Local Government Energy Audit Report

Fine Hall

July 3,2019

Prepared for:

Princeton University

Princeton University Campus

Princeton, NJ 08544

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Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities, help prioritize specific measures for implementation, and provide information about financial incentives that may be available. Most energy conservation measures have received preliminary analysis of feasibility that identifies expected ranges of savings and costs. This level of analysis is usually considered sufficient to establish a basis for further discussion and to help prioritize energy measures.

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

TRC bases estimated installation costs on our experience at similar facilities, pricing from local contractors and vendors, and/or cost estimates from *RS Means*. We encourage the owner of the facility to independently confirm these cost estimates and to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on individual 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. Review available program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state and federal requirements.

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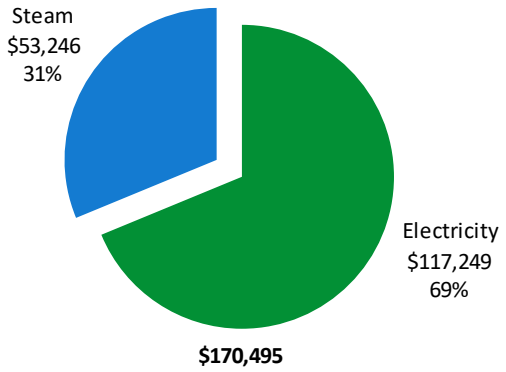
1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Fine Hall. This report provides you with information about your facility's energy use, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help make changes in your facility. TRC Energy Services (TRC) conducted this study as part of a comprehensive effort to assist New Jersey school districts and local governments in controlling their energy costs and help protect our environment by reducing statewide energy consumption.

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $170,495 Electricity: 1,863,883 kWh Steam: 8,610 kLbs	
ENERGY STAR® Benchmarking Score	N/A *(1-100 scale)*	A standard energy use benchmark is not available for this facility type. This report contains suggestions about how to improve building performance and reduce energy costs.

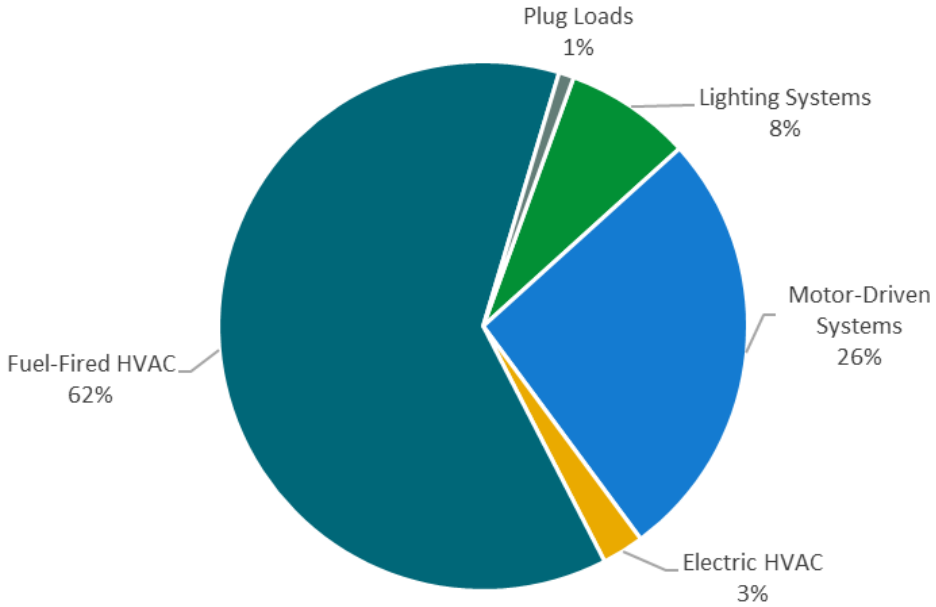


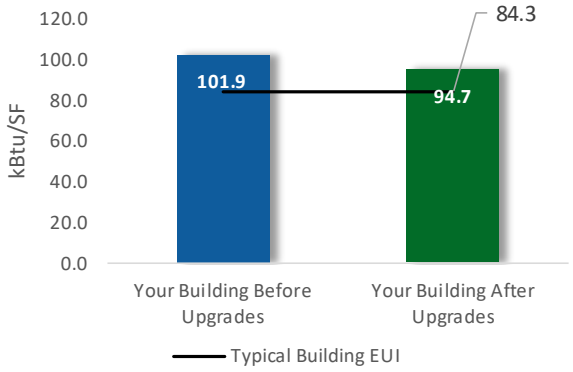
Figure 1 - Energy Use by System

POTENTIAL IMPROVEMENTS

This energy audit considered a range of potential energy improvements in your building. Costs and savings will vary between improvements. Presented below are two potential scopes of work for your consideration.

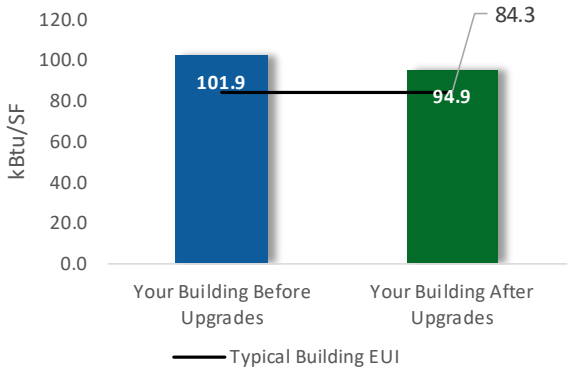
Scenario 1: Full Package (all evaluated measures)

Installation Cost	$96,862
Potential Rebates & Incentives[1]	$11,614
Annual Cost Savings	$19,461
Annual Energy Savings	Electricity: 321,676 kWh Steam: 72 kLbs
Greenhouse Gas Emission Savings	168 Tons
Simple Payback	4.4 Years
Site Energy Savings (all utilities)	7%



Scenario 2: Cost Effective Package[2]

Installation Cost	$91,424
Potential Rebates & Incentives	$11,614
Annual Cost Savings	$19,170
Annual Energy Savings	Electricity: 320,422 kWh Steam: 37 kLbs
Greenhouse Gas Emission Savings	165 Tons
Simple Payback	4.2 Years
Site Energy Savings (all utilities)	7%



On-site Generation Potential

Photovoltaic	Medium
Combined Heat and Power	None

[1] Incentives are based on current SmartStart Prescriptive incentives. Other Program incentives may apply.

[2] A cost-effective measure is defined as one where the simple payback does not exceed two-thirds of the expected proposed equipment useful life. Simple payback is based on the net measure cost after potential incentives.

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Lifetime Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**49,546**	**5.3**	**-21**	**$2,821**	**$42,316**	**$8,057**	**$1,904**	**$6,153**	**2.2**	**46,860**
ECM 1	Retrofit Fixtures with LED Lamps	49,373	5.3	-21	$2,811	$42,168	$7,550	$1,904	$5,646	2.0	46,696
ECM 2	Install LED Exit Signs	173	0.0	0	$10	$148	$507	$0	$507	51.3	164
Lighting Control Measures		**7,856**	**0.7**	**-3**	**$447**	**$3,579**	**$3,240**	**$350**	**$2,890**	**6.5**	**7,430**
ECM 3	Install Occupancy Sensor Lighting Controls	7,856	0.7	-3	$447	$3,579	$3,240	$350	$2,890	6.5	7,430
Motor Upgrades		**10,518**	**1.2**	**0**	**$622**	**$9,325**	**$18,958**	**$0**	**$18,958**	**30.5**	**10,591**
ECM 4	Premium Efficiency Motors	10,518	1.2	0	$622	$9,325	$18,958	$0	$18,958	30.5	10,591
Variable Frequency Drive (VFD) Measures		**252,501**	**36.6**	**0**	**$14,925**	**$223,879**	**$60,997**	**$9,360**	**$51,637**	**3.5**	**254,267**
ECM 5	Install VFDs on Constant Volume (CV) Fans	228,006	33.8	0	$13,477	$202,161	$53,783	$9,360	$44,423	3.3	229,600
ECM 6	Install VFDs on Chilled Water Pumps	24,495	2.8	0	$1,448	$21,718	$7,214	$0	$7,214	5.0	24,666
HVAC System Improvements		**1,254**	**0.0**	**42**	**$290**	**$4,356**	**$5,438**	**$0**	**$5,438**	**18.7**	**7,359**
	Implement Demand Control Ventilation (DCV)	1,254	0.0	42	$290	$4,356	$5,438	$0	$5,438	18.7	7,359
Domestic Water Heating Upgrade		**0**	**0.0**	**68**	**$355**	**$3,548**	**$172**	**$0**	**$172**	**0.5**	**10,002**
ECM 7	Install Low-Flow DHW Devices	0	0.0	68	$355	$3,548	$172	$0	$172	0.5	10,002
TOTALS		**321,676**	**43.9**	**86**	**$19,461**	**$287,003**	**$96,862**	**$11,614**	**$85,248**	**4.4**	**336,509**

* - All incentives presented in this table are based on NJ SmartStart 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).

Figure 2 – Evaluated Energy Improvements

1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decisions to make, such as:

- How will the project be funded and/or financed?
- Is it best to pursue individual ECMs, groups of ECMs, or use a comprehensive approach where all ECMs are installed together?
- Are there other facility improvements that should happen at the same time?

Pick Your Installation Approach

New Jersey's Clean Energy Programs give you the flexibility to do a little or a lot. Rebates, incentives, and financing are available to help reduce both your installation costs and your energy bills. If you are planning to take advantage of these programs, make sure to review incentive program guidelines before proceeding. This is important because in most cases you will need to submit applications for the incentives before purchasing materials or starting installation.

The potential ECMs identified for this building likely qualify for multiple incentive and funding programs. Based on current program rules and requirements, your measures are likely to qualify for the following programs:

Energy Conservation Measure		SmartStart	Direct Install	Pay For Performance
ECM 1	Retrofit Fixtures with LED Lamps	x		
ECM 2	Install LED Exit Signs			
ECM 3	Install Occupancy Sensor Lighting Controls	x		
ECM 4	Premium Efficiency Motors			
ECM 5	Install VFDs on Constant Volume (CV) HVAC	x		
ECM 6	Install VFDs on Chilled Water Pumps	x		
ECM 7	Install Low-Flow Domestic Hot Water Devices			

Figure 3 – Funding Options

New Jersey's Clean Energy Programs At-A-Glance

	SmartStart Flexibility to install at your own pace	**Direct Install** Turnkey installation	**Pay for Performance** Whole building upgrades
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified partner to develop your energy reduction plan and set your energy savings targets.

Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.

Individual Measures with SmartStart

For facilities wishing 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, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval is required for some SmartStart incentives, so only after receiving pre-approval should you proceed with ECM installation.

Turnkey Installation with Direct Install

The Direct Install program provides turnkey installation of multiple measures through an authorized network of participating contractors. This program can provide substantially higher incentives than SmartStart, up to 70% of the cost of selected measures. Direct Install contractors will assess and verify individual measure eligibility and, in most cases, they perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

Whole Building Approach with Pay for Performance

Pay for Performance can be a good option for medium to large sized facilities to achieve deep energy savings. Pay for Performance allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program (ESIP) loan also use this program. Pay for Performance works for larger customers with a peak demand over 200 kW. 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.

More Options from Around the State

Financing and Planning Support with the Energy Savings Improvement Program (ESIP)

For larger facilities with limited capital availability to implement ECMs, project financing may be available through the 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. You have already taken the first step as an LGEA customer, because this report is required to participate in ESIP.

Resiliency with Return on Investment through Combined Heat & Power (CHP)

The CHP program provides incentives for combined heat and power (aka cogeneration) and waste heat to power projects. Combined heat and power systems generate power on-site and recover heat from the generation system to meet on-site thermal loads. Waste heat to power systems use waste heat to generate power. You will work with a qualified developer who will design a system that meets your building's heating and cooling needs.

