Local Government Energy Audit Report

Gilligan Student Union

June 10, 2022

Prepared for:
New Jersey City University
2039 Kennedy Boulevard
Jersey City, New Jersey 07305

Prepared by:
TRC
317 George Street
New Brunswick, New Jersey 08901

Disclaimer

The goal of this audit report is to identify potential energy efficiency opportunities and help prioritize specific measures for implementation. 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 reviewed the energy conservation measures and estimates of energy savings 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 material and labor costs primarily on RS Means cost manuals as well as on our experience at similar facilities. This approach is based on standard cost estimating manuals and is vendor neutral. Cost estimates include material and labor pricing associated with one for one equipment replacements. Cost estimates do not include demolition or removal of hazardous waste. The actual implementation costs for energy savings projects are anticipated to be significantly higher based on the specific conditions at your site(s). We strongly recommend that you work with your design engineer or contractor to develop actual project costs for your specific scope of work for the installation of high efficiency equipment. We encourage you to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC and NJBPU do not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor estimates.

Incentive values provided in this report are estimated based of previously run state efficiency programs. Incentive levels are not guaranteed. The NJBPU reserves the right to extend, modify, or terminate programs without prior notice. Please review all available utility 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.

Table of Contents

Energy Efficiency Incentive & Rebate Transition

For the purposes of your LGEA, estimated incentives and rebates are included as placeholders for planning purposes. New Jersey utilities are rolling out their own energy efficiency programs, which your project may be eligible for depending on individual measures, quantities, and size of the building.

In 2018, Governor Murphy signed into law the landmark legislation known as the Clean Energy Act. The law called for a significant overhaul of New Jersey's clean energy systems by building sustainable infrastructure in order to fight climate change and reduce carbon emissions, which will in turn create well-paying local jobs, grow the state's economy, and improve public health while ensuring a cleaner environment for current and future residents.

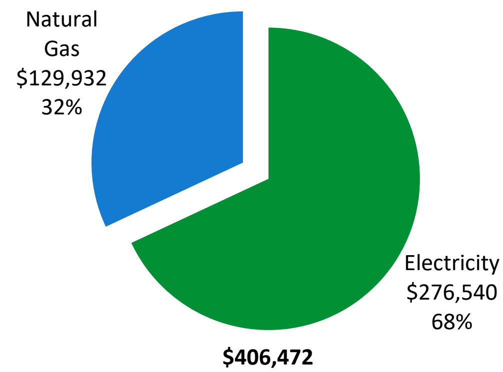
These next generation energy efficiency programs feature new ways of managing and delivering programs historically administered by New Jersey's Clean Energy Program™ (NJCEP). All of the investor-owned gas and electric utility companies will now also offer complementary energy efficiency programs and incentives directly to customers like you. NJCEP will still offer programs for new construction, renewable energy, the Energy Savings Improvement Program (ESIP), and large energy users.

New utility programs are under development. Keep up to date with developments by visiting the NJCEP website.

1 Executive Summary

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) report for Gilligan Student Union. 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 conducted this study as part of a comprehensive effort to assist New Jersey school districts and local governments in controlling their energy costs and to help protect our environment by reducing statewide energy consumption.

BUILDING PERFORMANCE REPORT

Annual Utilities	Costs: $406,472 Electricity: 2,485,774 kWh Natural Gas: 192,832 Therms	
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.

