensed Professional**

___ _____
,
(___)___-____
_____

**Professional Engineer Stamp**
**(if applicable)**