Ongoing Electric Savings with Demand Response

The Demand Response Energy Aggregator program reduces 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. By enabling commercial facilities to reduce their electric demand 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 demand response (DR) programs. Program participation is voluntary, and facilities receive payments regardless of whether they are called upon to curtail their load during times of peak demand.

2 EXISTING CONDITIONS

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Fine Hall. This report provides information on how your facility uses energy, identifies energy conservation measures (ECMs) that can reduce your energy use, and provides information and assistance to help you implement the ECMs. This report also contains valuable information on financial incentives from New Jersey's Clean Energy Program (NJCEP) for implementing ECMs.

TRC conducted this study as part of a comprehensive effort to assist New Jersey educational and local government facilities in controlling energy costs and protecting our environment by offering a wide range of energy management options and advice.

2.1 Site Overview

On August 9, 2018, TRC performed an energy audit at Fine Hall located on the Princeton University campus in Princeton, NJ. TRC met with Arthur Murphy to review the facility operations and help focus our investigation on specific energy-using systems.

Fine Hall is a 17-story, 163,290 square foot building built in 1968. Spaces include classrooms, lecture halls, auditorium, offices, library, restrooms, conference rooms, small kitchen, corridors, stairwells, and mechanical rooms.

The site has recently replaced most of the internal lighting to LED lighting throughout the building.

Aerial Screenshot of the Building

2.2 Building Occupancy

The facility is occupied year-round. Based on observation at the time of the audit the typical operating hours of this building are estimated to be as follows:

Building Name	Weekday/Weekend	Operating Schedule
Fine Hall	Weekday	7:00 AM - 12:00 AM
	Weekend	7:00 AM - 8:30 PM

Figure 4 - Building Occupancy Schedule

2.3 Building Envelope

Building walls are concrete block over structural steel with a brick and concrete facade. The roof is pitched and is covered with roofing shingles.

Most of the windows are double paned and have aluminum frames. Exterior doors have aluminum frames and are in fair condition with slightly worn door seals. Degraded window and door seals increase drafts and outside air infiltration.

Exterior Walls & Windows

2.4 Lighting Systems

The primary interior lighting system consists of 2', 3', 4' and 8' linear LED lamps. Additionally, there are some 4' linear fluorescent T8 lamp fixtures, recessed cans, downlights, wall scones that have screw-in and pin-based compact fluorescent, LED and halogen incandescent lamps.

Most exit signs in the building are LED fixtures with a few signs that have fluorescent lamps.

Most fixtures are in fair condition.

Interior lighting levels were generally sufficient.

Linear LED Fixtures

Linear Fixtures with Roof Mounted Occupancy Sensor

Light Fixtures in Auditorium

LED Downlight

Lighting Fixtures

Most lighting fixtures are controlled by occupancy sensors and the remainder by wall switches.

Exterior fixtures include spot fixtures throughout the perimeter of the building.

Exterior fixtures are manually controlled.

2.5 Air Handling Systems

Air Handling Units

Conditioned air is provided primarily by nine air handling units (AHU-1, 2, 4, 5, 6, 7, 9, 10 & 11). Based on the information provided by the site contact, AHUs 3 & 8 have been decommissioned. AHUs 1, 2, 5, 6, 9, 10 & 11 are all constant speed units with varied flow requirements. All air handling units have steam heating coils and chilled water-cooling coils to address the heating and cooling loads of the zones they serve. Each AHU is linked with a corresponding exhaust fan unit that serves the respective zones. Most of the exhaust fans are constant speed units.

There are several fan coil units in the building serving the perimeter rooms and offices. These fan coil units have chilled water-cooling coils.

AHU-4

AHU-6

Fan-Coil Unit

2.6 Steam to Hot Water Heating Systems

The central plant for Princeton University campus supplies low pressure steam to the building to serve its heating load. Steam is supplied directly to all air handling units.

Steam is also supplied to a heat exchanger that transfers heat to a heating hot water loop that circulates heating hot water to unit heaters located in vestibules and stairwells in the building.

The hot water loop has one VFD controlled 1.5 hp pump. There are also four 2 hp and four 1.5 hp condensate pumps.

Heating Hot Water Pump

2.7 Chilled Water Systems

The central plant supplies chilled water to the building to serve its cooling load. The chilled water loop is cooled by the chilled water from the central plant with the help of heat exchanger. Some of the air handling units are served directly by the primary chilled water from the chiller plant.

There are two 7.5 hp constant speed chilled water pumps that circulate chilled water in the secondary chilled water loop.

Chilled Water Pumps

2.8 Building Energy Management Systems (EMS)

A Siemens EMS is used to control the HVAC equipment and air handler units. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, heating water loop temperatures and chilled water loop temperatures.

2.9 Domestic Hot Water

Hot water is produced by a heat exchanger using steam from the central plant and stored in a tank.

2.10 Plug Load & Vending Machines

The utility bill analysis indicates that plug loads consume less than one percent of total building energy use. This is lower than a typical building.

Staff seems to already be doing a great job managing your electrical plug loads. This report makes additional suggestions for ECMs in this area as well as Energy Efficient Best Practices.

There are approximately 94 computer work stations throughout the facility. Plug loads throughout the building include general café and office equipment like refrigerators, coffee machines and microwave, and office equipment including printers, copiers, and overhead projectors.

Medium Printer

LCD TV

Mini Fridge

Copier

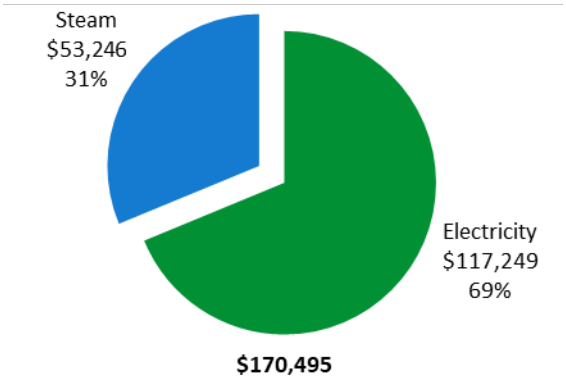
2.11 Water-Using Systems

There are multiple restrooms with toilets, urinals, and sinks throughout the building. Faucet flow rates are at 2.2 gallons per minute (gpm) or higher.

3 ENERGY USE AND COSTS

Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	**Usage**	**Cost**
Electricity	1,863,883	$117,249
Steam	8,610	$53,246
Total	**16,640.2**	**$170,495**



An energy balance identifies and quantifies energy use in your various building systems. This can highlight areas with the most potential for improvement. This energy balance was developed using calculated energy use for each of the end uses noted in the figure.

The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated energy use is then compared to the historical energy use and the initial inputs are revised, as necessary, to balance the calculated energy use to the historical energy use.

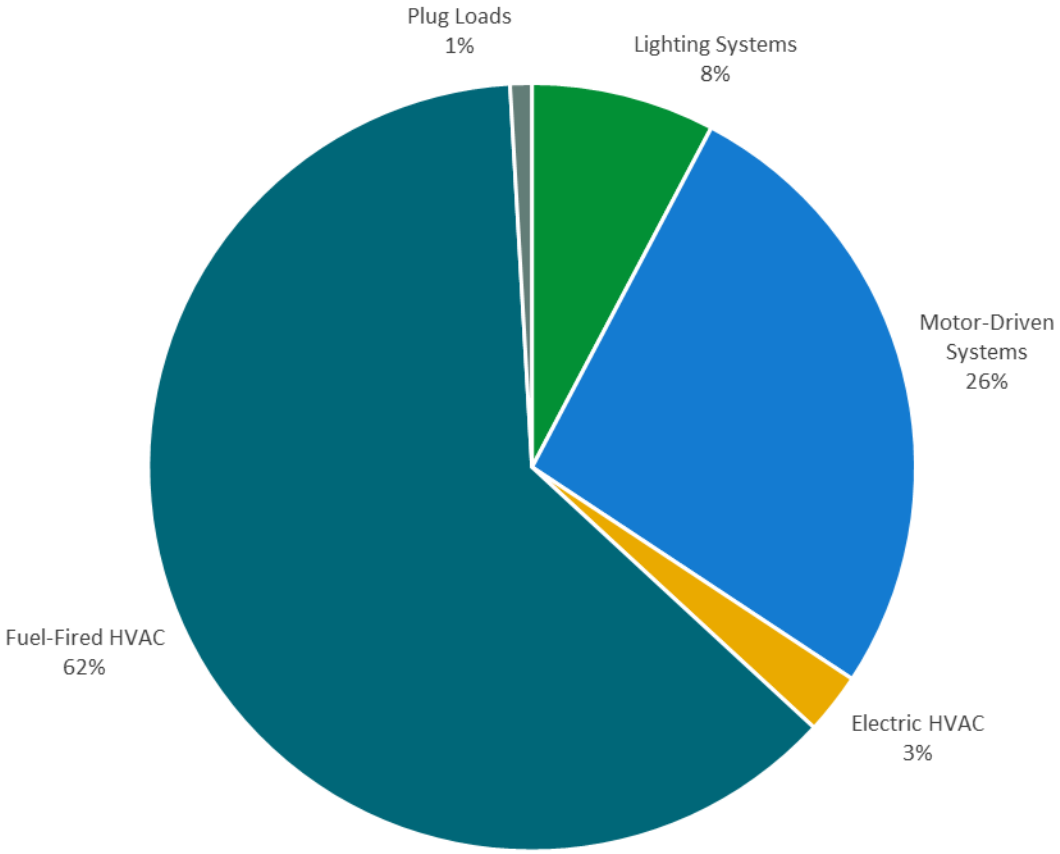
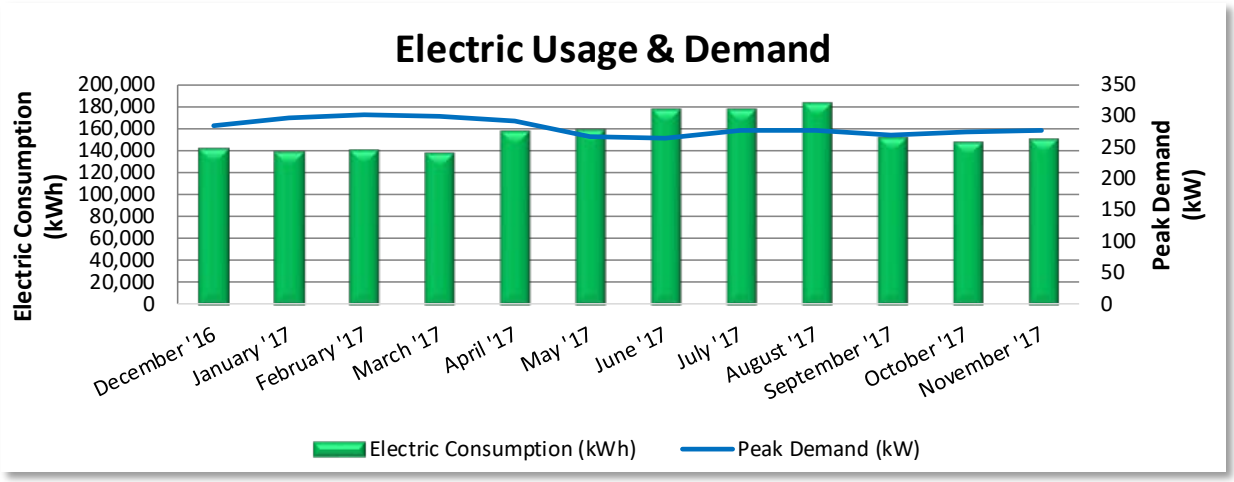


Figure 5 - Energy Balance

3.1 Electricity

PSE&G delivers electricity under rate class HTS, with electric production provided by Calpine Energy, a third-party supplier. Electricity is delivered to the campus's two substations from where it is distributed to all buildings in the campus and is monitored by the campus's EMS system. Electricity to this building complex is delivered from the Elm substation only.