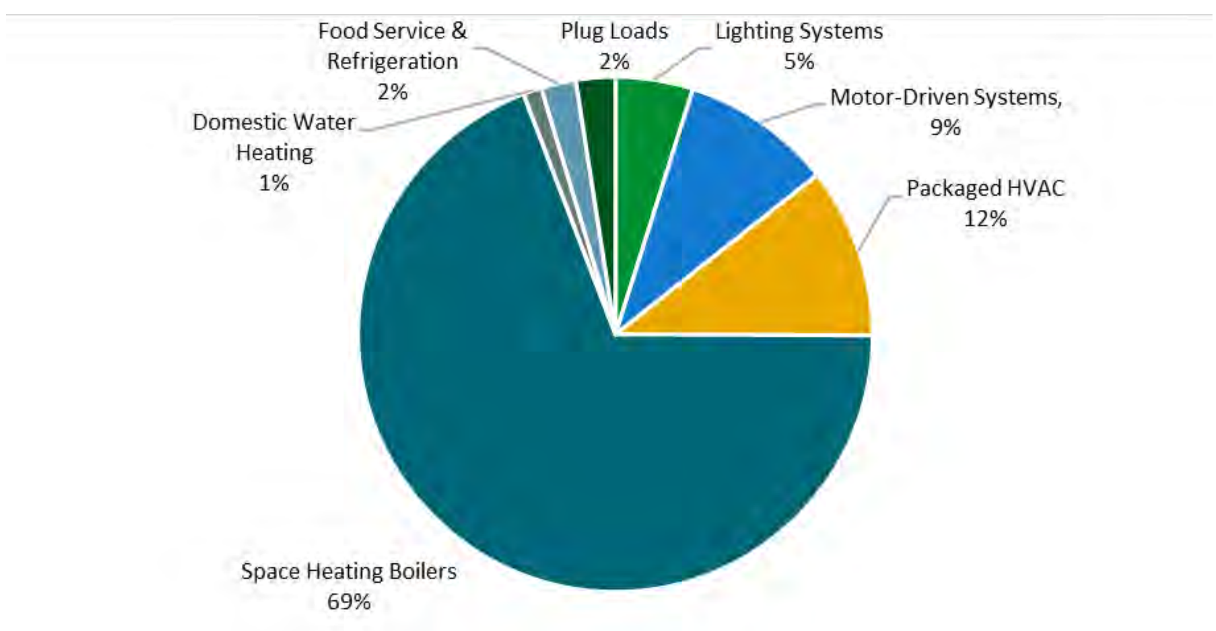


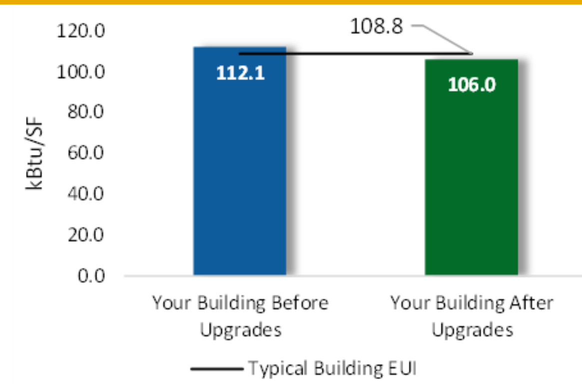
Figure 1 - Energy Use by System

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.

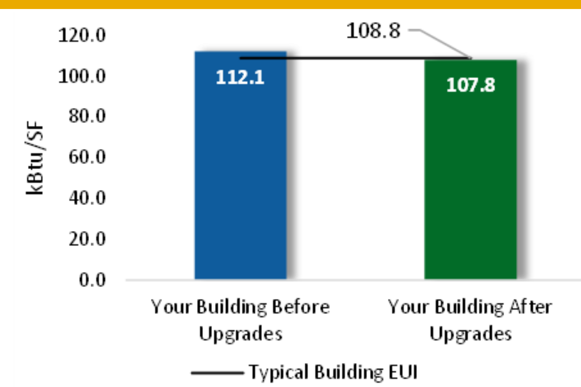
Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	$762,446
Potential Rebates & Incentives[1]	$70,751
Annual Cost Savings	$48,220
Annual Energy Savings	Electricity: 430,751 kWh Natural Gas: 445 Therms
Greenhouse Gas Emission Savings	219 Tons
Simple Payback	14.4 Years
Site Energy Savings (All Utilities)	5%



Scenario 2: Cost Effective Package[2]

Installation Cost	$147,324
Potential Rebates & Incentives	$21,999
Annual Cost Savings	$34,125
Annual Energy Savings	Electricity: 304,677 kWh Natural Gas: 341 Therms
Greenhouse Gas Emission Savings	155 Tons
Simple Payback	3.7 Years
Site Energy Savings (all utilities)	4%



On-site Generation Potential

Photovoltaic	High
Combined Heat and Power	None

[1] Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that 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	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**195,444**	**26.5**	**-40**	**$21,477**	**$57,126**	**$8,343**	**$48,783**	**2.3**	**192,180**
ECM 1	Install LED Fixtures	Yes	6,119	0.0	0	$681	$3,360	$600	$2,760	4.1	6,162
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	6,532	2.0	-1	$717	$4,787	$625	$4,162	5.8	6,417
ECM 3	Retrofit Fixtures with LED Lamps	Yes	182,794	24.5	-38	$20,078	$48,979	$7,118	$41,861	2.1	179,601
Lighting Control Measures			**39,763**	**5.5**	**-8**	**$4,368**	**$32,155**	**$6,395**	**$25,760**	**5.9**	**39,067**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	34,174	5.1	-7	$3,754	$28,780	$3,490	$25,290	6.7	33,577
ECM 5	Install High/Low Lighting Controls	Yes	5,588	0.5	-1	$614	$3,375	$2,905	$470	0.8	5,491
Variable Frequency Drive (VFD) Measures			**93,290**	**21.6**	**65**	**$10,818**	**$167,472**	**$9,725**	**$157,747**	**14.6**	**101,573**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	45,604	8.4	0	$5,073	$33,855	$2,925	$30,930	6.1	45,923
ECM 7	Install VFDs on Chilled Water Pumps	No	29,967	11.1	0	$3,334	$113,151	$3,000	$110,151	33.0	30,176
ECM 8	Install VFDs on Heating Water Pumps	Yes	6,126	1.0	0	$682	$8,394	$1,800	$6,594	9.7	6,169
ECM 9	Install VFDs on Kitchen Hood Fan Motors	Yes	6,282	0.1	65	$1,138	$3,812	$200	$3,612	3.2	13,956
ECM 10	Install VFDs on Condensate Pumps	Yes	5,311	1.0	0	$591	$8,260	$1,800	$6,460	10.9	5,348
Unitary HVAC Measures			**17,073**	**6.1**	**2**	**$1,916**	**$67,005**	**$4,465**	**$62,540**	**32.6**	**17,484**
ECM 11	Install High Efficiency Air Conditioning Units	No	17,073	6.1	2	$1,916	$67,005	$4,465	$62,540	32.6	17,484
Electric Chiller Replacement			**76,181**	**-32.5**	**0**	**$8,475**	**$422,424**	**$40,112**	**$382,312**	**45.1**	**76,714**
ECM 12	Install High Efficiency Chillers	No	76,181	-32.5	0	$8,475	$422,424	$40,112	$382,312	45.1	76,714
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**8**	**$53**	**$7,001**	**$500**	**$6,501**	**122.3**	**923**
ECM 13	Install High Efficiency Furnaces	No	0	0.0	8	$53	$7,001	$500	$6,501	122.3	923
HVAC System Improvements			**0**	**0.0**	**4**	**$24**	**$46**	**$16**	**$30**	**1.3**	**411**
ECM 14	Install Pipe Insulation	Yes	0	0.0	4	$24	$46	$16	$30	1.3	411
Domestic Water Heating Upgrade			**0**	**0.0**	**13**	**$90**	**$100**	**$50**	**$50**	**0.6**	**1,556**
ECM 15	Install Low-Flow DHW Devices	Yes	0	0.0	13	$90	$100	$50	$50	0.6	1,556
Food Service & Refrigeration Measures			**9,000**	**0.8**	**0**	**$1,001**	**$9,117**	**$745**	**$8,372**	**8.4**	**9,063**
ECM 16	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	1,835	0.2	0	$204	$2,426	$320	$2,106	10.3	1,848
ECM 17	Refrigeration Controls	No	2,854	0.1	0	$317	$5,541	$275	$5,266	16.6	2,873
ECM 18	Vending Machine Control	Yes	4,312	0.5	0	$480	$1,150	$150	$1,000	2.1	4,342
TOTALS (COST EFFECTIVE MEASURES)			**304,677**	**43.2**	**34**	**$34,125**	**$147,324**	**$21,999**	**$125,325**	**3.7**	**310,800**
TOTALS (ALL MEASURES)			**430,751**	**28.0**	**44**	**$48,220**	**$762,446**	**$70,351**	**$692,095**	**14.4**	**438,971**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

Figure 2 – Evaluated Energy Improvements

For more detail on each evaluated energy improvement and a break out of cost-effective improvements, see **Section 4: Energy Conservation Measures.**

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

Utility-run energy efficiency programs, such as 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.

For details on these programs please visit New Jersey's Clean Energy Program website or contact your utility provider.

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 and Power (CHP)

The CHP program provides incentives for combined heat and power (i.e., 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.

Successor Solar Incentive Program (SuSI)

New Jersey is committed to supporting solar energy. Solar projects help the state reach the renewable goals outlined in the state's Energy Master Plan. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available, but certified solar projects are able to earn one SREC II (Solar Renewable Energy Certificates II) for each megawatt-hour of solar electricity produced from a qualifying solar facility.

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 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.

Large Energy User Program (LEUP)

LEUP designed to promote self-investment in energy efficiency and combined heat and power or fuel cell projects. It incentivizes owners/users of buildings to upgrade or install energy conserving measures in existing buildings to help offset the capital costs associated with the project. The efficiency upgrades are customized to meet the requirements of the customers' existing facilities, while advancing the State's energy efficiency, conservation, and greenhouse gas reduction goals.

2 Existing Conditions

The New Jersey Board of Public Utilities (NJBPU) has sponsored this Local Government Energy Audit (LGEA) Report for Gilligan Student Union. 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.