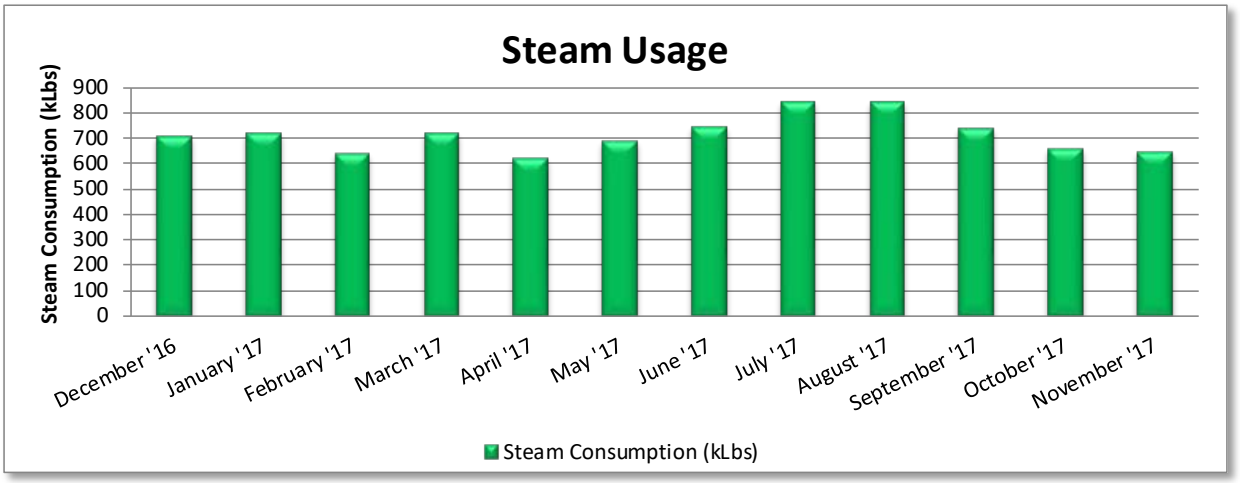
Electric Billing Data						
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost	TRC Estimated Usage?
12/31/16	31	141,957	285	0	9,741	Yes
1/31/17	31	138,396	296	0	11,390	Yes
2/28/17	28	140,404	302	0	9,221	Yes
3/31/17	31	138,094	298	0	9,117	Yes
4/30/17	30	156,962	291	0	8,516	Yes
5/31/17	31	159,439	267	0	10,089	Yes
6/30/17	30	177,961	264	0	9,950	Yes
7/31/17	31	177,443	277	0	11,865	Yes
8/31/17	31	183,587	278	0	11,128	Yes
9/30/17	30	151,662	268	0	8,930	Yes
10/31/17	31	147,573	276	0	8,085	Yes
11/30/17	30	150,405	276	0	9,217	Yes
Totals	**365**	**1,863,883**	**302**	**$0**	**$117,249**	
Annual	**365**	**1,863,883**	**302**	**$0**	**$117,249**	

Notes:

- Electricity and chilled water use reflected in the graph are based on sub-metered data. Please note that the monthly energy consumption and demand for the meters in the building also included the McDonnell Hall. The usage and demand were prorated based on the building area.
- Peak demand of 302 kW occurred in February '17.
- The average electric cost over the past 12 months was $0.059/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This rate is derived as an average from the monthly blended rate of the Elm substation that supply electricity to the building. The blended rate for this university is lower than what is typically seen in commercial buildings in New Jersey.
- The monthly electricity usage also includes the electric usage of the chillers in the central plant that supply chilled water to satisfy the building's cooling load. Based on historical data, 62% of the total chilled water produced by the central plant comes from electric chillers.

3.2 Steam

Central Plant delivers steam to the project site. The central plant uses natural gas to produce steam. PSE&G supplies natural gas to the central plant under the rate class CIG.



Steam Billing Data				
Period Ending	**Days in Period**	**Steam Usage (kLbs)**	**Fuel Cost**	**TRC Estimated Usage?**
12/31/16	31	710	4,399	Yes
1/31/17	31	722	4,472	Yes
2/28/17	28	645	3,994	Yes
3/31/17	31	726	4,498	Yes
4/30/17	30	622	3,852	Yes
5/31/17	31	693	4,281	Yes
6/30/17	30	750	4,634	Yes
7/31/17	31	846	5,219	Yes
8/31/17	31	847	5,227	Yes
9/30/17	30	739	4,566	Yes
10/31/17	31	659	4,077	Yes
11/30/17	30	650	4,027	Yes
Totals	**365**	**8,610**	**$53,246**	
Annual	**365**	**8,610**	**$53,246**	

Notes:

- Steam and chilled water use reflected in the graph are based on sub-metered data.
- The average Steam cost for the past 12 months is $6.200/kLb, which is the blended rate used throughout the analysis.
- The total monthly steam usage also includes the gas (steam) energy used to produce chilled water by the absorption chillers to produce chilled water to the building. Based on historical data, 38% of the total chilled water produced by the central plant comes from the absorption chillers.

3.3 Benchmarking

Your building was benchmarked using the United States Environmental Protection Agency's (EPA) *Portfolio Manager®* software. Benchmarking compares your building's energy use to that of similar buildings across the county, while neutralizing variations due to location, occupancy and operating hours. Some building types can be scored with a 1-100 ranking of a building's energy performance relative to the national building market. A score of 50 represents the national average and a score of 100 is best.

This ENERGY STAR® benchmarking score provides a comprehensive snapshot of your building's energy performance. It assesses the building's physical assets, operations, and occupant behavior, which is compiled into a quick and easy-to-understand score.

Benchmarking Score	**N/A**

Due to its unique characteristics, this building type is not able to receive a benchmarking score. This report contains suggestions about how to improve building performance and reduce energy costs.

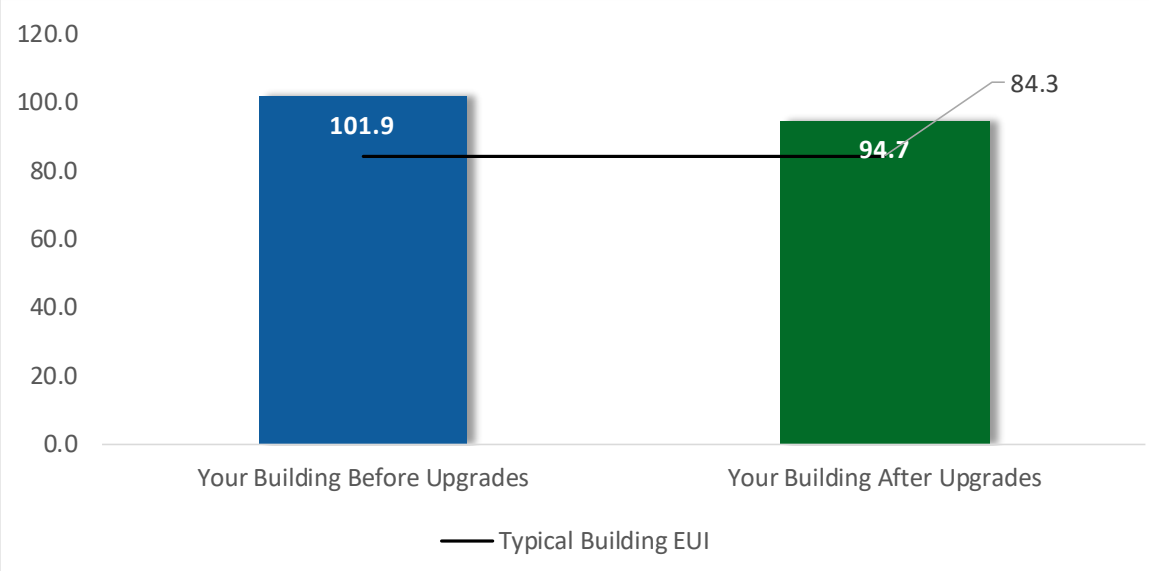


Figure 6 - Energy Use Intensity Comparison

Energy use intensity (EUI) measures energy consumption per square foot and is the standard metric for comparing buildings' energy performance. A lower EUI means better performance and less energy consumed. A number of factors can cause as building to vary from the "typical" energy usage. Local weather conditions, building age and insulation levels, equipment efficiency, daily occupancy hours, changes in occupancy throughout the year, equipment operating hours, and occupant behavior all contribute to a building's energy use and the benchmarking score.

Tracking Your Energy Performance

Keeping track of your energy use on a monthly basis is one of the best ways to keep energy costs in check. Update your utility information in Portfolio Manager® regularly, so that you can keep track of your building's performance.

We have created a Portfolio Manager® account for your facility and we have already entered the monthly utility data shown above for you. Account login information for your account will be sent via email.

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.

For more information on ENERGY STAR® and Portfolio Manager®, visit their website[3].

[3] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/earn-recognition/energy-star-certification/how-app-1

4 ENERGY CONSERVATION MEASURES

The goal of this audit report is to identify and evaluate potential energy efficiency improvements, provide information about the cost effectiveness of those improvements, and recognize potential financial incentives from NJBPU. Most energy conservation measures have received preliminary analysis of feasibility which identifies expected ranges of savings and costs. This level of analysis is typically sufficient to demonstrate project cost-effectiveness and help prioritize energy measures.

Calculations of energy use and savings are based on the current version of the *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*, which is 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.

Operation and maintenance costs for the proposed new equipment will generally be lower than the current costs for the existing equipment—especially if the existing equipment is at or past its normal useful life. We have conservatively assumed there to be no impact on overall maintenance costs over the life of the equipment.

Financial incentives are based on the current NJCEP prescriptive SmartStart program. A higher level of investigation may be necessary to support any SmartStart Custom, Pay for Performance, or Direct Install incentive applications. Some measures and proposed upgrades may be eligible for higher incentives than those shown below through other NJCEP programs described in a following section of this report.

For a detailed list of the locations and recommended energy conservation measures for all inventoried equipment, see **Appendix A: Equipment Inventory & Recommendations.**

#	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		**49,546**	**5.3**	**-21**	**$2,821**	**$8,057**	**$1,904**	**$6,153**	**2.2**	**46,860**
ECM 1	Retrofit Fixtures with LED Lamps	49,373	5.3	-21	$2,811	$7,550	$1,904	$5,646	2.0	46,696
ECM 2	Install LED Exit Signs	173	0.0	0	$10	$507	$0	$507	51.3	164
Lighting Control Measures		**7,856**	**0.7**	**-3**	**$447**	**$3,240**	**$350**	**$2,890**	**6.5**	**7,430**
ECM 3	Install Occupancy Sensor Lighting Controls	7,856	0.7	-3	$447	$3,240	$350	$2,890	6.5	7,430
Motor Upgrades		**10,518**	**1.2**	**0**	**$622**	**$18,958**	**$0**	**$18,958**	**30.5**	**10,591**
ECM 4	Premium Efficiency Motors	10,518	1.2	0	$622	$18,958	$0	$18,958	30.5	10,591
Variable Frequency Drive (VFD) Measures		**252,501**	**36.6**	**0**	**$14,925**	**$60,997**	**$9,360**	**$51,637**	**3.5**	**254,267**
ECM 5	Install VFDs on Constant Volume (CV) Fans	228,006	33.8	0	$13,477	$53,783	$9,360	$44,423	3.3	229,600
ECM 6	Install VFDs on Chilled Water Pumps	24,495	2.8	0	$1,448	$7,214	$0	$7,214	5.0	24,666
HVAC System Improvements		**1,254**	**0.0**	**42**	**$290**	**$5,438**	**$0**	**$5,438**	**18.7**	**7,359**
	Implement Demand Control Ventilation (DCV)	1,254	0.0	42	$290	$5,438	$0	$5,438	18.7	7,359
Domestic Water Heating Upgrade		**0**	**0.0**	**68**	**$355**	**$172**	**$0**	**$172**	**0.5**	**10,002**
ECM 7	Install Low-Flow DHW Devices	0	0.0	68	$355	$172	$0	$172	0.5	10,002
TOTALS		**321,676**	**43.9**	**86**	**$19,461**	**$96,862**	**$11,614**	**$85,248**	**4.4**	**336,509**

* - All incentives presented in this table are based on NJ SmartStart 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).

Figure 7 – All Evaluated 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		**49,546**	**5.3**	**-21**	**$2,821**	**$8,057**	**$1,904**	**$6,153**	**2.2**	**46,860**
ECM 1	Retrofit Fixtures with LED Lamps	49,373	5.3	-21	$2,811	$7,550	$1,904	$5,646	2.0	46,696
ECM 2	Install LED Exit Signs	173	0.0	0	$10	$507	$0	$507	51.3	164
Lighting Control Measures		**7,856**	**0.7**	**-3**	**$447**	**$3,240**	**$350**	**$2,890**	**6.5**	**7,430**
ECM 3	Install Occupancy Sensor Lighting Controls	7,856	0.7	-3	$447	$3,240	$350	$2,890	6.5	7,430
Motor Upgrades		**10,518**	**1.2**	**0**	**$622**	**$18,958**	**$0**	**$18,958**	**30.5**	**10,591**
ECM 4	Premium Efficiency Motors	10,518	1.2	0	$622	$18,958	$0	$18,958	30.5	10,591
Variable Frequency Drive (VFD) Measures		**252,501**	**36.6**	**0**	**$14,925**	**$60,997**	**$9,360**	**$51,637**	**3.5**	**254,267**
ECM 5	Install VFDs on Constant Volume (CV) Fans	228,006	33.8	0	$13,477	$53,783	$9,360	$44,423	3.3	229,600
ECM 6	Install VFDs on Chilled Water Pumps	24,495	2.8	0	$1,448	$7,214	$0	$7,214	5.0	24,666
Domestic Water Heating Upgrade		**0**	**0.0**	**68**	**$355**	**$172**	**$0**	**$172**	**0.5**	**10,002**
ECM 7	Install Low-Flow DHW Devices	0	0.0	68	$355	$172	$0	$172	0.5	10,002
TOTALS		**320,422**	**43.9**	**44**	**$19,170**	**$91,424**	**$11,614**	**$79,810**	**4.2**	**329,150**

* - All incentives presented in this table are based on NJ SmartStart 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).

Figure 8 – Cost Effective ECMs

4.1 Lighting

#	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		**49,546**	**5.3**	**-21**	**$2,821**	**$8,057**	**$1,904**	**$6,153**	**2.2**	**46,860**
ECM 1	Retrofit Fixtures with LED Lamps	49,373	5.3	-21	$2,811	$7,550	$1,904	$5,646	2.0	46,696
ECM 2	Install LED Exit Signs	173	0.0	0	$10	$507	$0	$507	51.3	164

When considering lighting upgrades, we suggest using a comprehensive design approach that simultaneously upgrades lighting fixtures and controls to maximize energy savings and improve occupant lighting. Comprehensive design will also consider appropriate lighting levels for different space types to make sure that the right amount of light is delivered where needed. If conversion to LED light sources are proposed, we suggest converting all of a specific lighting type (e.g. linear fluorescent) to LED lamps to minimize the number of lamp types in use at the facility, which should help reduce future maintenance costs.

ECM 1: Retrofit Fixtures with LED Lamps

Replace 4' linear fluorescent T8, compact fluorescent (CFL) and halogen incandescent lamps with LED lamps. Many LED tubes are direct replacements for existing fluorescent tubes and can be installed while leaving the fluorescent fixture ballast in place. LED lamps 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. Maintenance savings may also be available, as longer-lasting LEDs lamps will not need to be replaced as often as the existing lamps.

Affected building areas: classrooms and offices with fluorescent fixtures with T8 tubes and CFL lamps, and spot fixtures in Auditorium with halogen incandescent lamps.

ECM 2: Install LED Exit Signs

Replace 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. Maintenance savings and improved reliability may also be achieved, as the longer-lasting LED lamps will not need to be replaced as often as the existing lamps.

4.2 Lighting Controls

#	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		**7,856**	**0.7**	**-3**	**$447**	**$3,240**	**$350**	**$2,890**	**6.5**	**7,430**
ECM 3	Install Occupancy Sensor Lighting Controls	7,856	0.7	-3	$447	$3,240	$350	$2,890	6.5	7,430

Lighting controls reduce energy use by turning off or lowering, lighting fixture power levels when not in use. A comprehensive approach to lighting design should upgrade the lighting fixtures and the controls together for maximum energy savings and improved lighting for occupants.

ECM 3: Install Occupancy Sensor Lighting Controls

Install occupancy sensors to control lighting fixtures in areas that are frequently unoccupied, even for short periods. For most spaces, we recommend lighting controls use dual technology sensors, which reduce the possibility of lights turning off unexpectedly.

Occupancy sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Most occupancy sensor lighting controls allow users to manually turn fixtures on/off, as needed. Some controls can also provide dimming options.

Occupancy sensors can be mounted on the wall at existing switch locations, mounted on the ceiling, or in remote locations. In general, wall switch replacement sensors are best suited to single occupant offices and other small rooms. Ceiling-mounted or remote mounted sensors are used in large spaces, locations without local switching, and where wall switches are not in the line-of-sight of the main work area.

This measure provides energy savings by reducing the lighting operating hours.

Affected building areas: offices, classrooms, auditorium, and lobby.

4.3 Motors

#	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)
Motor Upgrades		**10,518**	**1.2**	**0**	**$622**	**$18,958**	**$0**	**$18,958**	**30.5**	**10,591**
ECM 4	Premium Efficiency Motors	10,518	1.2	0	$622	$18,958	$0	$18,958	30.5	10,591

ECM 4: Premium Efficiency Motors

Replace standard efficiency motors with IHP 2014 efficiency motors. This evaluation assumes that existing motors will be replaced with motors of equivalent size and type. In some cases, additional savings may be possible by downsizing motors to better meet the motor's current load requirements.

It is recommended to implement this measure in conjunction with the implementation of the VFD's measure.

Affected motors:

Location	Area(s)/System(s) Served	Motor Quantity	Motor Application	HP Per Motor	Additional Motor Description
Basement Mechanical Room	AHU1 (Library)	1	Supply Fan	20.0	
Basement Mechanical Room	EX1 (Library)	1	Exhaust Fan	10.0	Exhauster
Basement Mechanical Room	AHU6 (Library Exterior)	1	Supply Fan	15.0	
Basement Mechanical Room	EX6 (Library Exterior)	1	Exhaust Fan	5.0	Exhauster
Basement Mechanical Room	AHU5 (Equipment Room)	1	Supply Fan	7.5	
Basement Mechanical Room	EX5 (Equipment Room)	1	Exhaust Fan	5.0	Exhauster
Basement Mechanical Room	AHU2 (Classrooms East)	1	Supply Fan	15.0	
Basement Mechanical Room	EX2 (Classrooms East)	1	Exhaust Fan	7.5	Exhauster
Basement Mechanical Room	Secondary Chilled Water Loop	2	Chilled Water Pump	7.5	
3rd Floor Mechanical Room	AHU9 (Tower Lower)	1	Supply Fan	7.5	
3rd Floor Mechanical Room	EX-10 (Tower Lower)	1	Exhaust Fan	3.0	
14th Floor Mechanical Room	AHU10 (Tower Upper)	1	Supply Fan	10.0	
14th Floor Mechanical Room	EX11 (Tower Upper)	1	Exhaust Fan	2.0	
14th Floor Mechanical Room	AHU11 (Professor Lounge)	1	Supply Fan	7.5	
14th Floor Mechanical Room	EX12 (Professor Lounge)	1	Exhaust Fan	2.0	

Savings are based on the difference between baseline and proposed efficiencies and the assumed annual operating hours. The base case motor energy consumption is estimated using the efficiencies found on nameplates or estimated based on the age of the motor and our best estimates of motor run hours. Efficiencies of proposed motor upgrades are obtained from the current *New Jersey's Clean Energy Program Protocols to Measure Resource Savings*.

4.4 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**252,501**	**36.6**	**0**	**$14,925**	**$60,997**	**$9,360**	**$51,637**	**3.5**	**254,267**
ECM 5	Install VFDs on Constant Volume (CV) Fans	228,006	33.8	0	$13,477	$53,783	$9,360	$44,423	3.3	229,600
ECM 6	Install VFDs on Chilled Water Pumps	24,495	2.8	0	$1,448	$7,214	$0	$7,214	5.0	24,666

Variable frequency drives control motors for fans, pumps, and process equipment based on the actual output required of the driven equipment. Energy savings result from more efficient control of motor energy usage when equipment operates at partial load. The magnitude of energy savings depends on the estimated amount of time that the motor would operate at partial load. For equipment with proposed VFDs, we have included replacing the controlled motor with a new motor —unless the existing motor meets or exceeds IHP 2014 standards—to conservatively account for the cost of an inverter duty rated motor. The savings and cost associated with the new motor are presented with the Premium Efficiency Motor measures. If the proposed VFD measure is not selected for implementation the motor replacement should be reevaluated.

ECM 5: Install VFDs on Constant Volume (CV) Fans

Install VFDs to control constant volume fan motor speeds. This converts 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 signal the VFD to adjust fan speed to maintain the appropriate temperature in the zone, while maintaining a constant supply air temperature.

VAV system controls should not raise the supply air temperature 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.

Energy savings result from reducing the fan speed (and power) when conditions allow for reduced air flow.

Affected air handlers: AHUs 1, 2, 5, 6, 9, 10 & 11 (includes supply and exhaust fans).

ECM 6: Install VFDs on Chilled Water Pumps

Install VFDs to control chilled water pumps. Two-way valves must serve the chilled water coils being served and the chilled water loop must have a differential pressure sensor installed. If three-way valves or a bypass leg are used in the chilled water distribution they will need to be modified when this measure is implemented. As the chilled water valves close, the differential pressure increases, and the VFD modulates the pump speed to maintain a differential pressure setpoint.

For systems with variable chilled water flow through the chiller, the minimum flow to prevent the chiller from tripping off will need to be determined during the final project design. The control system should be programmed to maintain the minimum flow through the chiller and to prevent pump cavitation.

Energy savings result from reducing the pump motor speed (and power) as chilled water valves close. The magnitude of energy savings is based on the estimated amount of time that the system operates at reduced loads.

Affected pumps: two constant speed 7.5 hp secondary chilled water pumps.

4.5 HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**1,254**	**0.0**	**42**	**$290**	**$5,438**	**$0**	**$5,438**	**18.7**	**7,359**
	Implement Demand Control Ventilation (DCV)	1,254	0.0	42	$290	$5,438	$0	$5,438	18.7	7,359

Implement Demand Control Ventilation (DCV)

Demand control ventilation (DCV) monitors the indoor air's carbon dioxide (CO_2) content to measure room occupancy. This data is used to regulate the amount of outdoor air provided to the space for ventilation.

Standard ventilation systems often provide outside air based on a space's estimated maximum occupancy but not actual occupancy. During low occupancy periods, the space may then be over ventilated. This wastes energy through excessive fan motor usage as well as heating and cooling the excess outside air flow. DCV reduces unnecessary outdoor air intake by regulating ventilation based on actual occupancy levels. DCV is most suited for facilities where occupancy levels vary significantly from hour to hour and day to day.

Energy savings associated with DCV are based on hours of operation, space occupancy, system air flow, outside air reduction, and other factors. Energy savings results from eliminating unnecessary ventilation and space conditioning.

Reason for not recommending: due to the long payback period, it is not recommended on the basis of energy savings alone.

4.6 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated Install Cost ($)	Estimated Incentive ($)*	Estimated Net Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**68**	**$355**	**$172**	**$0**	**$172**	**0.5**	**10,002**
ECM 7	Install Low-Flow DHW Devices	0	0.0	68	$355	$172	$0	$172	0.5	10,002

ECM 7: Install Low-Flow DHW Devices

Install low-flow devices to reduce overall hot water demand. The following low flow devices are recommended to reduce hot water usage:

Device	Flow Rate
Faucet aerators (lavatory)	0.5 gpm
Faucet aerator (kitchen)	1.5 gpm
Showerhead	2.0 gpm
Pre-rinse spray valve (kitchen)	1.28 gpm

Low-flow devices reduce the overall water flow from the fixture, while still providing adequate pressure for washing. [Pre-rinse spray valves (PRSVs) — often used in commercial and institutional kitchens — remove food waste from dishes prior to dishwashing.]