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 September 14, 2021, TRC performed an energy audit at Gilligan Student Union located in Jersey City, New Jersey. TRC met with Andre Pearson to review the facility operations and help focus our investigation on specific energy-using systems.

Gilligan Student Union is a three-story, 247,603 square foot building built in 1975. The building is the center of NJCU's essential student services as well as a variety of programs and events. Spaces include administrative offices, conference rooms, campus bookstore and cafeteria, faculty dining room, meeting rooms, parking garage, storage rooms, restrooms, hallways, lobbies, and penthouse mechanical space.

Lighting is provided by many lamp types and sources; predominantly by linear fluorescent T8 fixtures and compact fluorescent lamps. The building is electrically fed from the campus main electric meter located at the central plant. It uses steam produced by the central plant and is also directly served by a gas meter. Cooling is provided by two air-cooled chillers. There are two passenger elevators and a diesel backup power generator.

Recent improvements and Facility Concerns

Over the last two years, the facility has replaced the indoor garage lights to LED sources.

The facility has many concerns including aging heating and cooling equipment, mainly air handling units (AHUs), which are operating beyond their useful life and are in fair condition.

Meeting Room

2.2 Building Occupancy

Gilligan Student Union is the center of the college student services. It operates on a 12-month schedule with varied weekend use. The building is shut down at approximately 11:00 PM. During a typical weekday, the facility is occupied by 500 students and 100 staff. It should be noted that the energy and economic analysis for this building is based on the use of the building during the utility billing period, and that results will vary based on changes to building use patterns.

Building Name	Weekday/Weekend	Operating Schedule
Gilligan Student Center (GSU)	Weekday	7:00 AM - 11:00 PM
	Weekend	Varies

Figure 3 - Building Occupancy Schedule

2.3 Building Envelope

The walls are made of concrete masonry units (CMUs) with a brick veneer and gypsum drywall interior finish. The building walls are in good condition. The flat roof is supported with steel trusses and a reinforced concrete deck and finished with an insulated layer and a covering of white membrane.

The windows are double paned and have aluminum frames. The glass-to-frame seals are in good condition. The weather seals are in good condition, showing little signs of outside air infiltration. The front entrance doors are incorporated in an aluminum framed glass storefront-type system. The building's back exit doors are meta -framed and appear in fair condition.

Building Walls

Flat Roof & Entrance Doors

2.4 Lighting Systems

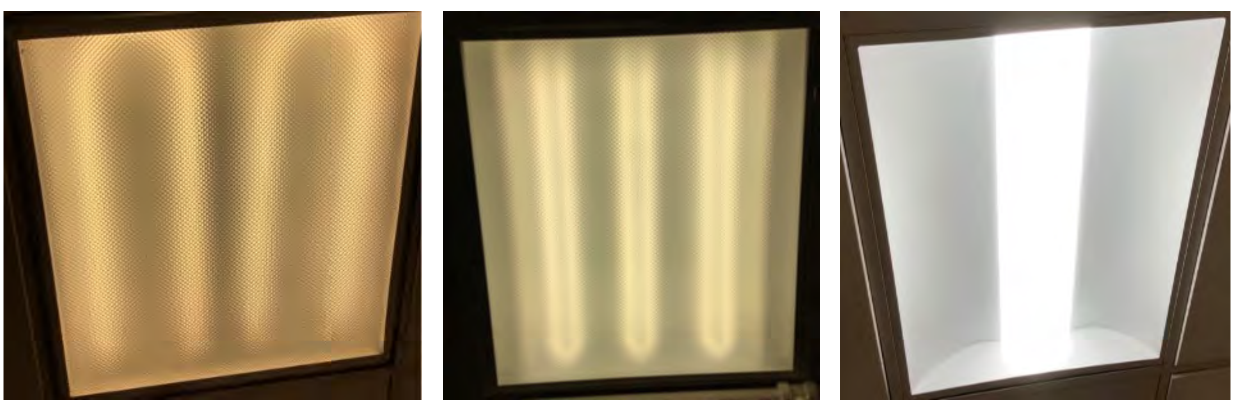
The primary interior lighting system includes linear fluorescent lamps and compact fluorescent lamps (CFLs). There are also several halogen incandescent lamps, T-5 and T-12 linear fixtures, and LED general purpose lamps. Typically, T8 fluorescent lamps use electronic ballasts and T12 fluorescent lamps use magnetic ballasts. Fixture types include 1-lamp, 2-lamp or 4-lamp, 2-foot or 4-foot long-troffer, recessed, and surface mounted fixtures and 2-foot fixtures with U-bend tube lamps. CFL fixtures are found in spaces including the first-floor area, second floor hallways, cafeteria, kitchen, lobbies, MPR-B, faculty dining room, meeting rooms, and other small spaces.

Spaces including mechanical rooms, food pantry, small corridors, offices, storage rooms, and meeting rooms are lit with linear T8 fixtures. Older linear fluorescent T12 fixtures are found in elevator rooms and storage rooms 125F and 204. Several spaces, including the third-floor lobby and hallway, cafeteria, garage, stairs, rooms 212, 215, 217, 218, and 304 use linear fluorescent T5 high output lamps. The garage, art gallery room 102, and the cafeteria stairs lights have been retrofitted to LED sources.

Most fixtures are in good condition. Interior lighting levels were generally sufficient. All exit signs are LED units. Light fixtures in most spaces are controlled either by manual wall mounted switches, by occupancy sensors that are either ceiling or wall mounted, or by mechanical timers.

Exterior fixtures include wall mounted CFL and LED lamps, high pressure sodium, and metal halide lamps that are controlled by photocells and/or timers.

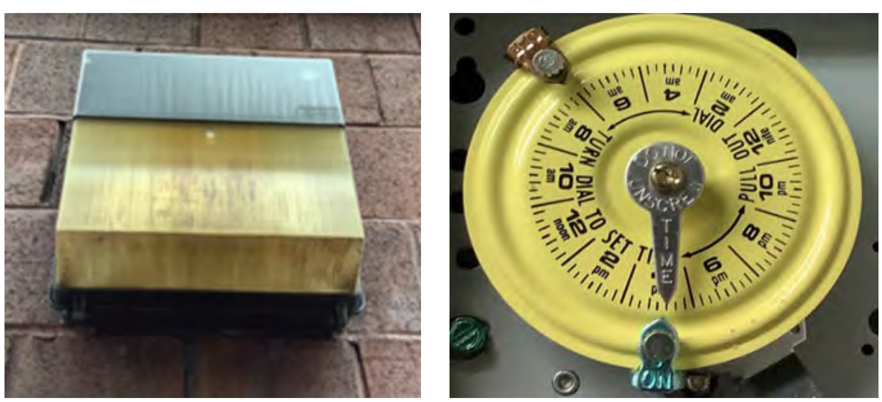
Linear Fluorescent Fixtures



U-Bend, CFL, & LED Fixtures

CFL, LED, LED Exit Sign & Wall Mounted Occupancy Sensor

Exterior Wall Mounted LED, Metal Halide & CFL Fixtures

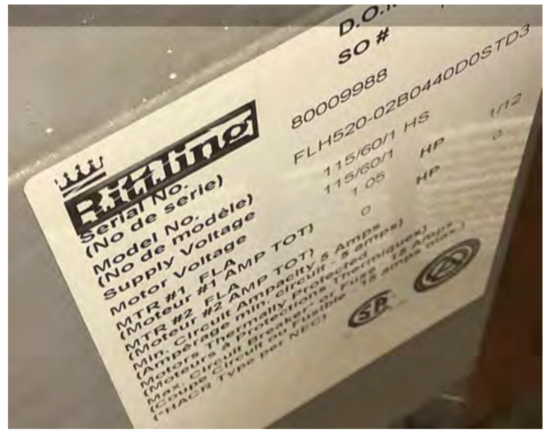


Exterior Wall Mounted HPS Fixtures & Timer

2.5 Air Handling Systems

Fan Coil Units (FCUs)

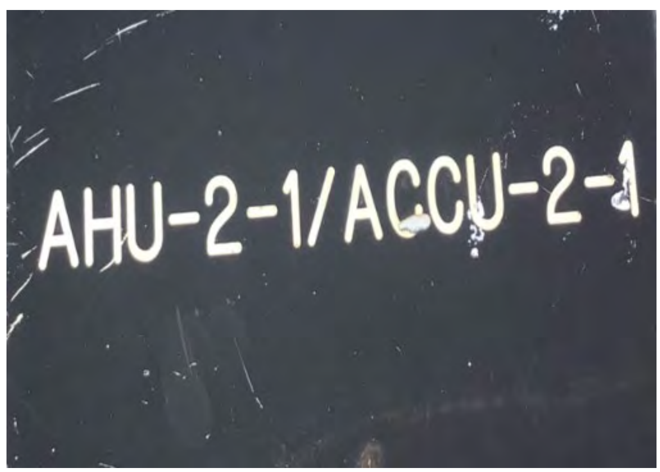
Vertical fan coil units are digitally controlled, equipped with supply fan motors, and connected to the chilled and hot water distribution systems. They provide heating, cooling and ventilation to third floor office spaces and other areas. This system appears to be in good operating condition.