Additional cost savings may result from reduced water usage.

5 ENERGY EFFICIENT BEST PRACTICES

A whole building maintenance plan will extend equipment life; improve occupant comfort, health, and safety; and reduce energy and maintenance costs. You may already be doing some of these things— see our list below for potential additions to your maintenance plan. Be sure to consult with qualified equipment specialists for details on proper maintenance and system operation.

Energy Tracking with ENERGY STAR® Portfolio Manager®

You've heard it before - you can't manage what you don't measure. ENERGY STAR® Portfolio Manager® is an online tool that you can use to measure and track energy and water consumption, as well as greenhouse gas emissions[4]. Your account has already been established. Now you can continue to keep tabs on your energy performance every month.

Weatherization

Caulk or weather strip leaky doors and windows to reduce drafts and loss of heated or cooled air. Sealing cracks and openings can reduce heating and cooling costs, improve building durability, and create a healthier indoor environment.

Doors and Windows

Close exterior doors and windows in heated and cooled areas. Leaving doors and windows open leads to a loss of heat during the winter and chilled air during the summer. Reducing air changes per hour (ACH) can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Lighting Controls

As part of a lighting maintenance schedule, test lighting controls to ensure proper functioning. For occupancy sensors, this requires triggering the sensor and verifying that the sensor's timer settings are correct. For daylight and photocell sensors, maintenance involves cleaning sensor lenses and confirming that setpoints and sensitivity are configured properly.

HVAC Filter Cleaning and Replacement

Air filters should be checked regularly (often monthly) and cleaned or replaced when appropriate. Air filters reduce indoor air pollution, increase occupant comfort, and help keep equipment operating efficiently. If the building has a building management system, consider installing a differential pressure switch across filters to send an alarm about premature fouling or overdue filter replacement. Over time, filters become less effective as particulate buildup increases. Dirty filters also restrict air flow through the air conditioning or heat pump system, which increases the load on the distribution fans.

[4] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager

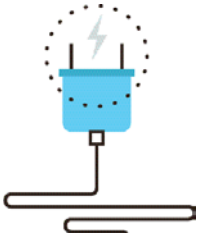
Duct Sealing

Duct leakage in commercial buildings can account for five to twenty-five percent of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Steam Trap Repair and Replacement

Steam traps are a crucial part of delivering heat from the boiler to the space heating units. Repair or replace traps that are blocked or allowing steam to pass. Inspect steam traps as part of a regular steam system maintenance plan.

Plug Load Controls



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips[5]. Your local utility may offer incentives or rebates for this equipment.

Computer Power Management Software

Many computers consume power during nights, weekends, and holidays. Screen savers are commonly confused as a power management strategy. This contributes to avoidable, excessive electrical energy consumption. There are innovative power management software packages available that are designed to deliver significant energy saving and provide ongoing tracking measurements. A central power management platform helps enforce energy savings policies as well as identify and eliminate underutilized devices

[5] For additional information refer to "Assessing and Reducing Plug and Process Loads in Office Buildings" http://www.nrel.gov/docs/fy13osti/54175.pdf, or "Plug Load Best Practices Guide" http://www.advancedbuildings.net/plug-load-best-practices-guide-offices

Water Conservation

Installing dual flush or low-flow toilets and low-flow/waterless urinals are ways to reduce water use. The EPA WaterSense™ ratings for urinals is 0.5 gallons per flush (gpf) and for flush valve toilets is 1.28 gpf (this is lower than the current 1.6 gpf federal standard).

For more information regarding water conservation go to the EPA's WaterSense™ website[6] or download a copy of EPA's "WaterSense™ at Work: Best Management Practices for Commercial and Institutional Facilities[7]" to get ideas for creating a water management plan and best practices for a wide range of water using systems.

Water conservation devices that do not reduce hot water consumption will not provide energy savings at the site level, but they may significantly affect your water and sewer usage costs. 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.

If the facility has detached buildings with a master water meter for the entire campus, check for unnatural wet areas in the lawn or water seeping in the foundation at water pipe penetrations through the foundation. Periodically check overnight meter readings when the facility is unoccupied, and there is no other scheduled water usage.

Manage irrigation systems to use water more effectively outside the building. Adjust spray patterns so that water lands on intended lawns and plantings and not on pavement and walls. Consider installing an evapotranspiration irrigation controller that will prevent over-watering.

Procurement Strategies

Purchasing efficient products reduces energy costs without compromising quality. Consider modifying your procurement policies and language to require ENERGY STAR® or WaterSense™ products where available.

[6] https://www.epa.gov/watersense

[7] https://www.epa.gov/watersense/watersense-work-0

6 On-site Generation

You don't have to look far in New Jersey to see one of the thousands of solar electric systems providing clean power to homes, businesses, schools, and government buildings. On-site generation includes both renewable (e.g., solar, wind) and non-renewable (e.g., fuel cells) technologies that generate power to meet all or a portion of the facility's electric energy needs. Also referred to as distributed generation, these systems contribute to greenhouse gas (GHG) emission reductions, demand reductions and reduced customer electricity purchases reduction, which results in improved electric grid reliability through better use of transmission and distribution systems.

Preliminary screenings were performed to determine if an on-site generation measure could be a cost-effective solution for your facility. Before deciding to install an on-site generation system, we recommend conducting a feasibility study to analyze 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 Solar Photovoltaic

Photovoltaic (PV) panels convert sunlight into electricity. Individual panels are combined into an array that produces direct current (DC) electricity. The DC current is converted to alternating current (AC) through an inverter. The inverter is then connected to the building's electrical distribution system.

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

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the **medium** potential. A PV array located on the roof may be feasible. If you are interested in pursuing the installation of PV, we recommend conducting a full feasibility study.

The graphic below displays the results of the PV potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

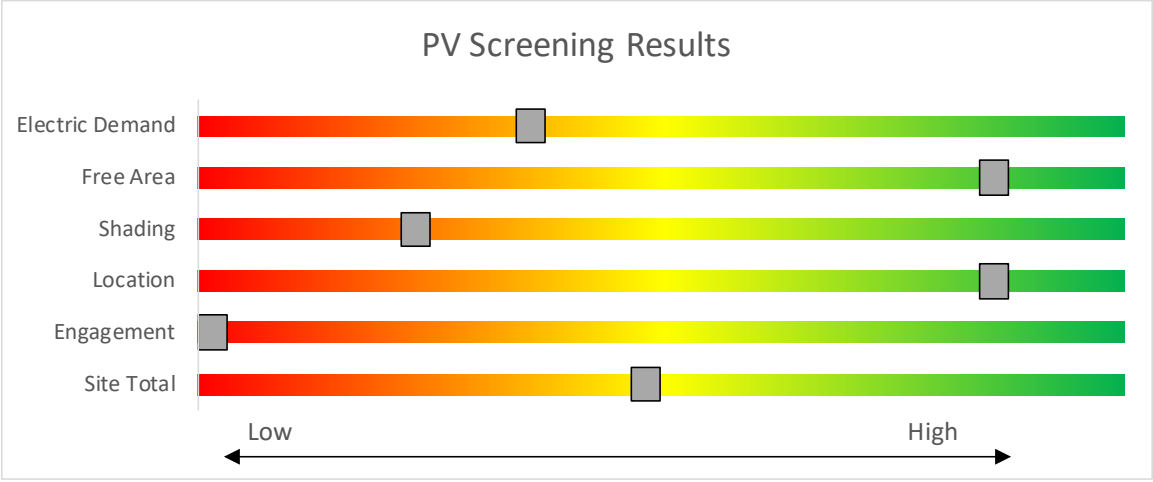


Figure 9 - Photovoltaic Screening

Solar Renewable Energy Credit (SREC) Registration Program (SRP)

Rebates are not available for solar projects, but owners of solar projects MUST register their projects in the SREC Registration Program before starting construction. Once your PV system is up and running, you periodically earn credits, which can then be sold on the open market for up to 15 years.

If you are considering installing solar photovoltaics on your building, visit www.njcleanenergy.com/srec for more information about the SREC Registration Program.

Get more information about solar power in New Jersey or find a qualified solar installer who can help you decide if solar is right for your building:

- **Basic Info on Solar PV in NJ**: www.njcleanenergy.com/whysolar
- **NJ Solar Market FAQs**: www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs
- **Approved Solar Installers in the NJ Market**: 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) generates electricity at the facility and puts waste heat energy to good use. Common types of CHP systems are reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines.

CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be routed through absorption chillers for space cooling.

The key criteria used for screening is the amount of time that the CHP system would operate at full load and the facility's ability to use the recovered heat. Facilities with a continuous need for large quantities of waste heat are the best candidates for CHP.

A preliminary screening based on heating and electrical demand, siting, and interconnection shows that the facility has **no** potential for installing a cost-effective CHP system.

Based on a preliminary analysis, the facility does not appear to meet the minimum requirements for a cost-effective CHP installation. The lack of gas service, low or infrequent thermal load, and lack of space for siting the equipment are the most significant factors contributing to the lack of CHP potential.

The graphic below displays the results of the CHP potential screening conducted as a part of this audit. The position of each slider indicates the potential (potential increases to the right) that each factor contributes to the overall site potential.

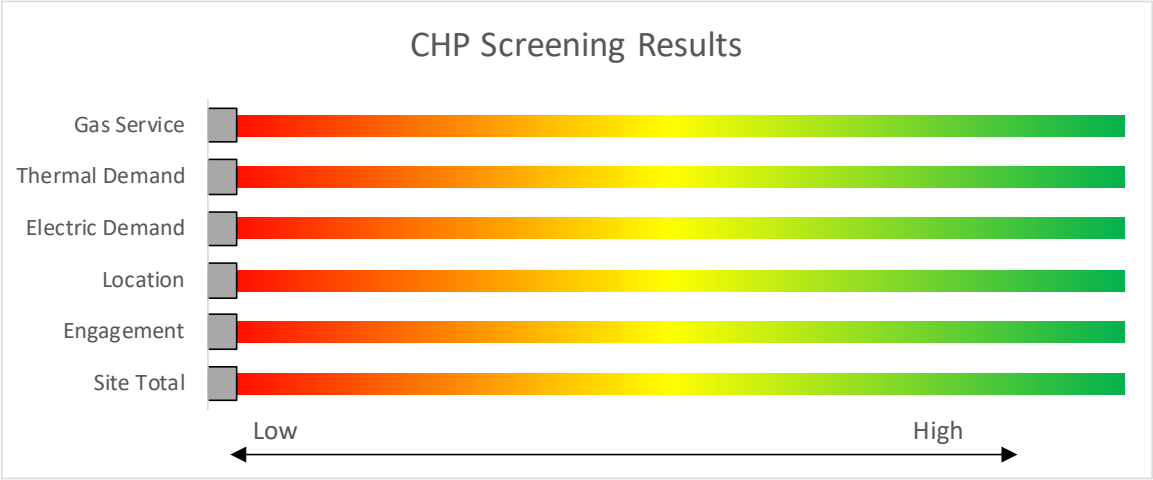


Figure 10 - Combined Heat and Power Screening

Find a qualified firm that specializes in commercial CHP cost assessment and installation: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/

7 PROJECT FUNDING AND INCENTIVES

Ready to improve your building's performance? Pick the program that works best for you. Incentive programs that may apply to this facility are identified in the Executive Summary. This section provides an overview of currently available New Jersey's Clean Energy Programs.