3rd Floor Office FCU

Unitary Electric HVAC Equipment

Spaces including the server room and control room are cooled by three, 1.5-ton Liebert condensing units connected to small indoor air handling units. The units have passed their useful life, appear in poor condition, and have been evaluated for replacement. They are controlled with programmable thermostats.



1.5 Ton Liebert Condensing Unit

Unitary Heating Equipment

Area A on the second floor is conditioned by two Greenheck makeup air units (MAU-1 & 2) each equipped with a 240 MBh gas-fired heating section. MUA-2 also has a direct expansion coil for cooling, connected to a 7.5-ton Lennox condensing unit. The units appear in fair condition and have been evaluated for replacement. They are controlled with programmable thermostats.

The fire pump room and all-gender restrooms are heated by electric resistance heaters.

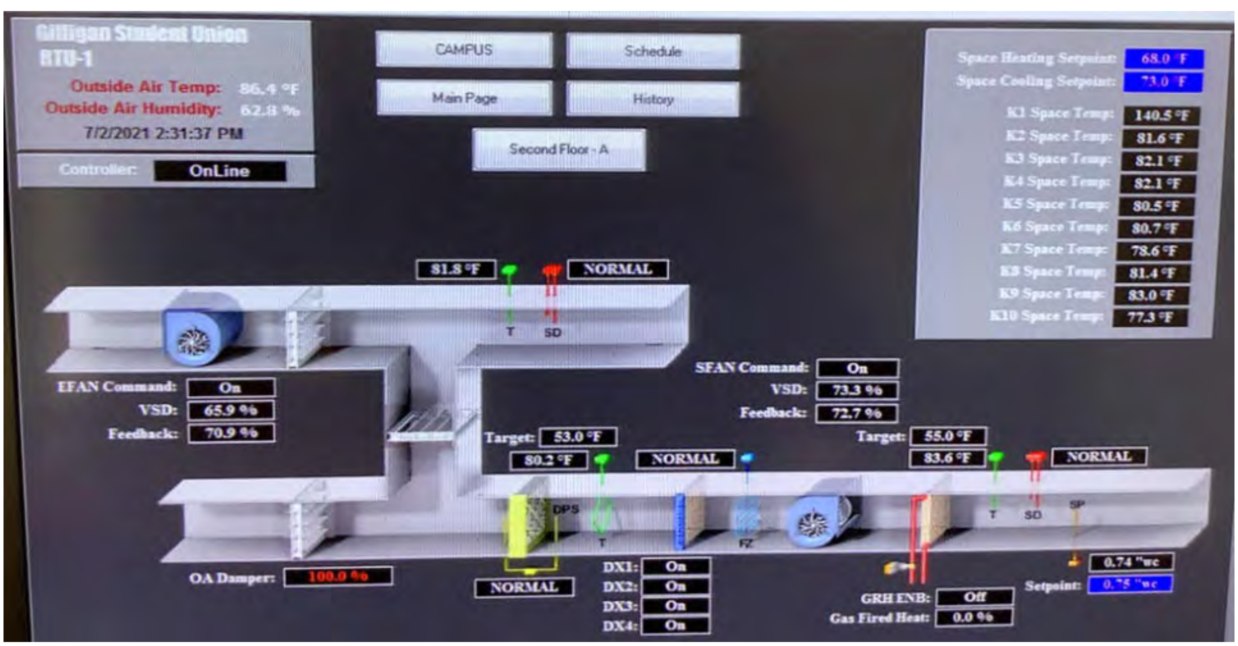
MUA-1 & Electric Resistance Heater

MUA-1

Packaged Units

The building has a 40-ton AAON roof mounted packaged unit, RTU-1, connected to a ducted distribution system. The unit is equipped with a 632 MBh furnace section, supply and exhaust fans, and combustion fans. The supply and exhaust fans are equipped with variable frequency drives. The unit is 17 years old and appears in poor condition. It has been evaluated for replacement and is controlled by the building energy management system (EMS).