	SmartStart *Flexibility to install at your own pace*	**Direct Install** *Turnkey installation*	**Pay for Performance** *Whole building upgrades*
Who should use it?	Buildings installing individual measures or small group of measures.	Small to mid-size facilities that can bundle multiple measures together. Average peak demand should be below 200 kW. Not suitable for significant building shell issues.	Mid to large size facilities looking to implement as many measures as possible at one time. Peak demand should be over 200 kW.
How does it work?	Use in-house staff or your preferred contractor.	Pre-approved contractors pass savings along to you via reduced material and labor costs.	Whole-building approach to energy upgrades designed to reduce energy use by at least 15%. The more you save, the higher the incentives.
What are the Incentives?	Fixed incentives for specific energy efficiency measures.	Incentives pay up to 70% of eligible costs, up to $125,000 per project. You pay the remaining 30% directly to the contractor.	Up to 25% of installation cost, calculated based on level of energy savings per square foot.
How do I participate?	Submit an application for the specific equipment to be installed.	Contact a participating contractor in your region.	Contact a pre-qualified Partner to develop your Energy Reduction Plan and set your energy savings targets.
Take the next step by visiting **www.njcleanenergy.com** for program details, applications, and to contact a qualified contractor.			

7.1 SmartStart

SmartStart offers incentives for installing prescriptive and custom energy efficiency measures at your facility. This program provides an effective mechanism for securing incentives for energy efficiency measures installed individually or as part of a package of energy upgrades. This program serves most common equipment types and sizes.

SmartStart routinely 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

Incentives

The SmartStart Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type.

SmartStart Custom provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives. Custom incentives are calculated at $0.16/kWh and $1.60/therm based on estimated annual savings. Incentives are 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

Submit an application for the specific equipment to be installed. Many applications are designed as rebates, although others require application approval prior to installation. You can work with your preferred contractor or use internal staff to install measures.

Visit www.njcleanenergy.com/SSB for a detailed program description, instructions for applying, and applications.

7.2 Energy Savings Improvement Program

The Energy Savings Improvement Program (ESIP) serves New Jersey's government agencies by financing energy projects. 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. Annual payments are lower than the savings projected from the ECMs, ensuring that ESIP projects are cash flow positive for the life of the contract.

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 described above can also be used to help further reduce the total project cost of eligible measures.

How to Participate

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 used 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. Carefully consider all alternatives to develop an approach that best meets your needs. A detailed program descriptions and application can be found at: www.njcleanenergy.com/ESIP.

ESIP is a program delivered directly by the NJBPU and is not an NJCEP incentive program. As mentioned above, you can use NJCEP incentive programs to help further reduce costs when developing the energy savings plan. Refer to the ESIP guidelines at the link above for further information and guidance on next steps.

7.3 SREC Registration Program

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

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

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

Electricity suppliers, the primary purchasers of SRECs, are required to pay a Solar Alternative Compliance Payment (SACP) if they do not meet the requirements of New Jersey's Solar Renewable Portfolio Standard. Purchasing SRECs can help them meet those requirements. As SRECs are traded in a competitive market, the price may vary significantly. The actual price of an SREC during a trading period fluctuates depending on supply and demand.

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

8 Energy Purchasing and Procurement Strategies

8.1 Retail Electric Supply Options

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 already buys electricity from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party electric suppliers is available at the NJBPU website[8].

8.2 Retail Natural Gas Supply Options

The natural gas market in New Jersey is also deregulated. Most customers that remain with the utility for natural gas service pay rates that are market-based and that fluctuate monthly. 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 typically depends on whether a customer prefers 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 does not already purchase natural gas from a third-party supplier, consider shopping for a reduced rate from third-party natural gas suppliers. If your facility already purchases natural gas from a third-party supplier, review and compare prices at the end of each contract year.

A list of licensed third-party natural gas suppliers is available at the NJBPU website[9].

[8] www.state.nj.us/bpu/commercial/shopping.html.

[9] 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	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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
Basement Mechanical Room	33	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	6,989		None	No	33	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	6,989	0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	4	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Wall Switch	S	10	6,989		None	No	4	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Wall Switch	10	6,989	0.0	0	0	$0	$0	$0	0.0
14th Floor Mechanical Room	15	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	6,989		None	No	15	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	6,989	0.0	0	0	$0	$0	$0	0.0
14th Floor Mechanical Room	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1106 (Office)	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1107 (Office)	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1109 (Office)	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1110 (Office)	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1101 (Office)	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1102 (Office)	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1105A (Kitchen)	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1105 (Office)	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Room 1104 (Office)	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Closet	1	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	1	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Restroom	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Restroom	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	S	9	4,822		None	No	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Exit Signs	6	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	6	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
11th Floor - Hallways	18	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	10	4,822		None	No	18	LED - Fixtures: Downlight Recessed	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
11th Floor - Hallways	6	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	6	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX01	64	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	64	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX02	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX03	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX04	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX05	48	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	48	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX05A	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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
4th Floor Through 10th Floor & 12th Floor - Room XX05B	8	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	8	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Restroom	16	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	16	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Restroom	24	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	24	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Janitor/Closet	8	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	8	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX06	48	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	48	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX07	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX08	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX09	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Room XX10	32	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	32	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Hallway	144	LED - Fixtures: Downlight Recessed	Occupancy Sensor	S	10	4,822		None	No	144	LED - Fixtures: Downlight Recessed	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
4th Floor Through 10th Floor & 12th Floor - Hallway	48	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	48	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
B02	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	4,822		None	No	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,822	0.0	0	0	$0	$0	$0	0.0
B03	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	4,822		None	No	2	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,822	0.0	0	0	$0	$0	$0	0.0
B04	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	4,822		None	No	4	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,822	0.0	0	0	$0	$0	$0	0.0
B04	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
B01	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	4,822		None	No	10	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,822	0.0	0	0	$0	$0	$0	0.0
Stairwell	32	LED - Linear Tubes: (1) 3' Lamp	Occupancy Sensor	S	11	4,822		None	No	32	LED - Linear Tubes: (1) 3' Lamp	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	7	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	4,822		None	No	7	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,822	0.0	0	0	$0	$0	$0	0.0
Lab B08	27	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	27	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Lab B08	17	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	17	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
Lab B08	5	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Closet	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Library B10	65	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	65	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
Library B10	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Library B12	50	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	4,822		None	No	50	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,822	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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
Library B12	5	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	5	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Fine Library B13	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	32	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Stairwell	3	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Occupancy Sensor	S	26	4,822		None	No	3	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Occupancy Sensor	26	4,822	0.0	0	0	$0	$0	$0	0.0
Stairwell	8	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	8	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
B15A	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
B15A Storage	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	4	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	4	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
B16 Storage	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
B16 Storage	25	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	25	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
B16 Storage	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
A Level Basement - A12 Storage	6	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	6	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
Closet	1	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	1	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Library A11	47	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	4,822		None	No	47	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.0	0	0	$0	$0	$0	0.0
Library A11	60	LED - Linear Tubes: (4) 8' Lamps	Occupancy Sensor	S	144	4,822		None	No	60	LED - Linear Tubes: (4) 8' Lamps	Occupancy Sensor	144	4,822	0.0	0	0	$0	$0	$0	0.0
Library A11	72	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	72	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Library A11	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Office A15	1	LED - Linear Tubes: (4) 8' Lamps	Occupancy Sensor	S	144	4,822		None	No	1	LED - Linear Tubes: (4) 8' Lamps	Occupancy Sensor	144	4,822	0.0	0	0	$0	$0	$0	0.0
Office A16	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	S	44	4,822		None	No	8	LED - Linear Tubes: (3) 4' Lamps	Occupancy Sensor	44	4,822	0.0	0	0	$0	$0	$0	0.0
Office A16	3	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	3	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Office A17	6	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	6	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Open Area A19	10	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	10	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Office A20	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Open Area A19	150	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	150	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
Office A22	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Office A14	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Office A14	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Office A14	1	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	1	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
A Level Mechanocal Room	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	7	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Corridor A19	50	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	50	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Corridor A19	44	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Occupancy Sensor	S	26	4,822		None	No	44	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Occupancy Sensor	26	4,822	0.0	0	0	$0	$0	$0	0.0
Corridor A19	14	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Occupancy Sensor	S	26	4,822		None	No	14	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Occupancy Sensor	26	4,822	0.0	0	0	$0	$0	$0	0.0
Corridor A19	54	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	54	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Corridor A09	10	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	10	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Office A09	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	4,822		None	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.0	0	0	$0	$0	$0	0.0
Office A08	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	S	58	4,822		None	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Mens)	19	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	19	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Womens)	19	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	19	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
A07	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Closet	1	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	1	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
A05	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
A06	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	9	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	9	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
A02	4	LED - Linear Tubes: (2) 4' T5HO (25W) Lamps	Occupancy Sensor	S	51	4,822		None	No	4	LED - Linear Tubes: (2) 4' T5HO (25W) Lamps	Occupancy Sensor	51	4,822	0.0	0	0	$0	$0	$0	0.0
A03	2	LED - Linear Tubes: (2) 4' T5HO (25W) Lamps	Occupancy Sensor	S	51	4,822		None	No	2	LED - Linear Tubes: (2) 4' T5HO (25W) Lamps	Occupancy Sensor	51	4,822	0.0	0	0	$0	$0	$0	0.0
A04	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
A01	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Exterior Spot Lights	40	LED - Fixtures: Architectural Flood/Spot Luminaire	Time Switch		10	874		None	No	40	LED - Fixtures: Architectural Flood/Spot Luminaire	Time Switch	10	874	0.0	0	0	$0	$0	$0	0.0
Classroom 110	24	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	6,989	1, 3	Relamp	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.7	7,747	-3	$441	$1,416	$310	2.5
Classroom 110	2	Exit Signs: Fluorescent	None		9	8,760	2	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	50	0	$3	$145	$0	51.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Classroom 110	8	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	S	11	6,989		None	No	8	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	11	6,989	0.0	0	0	$0	$0	$0	0.0
Classroom 110	1	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Wall Switch	S	26	6,989		None	No	1	LED Screw-In Lamps: (2) 13W LED Screw-In Lamps - Recessed Can	Wall Switch	26	6,989	0.0	0	0	$0	$0	$0	0.0
Lobby 110	16	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	S	11	6,989	3	None	Yes	16	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	400	0	$23	$540	$0	23.7
Stairwell	8	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	S	11	6,989		None	No	8	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	11	6,989	0.0	0	0	$0	$0	$0	0.0
Exit	1	Exit Signs: Fluorescent	None		9	8,760	2	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	25	0	$1	$72	$0	51.3
Verstibule	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	S	11	6,989		None	No	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	11	6,989	0.0	0	0	$0	$0	$0	0.0
Corridor 107	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	2	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Fire 107	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Stairwell	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Stairwell	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Stairwell 4	24	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	S	11	6,989		None	No	24	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	11	6,989	0.0	0	0	$0	$0	$0	0.0
Lobby 100	15	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	15	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Lobby 100	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Office 100	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Office 101	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Office 102	2	LED - Linear Tubes: (2) 5' Lamps	Occupancy Sensor	S	40	4,822		None	No	2	LED - Linear Tubes: (2) 5' Lamps	Occupancy Sensor	40	4,822	0.0	0	0	$0	$0	$0	0.0
Office 105 Corridor	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Office 105	1	LED - Linear Tubes: (2) 5' Lamps	Occupancy Sensor	S	40	4,822		None	No	1	LED - Linear Tubes: (2) 5' Lamps	Occupancy Sensor	40	4,822	0.0	0	0	$0	$0	$0	0.0
Office 106	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Lobby	1	LED - Fixtures: Decorative Pendant	Occupancy Sensor	S	10	4,822		None	No	1	LED - Fixtures: Decorative Pendant	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Lobby	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
2nd Floor - Open Office 205	14	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	14	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Office 205	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Conference Romm 204	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Conference Romm 204	4	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	4	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	Fixture Recommendation	Add Controls?	Fixture Quantity	Fixture Description	Control System	Watts per Fixture	Annual Operating Hours	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Office 203	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Office 202	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	1	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Office 201	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Mens)	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Mens)	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	S	9	4,822		None	No	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Womens)	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	3	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Womens)	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	S	9	4,822		None	No	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	4,822	0.0	0	0	$0	$0	$0	0.0
Office 200	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Closet	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	1	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	6	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	6	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Office 206	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	2	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Office 207	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	4	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Office 209	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Hallway	33	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	33	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	4	LED - Linear Tubes: (4) 5' Lamps	Occupancy Sensor	S	80	4,822		None	No	4	LED - Linear Tubes: (4) 5' Lamps	Occupancy Sensor	80	4,822	0.0	0	0	$0	$0	$0	0.0
Office 210	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.2	1,188	0	$68	$292	$80	3.1
Office 211	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.2	1,188	0	$68	$292	$80	3.1
Office 212	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
CR214	34	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	6,989	1, 3	Relamp	Yes	34	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	1.0	10,975	-5	$625	$1,782	$410	2.2
CR214	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	S	10	6,989		None	No	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Wall Switch	10	6,989	0.0	0	0	$0	$0	$0	0.0
CR214	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
CR214	4	Halogen Incandescent: Halogen Spot Light	Wall Switch		50	6,989	1	Relamp	No	4	LED Screw-In Lamps: LED Screw-In Lamps	Wall Switch	8	6,989	0.1	1,307	-1	$74	$69	$4	0.9
Office 213	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Office 215	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Lounge 216	8	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	8	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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
Lounge 216	6	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	6	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Open Office 218	20	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	S	17	4,822		None	No	20	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Open Office 218	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
218A	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
218B	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
221	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	S	17	4,822		None	No	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
223	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	S	17	4,822		None	No	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
223	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
CR224	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	6,989	1, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.3	2,905	-1	$165	$599	$125	2.9
CR224	4	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	6,989	1, 3	Relamp	Yes	4	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.1	676	0	$39	$73	$20	1.4
CR224	11	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	6,989	3	None	Yes	11	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	4,822	0.0	446	0	$25	$270	$35	9.3
CR224	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Wall Switch	S	10	6,989	3	None	Yes	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	68	0	$4	$0	$0	0.0
CR224	2	Exit Signs: Fluorescent	None		9	8,760	2	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	50	0	$3	$145	$0	51.3
Restroom (Womens)	3	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	S	9	4,822		None	No	3	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Womens)	5	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	5	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Office 220	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Office 219	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
Office 217	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	S	15	4,822		None	No	2	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.0	0	0	$0	$0	$0	0.0
Auditorium 225	100	LED - Fixtures: 20W LED Spot Lights	Wall Switch	S	20	6,989		None	No	100	LED - Fixtures: 20W LED Spot Lights	Wall Switch	20	6,989	0.0	0	0	$0	$0	$0	0.0
Auditorium 225	28	Halogen Incandescent: Halogen Spot Light	Wall Switch	S	50	6,989	1	Relamp	No	28	LED Screw-In Lamps: LED Screw-In Lamps	Wall Switch	8	6,989	0.9	9,148	-4	$521	$482	$28	0.9
Auditorium 225	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Auditorium 225	4	Compact Fluorescent: (2) 26W CFL Screw-In Lamps	Wall Switch	S	52	6,989	1, 3	Relamp	Yes	4	LED Screw-In Lamps: LED Screw-In Lamps	Occupancy Sensor	36	4,822	0.1	827	0	$47	$408	$43	7.7
Auditorium Corridor	23	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	23	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Auditorium Corridor	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
3rd Floor - Dressing Room 324	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	12	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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
A/V Room	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
A/V Room	3	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	3	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Backstage	4	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	4	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Backstage	18	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	18	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Corridor	9	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	9	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Corridor	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Restroom (Mens)	3	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	S	9	4,822		None	No	3	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Mens)	5	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	5	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
CR322	9	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	6,989	1, 3	Relamp	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.3	2,905	-1	$165	$599	$125	2.9
CR322	4	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	6,989	1, 3	Relamp	Yes	4	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	4,822	0.1	676	0	$39	$73	$20	1.4
CR322	11	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	6,989	3	None	Yes	11	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	4,822	0.0	446	0	$25	$270	$35	9.3
CR322	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Wall Switch	S	10	6,989	3	None	Yes	3	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	68	0	$4	$0	$0	0.0
CR322	2	Exit Signs: Fluorescent	None		9	8,760	2	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	50	0	$3	$145	$0	51.3
Restroom (Womens)	4	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	4	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Restroom (Womens)	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	S	9	4,822		None	No	2	LED - Linear Tubes: (1) 2' Lamp	Occupancy Sensor	9	4,822	0.0	0	0	$0	$0	$0	0.0
Lounge 317	36	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	36	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Lounge 317	10	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	S	72	4,822		None	No	10	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	4,822	0.0	0	0	$0	$0	$0	0.0
Lounge 317	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	S	29	4,822		None	No	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.0	0	0	$0	$0	$0	0.0
Lounge 317 Kitchen	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	S	17	4,822		None	No	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	4,822	0.0	0	0	$0	$0	$0	0.0
Office 320	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Office 316	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Office 314	34	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	4,822	1	Relamp	No	34	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	4,822	0.8	5,952	-2	$339	$1,242	$340	2.7
Office 314	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	S	11	4,822		None	No	2	LED Screw-In Lamps: (1) 10.5W LED Screw-In	Occupancy Sensor	11	4,822	0.0	0	0	$0	$0	$0	0.0
Office 314	2	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	2	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
Office 314	4	Halogen Incandescent: Halogen Spot Light	Occupancy Sensor		50	4,822	1	Relamp	No	4	LED Screw-In Lamps: LED Screw-In Lamps	Occupancy Sensor	8	4,822	0.1	902	0	$51	$69	$4	1.3