AOON RTU-1



EMS Screenshot - RTU-1

Air Handling Units (AHUs)

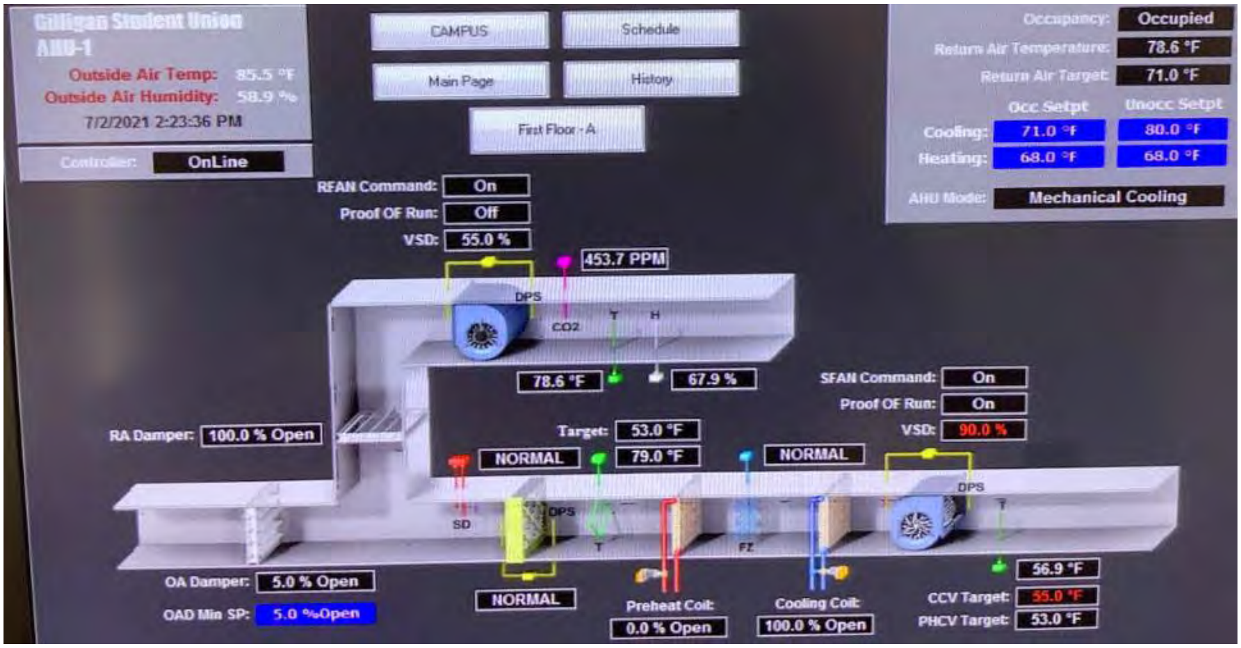
The building is conditioned by eight air handling units (AHUs 1-7 and AC-7). They contain hydronic preheat coils, chilled water coils, hot water coils, supply fan motors and return fan motors. The AHUs are variable air volume units with supply and return fans controlled by variable speed drives except for AHU-4 and AC-7, which are equipped with constant speed motors.

Air distribution is provided to supply air registers by ducts concealed above the ceilings. Heated and cooled air is distributed through ducts to variable air volume (VAV) terminals concealed above the ceilings. The AHUs are controlled by the facility energy management system (EMS). They are in good condition.

The building air distribution system setpoints are as follow.

Heating Occupied	Cooling Occupied	Heating Unoccupied	Cooling Unoccupied
68°F	72°F	60°F	80°F

AHU-1 & 2



AHU-1 EMS Screenshot

Unit ID	Location	Areas Served	Supply Fan HP	Return Fan	Heating Coil	Cooling Coil	Condition
AHU-1	Mech Rm 113	Book Store	5	N/A	Yes	Yes	Good
AHU-2	Mech Rm 113	1st Floor A/B	20	15	Yes	Yes	Good
AHU-3	Mech Rm 113	1st Floor A	7.5	5	Yes	Yes	Good
AHU-4	Mech Rm 113	1st Floor	7.5	5	No	No	Good
AHU-5	3rd Floor Mech Rm	3rd Floor	20	15	Yes	Yes	Good
AHU-6	3rd Floor Mech Rm	Multipurpose Rm	20	15	Yes	Yes	Good
AHU-7	3rd Floor Mech Rm	2nd Floor Lounges	20	10	Yes	Yes	Good
AHU-8	3rd Floor Mech Rm	3rd Floor A/B	15	7.5	Yes	Yes	Good
AC-7	3rd Floor Mech Rm	1st Floor Gallery	3	1	No	No	Good

2.6 General Exhaust System

Air is exhausted in spaces including the restrooms and kitchen using roof mounted exhaust fans that vary in size from 0.1 hp to 3 hp. The exhaust fans are controlled by the facility energy management system (EMS).

Exhaust Fans

2.7 Steam Heating Systems

Steam is supplied by boilers located in the central plant. Steam is used in this building to provide space heating water through a steam to hot water heat exchanger (HX). There are two, 5 hp constant speed condensate pumps.