	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
Location	Fixture Quantity	Fixture Description	Control System	Light Level	Watts per Fixture	Annual Operating Hours	ECM #	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
Mailroom	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	6,989		None	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	6,989	0.0	0	0	$0	$0	$0	0.0
Office 318	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	S	17	6,989		None	No	2	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	6,989	0.0	0	0	$0	$0	$0	0.0
Office 315	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Office 312	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Office 311	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.2	1,188	0	$68	$292	$80	3.1
Office 310	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	6,989	1, 3	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.2	2,275	-1	$130	$562	$115	3.5
Office 309	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Occupancy Sensor	S	114	4,822	1	Relamp	No	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	4,822	0.1	594	0	$34	$146	$40	3.1
Hallway	6	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	6	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	33	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	S	10	4,822		None	No	33	LED Screw-In Lamps: (1) 9.5W LED Screw-In	Occupancy Sensor	10	4,822	0.0	0	0	$0	$0	$0	0.0
Hallway	4	LED - Linear Tubes: (4) 5' Lamps	Occupancy Sensor	S	80	4,822		None	No	4	LED - Linear Tubes: (4) 5' Lamps	Occupancy Sensor	80	4,822	0.0	0	0	$0	$0	$0	0.0

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?	Remaining Useful Life	Annual Operating Hours	ECM #	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
Basement Mechanical Room	AHU1 (Library)	1	Supply Fan	20.0	93.6%	No	B	6,570	4, 5	Yes	93.6%	Yes	1	5.7	40,660	0	$2,403	$8,582	$1,600	2.9
Basement Mechanical Room	EX1 (Library)	1	Exhaust Fan	10.0	89.5%	No	B	6,570	4, 5	Yes	91.7%	Yes	1	3.1	18,826	0	$1,113	$5,152	$800	3.9
Basement Mechanical Room	AHU4	1	Supply Fan	15.0	92.4%	Yes	N	6,570		No	92.4%	No		0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	AHU4	1	Return Fan	5.0	89.5%	Yes	N	6,570		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	AHU6 (Library Exterior)	1	Supply Fan	15.0	91.0%	No	B	6,570	4, 5	Yes	93.0%	Yes	1	4.4	31,746	0	$1,876	$7,041	$1,200	3.1
Basement Mechanical Room	EX6 (Library Exterior)	1	Exhaust Fan	5.0	87.5%	No	B	6,570	4, 5	Yes	89.5%	Yes	1	1.5	9,391	0	$555	$4,076	$400	6.6
Basement Mechanical Room	Air Compressor	1	Air Compressor	7.5	90.2%	No	W	6,570		No	90.2%	No		0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	AHU5 (Equipment Room)	1	Supply Fan	7.5	88.5%	No	B	6,570	4, 5	Yes	91.0%	Yes	1	2.2	16,069	0	$950	$4,738	$600	4.4
Basement Mechanical Room	EX5 (Equipment Room)	1	Exhaust Fan	5.0	87.5%	No	B	6,570	4, 5	Yes	89.5%	Yes	1	1.5	9,391	0	$555	$4,076	$400	6.6
Basement Mechanical Room	AHU2 (Classrooms East)	1	Supply Fan	15.0	91.0%	No	B	6,570	4, 5	Yes	93.0%	Yes	1	4.4	31,746	0	$1,876	$7,041	$1,200	3.1
Basement Mechanical Room	EX2 (Classrooms East)	1	Exhaust Fan	7.5	88.5%	No	B	6,570	4, 5	Yes	91.0%	Yes	1	2.3	14,232	0	$841	$4,738	$600	4.9
Basement Mechanical Room	NE Building (Exhaust)	1	Exhaust Fan	1.0	85.5%	No	W	6,570		No	85.5%	No		0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	Secondary Chilled Water Loop	2	Chilled Water Pump	7.5	91.0%	No	W	6,570	4, 6	Yes	91.0%	Yes	2	2.8	24,495	0	$1,448	$9,476	$0	6.5
Basement Mechanical Room	Heating Hot Water Loop	1	Heating Hot Water Pump	1.5	86.5%	Yes	W	5,475		No	86.5%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU9 (Tower Lower)	1	Supply Fan	7.5	88.5%	No	B	5,475	4, 5	Yes	91.0%	Yes	1	2.2	14,530	0	$859	$4,738	$600	4.8
3rd Floor Mechanical Room	EX-10 (Tower Lower)	1	Exhaust Fan	3.0	86.5%	No	B	6,570	4, 5	Yes	89.5%	Yes	1	0.9	5,774	0	$341	$3,884	$240	10.7
14th Floor Mechanical Room	AHU10 (Tower Upper)	1	Supply Fan	10.0	89.5%	No	B	6,570	4, 5	Yes	91.7%	Yes	1	3.0	21,276	0	$1,258	$5,152	$800	3.5
14th Floor Mechanical Room	EX11 (Tower Upper)	1	Exhaust Fan	2.0	78.5%	No	B	6,570	4, 5	Yes	86.5%	Yes	1	0.7	4,408	0	$261	$3,261	$160	11.9
14th Floor Mechanical Room	AHU11 (Professor Lounge)	1	Supply Fan	7.5	88.5%	No	B	6,570	4, 5	Yes	91.0%	Yes	1	2.2	16,069	0	$950	$4,738	$600	4.4
14th Floor Mechanical Room	EX12 (Professor Lounge)	1	Exhaust Fan	2.0	78.5%	No	B	6,570	4, 5	Yes	86.5%	Yes	1	0.7	4,408	0	$261	$3,261	$160	11.9

		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?	Remaining Useful Life	Annual Operating Hours	ECM #	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
A Level Mechanical Room	AHU7	1	Supply Fan	20.0	93.0%	Yes	N	6,570		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
A Level Mechanical Room	AHU7	1	Return Fan	5.0	89.5%	Yes	N	6,570		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Perimeter Zones Throughout Building	Perimeter Zones Throughout Building	257	Fan Coil Unit	0.3	72.4%	No	B	6,570		No	72.4%	No		0.0	0	0	$0	$0	$0	0.0
Basement Mechanical Room	Basement Mechanical Room	4	Condensate Pump	2.0	84.0%	No	B	3,650		No	84.0%	No		0.0	0	0	$0	$0	$0	0.0
Library Equipment Room	Library Equipment Room	2	Condensate Pump	1.5	82.5%	No	B	3,650		No	82.5%	No		0.0	0	0	$0	$0	$0	0.0
Tower Equipment Room	Tower Equipment Room	2	Condensate Pump	1.5	82.5%	No	B	3,650		No	82.5%	No		0.0	0	0	$0	$0	$0	0.0

Electric Chiller Inventory & Recommendations

		Existing Conditions				Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	Chiller Quantity	System Type	Cooling Capacity per Unit (Tons)	Remaining Useful Life	ECM #	Install High Efficiency Chillers?	Chiller Quantity	System Type	Constant/ Variable Speed	Cooling Capacity (Tons)	Full Load Efficiency (kW/Ton)	IPLV Efficiency (kW/Ton)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Central Plant	Chilled water Loop	1	Water-Cooled Centrifugal Chiller	540.00	W		No							0.0	0	0	$0	$0	$0	0.0

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)	Remaining Useful Life	ECM #	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
Throughout Building	Chilled Water Loop (Absorption Chiller)	1	Furnace	6,531.60	W		No						0.0	0	0	$0	$0	$0	0.0
Throughout Building	Heating Hot Water Loop	1	Furnace	8,164.50	W		No						0.0	0	0	$0	$0	$0	0.0

Demand Control Ventilation Recommendations

		Recommendation Inputs					Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Number of Zones	Cooling Capacity of Controlled System (Tons)	Electric Heating Capacity of Controlled System (kBtu/hr)	Output Heating Capacity of Controlled System (MBh)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Library	Library	7	2.00	88.75	0.00	441.78	0.0	1,001	25	$188	$2,719	$0	14.4
14th Floor Mechanical Room	AHU11 (Professor Lounge)	7	2.00	22.50	0.00	298.50	0.0	254	17	$102	$2,719	$0	26.6

Low-Flow Device Recommendations

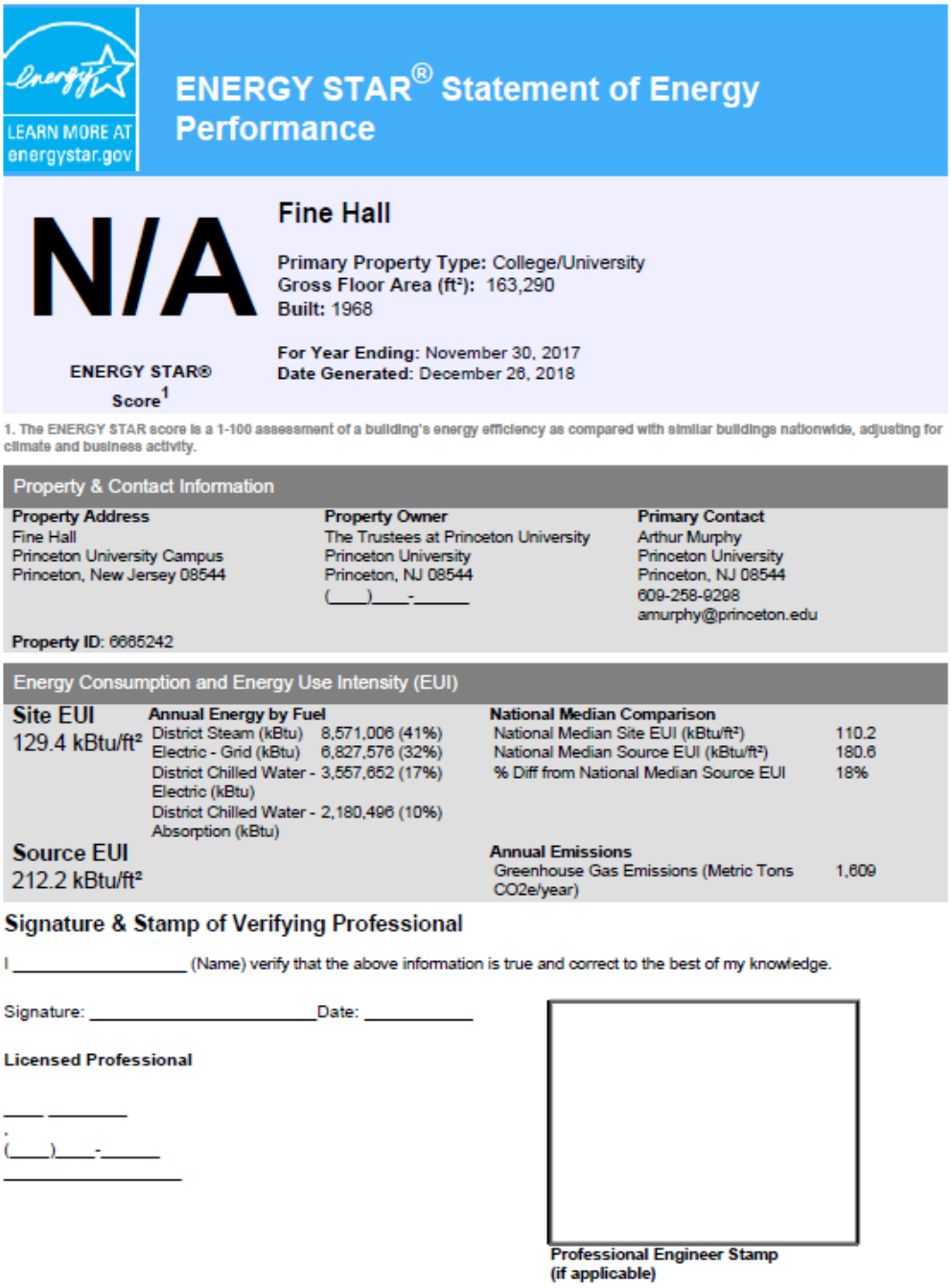
	Recommedation Inputs					Energy Impact & Financial Analysis						
Location	ECM #	Device Quantity	Device Type	Existing Flow Rate (gpm)	Proposed Flow Rate (gpm)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Total Installation Cost	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	8	24	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	68	$355	$172	$0	0.5

Plug Load Inventory

	Existing Conditions			
Location	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?
Throughout Buiding	94	Desktop Computers	170.0	Yes
Throughout Buiding	14	Printers (Small)	20.0	Yes
Throughout Buiding	10	Printers (Medium)	60.0	Yes
Throughout Buiding	3	Printers (Large)	600.0	Yes
Throughout Buiding	3	Mini Fridge	153.0	Yes
Throughout Buiding	3	Fridge	156.0	Yes
Throughout Buiding	3	Microwave	1,000.0	Yes
Throughout Buiding	5	LED TV	110.0	Yes
Throughout Buiding	2	Projectors	200.0	Yes
Throughout Buiding	4	Coffee Machine	900.0	Yes

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

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.



LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

Fine Hall

Primary Property Type: College/University
Gross Floor Area (ft²): 163,290
Built: 1968

For Year Ending: November 30, 2017
Date Generated: December 26, 2018

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

Property & Contact Information

Property Address	Property Owner	Primary Contact
Fine Hall Princeton University Campus Princeton, New Jersey 08544	The Trustees at Princeton University Princeton University Princeton, NJ 08544 (___)___-_____	Arthur Murphy Princeton University Princeton, NJ 08544 609-258-9298 amurphy@princeton.edu

Property ID: 6665242

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
129.4 kBtu/ft²

Annual Energy by Fuel

District Steam (kBtu)	8,571,006 (41%)
Electric - Grid (kBtu)	6,827,576 (32%)
District Chilled Water - Electric (kBtu)	3,557,652 (17%)
District Chilled Water - Absorption (kBtu)	2,180,496 (10%)

National Median Comparison

National Median Site EUI (kBtu/ft²)	110.2
National Median Source EUI (kBtu/ft²)	180.6
% Diff from National Median Source EUI	18%

Source EUI
212.2 kBtu/ft²

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	1,609

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)

APPENDIX C: GLOSSARY

TERM	DEFINITION
Blended Rate	Used to calculate fiscal savings associated with measures. The blended rate is calculated by dividing the amount of your bill by the total energy use. For example, if your bill is $22,217.22, and you used 266,400 kilowatt-hours, your blended rate is 8.3 cents per kilowatt-hour.
Btu	*British thermal unit*: a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
CHP	*Combined heat and power*. Also referred to as cogeneration.
COP	*Coefficient of performance*: a measure of efficiency in terms of useful energy delivered divided by total energy input.
Demand Response	Demand response reduces or shifts electricity usage at or among participating buildings/sites during peak energy use periods in response to time-based rates or other forms of financial incentives.
DCV	*Demand control ventilation*: a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
US DOE	*United States Department of Energy*
EC Motor	*Electronically commutated motor*
ECM	*Energy conservation measure*
EER	*Energy efficiency ratio*: a measure of efficiency in terms of cooling energy provided divided by electric input.
EUI	*Energy Use Intensity:* measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
Energy Efficiency	Reducing the amount of energy necessary to provide comfort and service to a building/area. Achieved through the installation of new equipment and/or optimizing the operation of energy use systems. Unlike conservation, which involves some reduction of service, energy efficiency provides energy reductions without sacrifice of service.
ENERGY STAR®	ENERGY STAR® is the government-backed symbol for energy efficiency. The ENERGY STAR® program is managed by the EPA.
EPA	*United States Environmental Protection Agency*
Generation	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
GHG	*Greenhouse gas:* gases that are transparent to solar (short-wave) radiation but opaque to long-wave (infrared) radiation, thus preventing long-wave radiant energy from leaving Earth's atmosphere. The net effect is a trapping of absorbed radiation and a tendency to warm the planet's surface.
gpf	*Gallons per flush*

gpm	*Gallon per minute*
HID	*High intensity discharge:* high-output lighting lamps such as high-pressure sodium, metal halide, and mercury vapor.
hp	*Horsepower*
HPS	*High-pressure sodium*: a type of HID lamp.
HSPF	*Heating seasonal performance factor:* a measure of efficiency typically applied to heat pumps. Heating energy provided divided by seasonal energy input.
HVAC	*Heating, ventilating, and air conditioning*
IHP 2014	US DOE Integral Horsepower rule. The current ruling regarding required electric motor efficiency.
IPLV	*Integrated part load value:* a measure of the part load efficiency usually applied to chillers.
kBtu	*One thousand British thermal units*
kW	*Kilowatt*: equal to 1,000 Watts.
kWh	*Kilowatt-hour*: 1,000 Watts of power expended over one hour.
LED	*Light emitting diode*: a high-efficiency source of light with a long lamp life.
LGEA	*Local Government Energy Audit*
Load	The total power a building or system is using at any given time.
Measure	A single activity, or installation of a single type of equipment, that is implemented in a building system to reduce total energy consumption.
MH	*Metal halide*: a type of HID lamp.
MBh	*Thousand Btu per hour*
MBtu	*One thousand British thermal units*
MMBtu	*One million British thermal units*
MV	*Mercury Vapor:* a type of HID lamp
NJBPU	*New Jersey Board of Public Utilities*
NJCEP	*New Jersey's Clean Energy Program:* NJCEP is a statewide program that offers financial incentives, programs and services for New Jersey residents, business owners and local governments to help them save energy, money and the environment.
psig	Pounds per square inch gauge
Plug Load	Refers to the amount of power used in a space by products that are powered by means of an ordinary AC plug.
PV	*Photovoltaic:* refers to an electronic device capable of converting incident light directly into electricity (direct current).

SEER	*Seasonal energy efficiency ratio:* a measure of efficiency in terms of annual cooling energy provided divided by total electric input.
SEP	*Statement of energy performance:* a summary document from the ENERGY STAR® Portfolio Manager®.
Simple Payback	The amount of time needed to recoup the funds expended in an investment or to reach the break-even point between investment and savings.
SREC	*Solar renewable energy credit*: a credit you can earn from the state for energy produced from a photovoltaic array.
T5, T8, T12	A reference to a linear lamp diameter. The number represents increments of 1/8th of an inch.
Temperature Setpoint	The temperature at which a temperature regulating device (thermostat, for example) has been set.
therm	100,000 Btu. Typically used as a measure of natural gas consumption.
tons	A unit of cooling capacity equal to 12,000 Btu/hr.
Turnkey	Provision of a complete product or service that is ready for immediate use
VAV	*Variable air volume*
VFD	*Variable frequency drive*: a controller used to vary the speed of an electric motor.
WaterSense™	The symbol for water efficiency. The WaterSense™ program is managed by the EPA.
Watt (W)	Unit of power commonly used to measure electricity use.