Heating hot water is distributed to AHUs, fan coil units and hydronic baseboards using two, 5 hp constant speed and two, 20 hp variable speed hot water pumps operating with an automated lead-lag control scheme. The hydronic distribution system is a two-pipe heating-only system. The hot water supply temperature is controlled to maintain 160°F when the outside temperature is below 60°F, and this setpoint is reset to 180°F when the outside temperature is below 20°F. The hot water distribution system is controlled by the building management system (EMS).

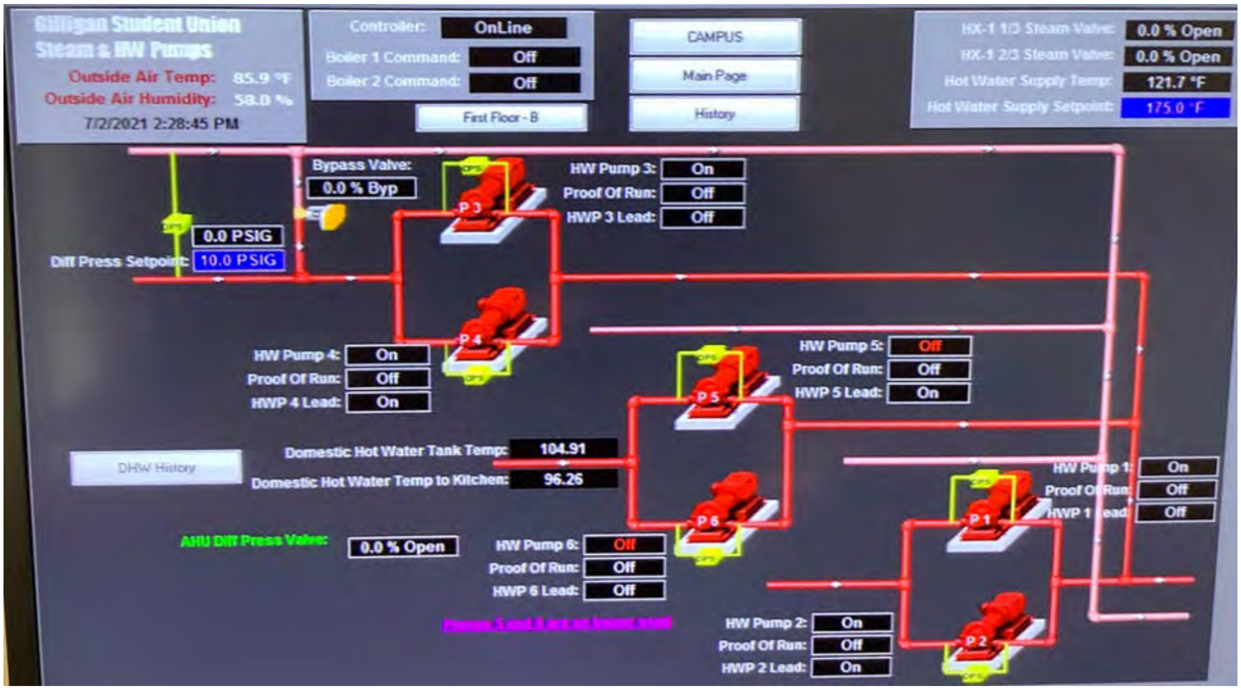
Energy use associated with producing steam was allocated to individual buildings served by the central plant boilers. Please see the central plant report for details regarding the steam system.

There are two, 1655 MBh hot water boilers that serve as backup heating system whenever the heat exchanger system is not functional. These boilers operate infrequently. The burners are non-modulating with a nominal efficiency of 85%. They are in mechanical room 113 and in good condition.

Steam to Hot Water Heat Exchanger

Hot Water Boilers (Back-up)

HWP-1 & 2, HWP-3 & 4

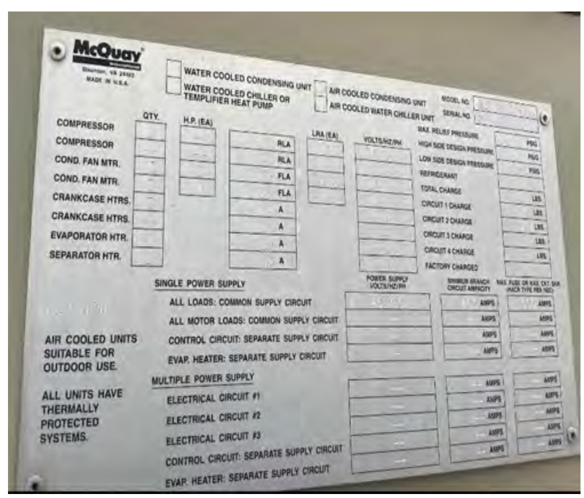


Hot Water Loop - EMS Screenshot

2.8 Chilled Water Systems

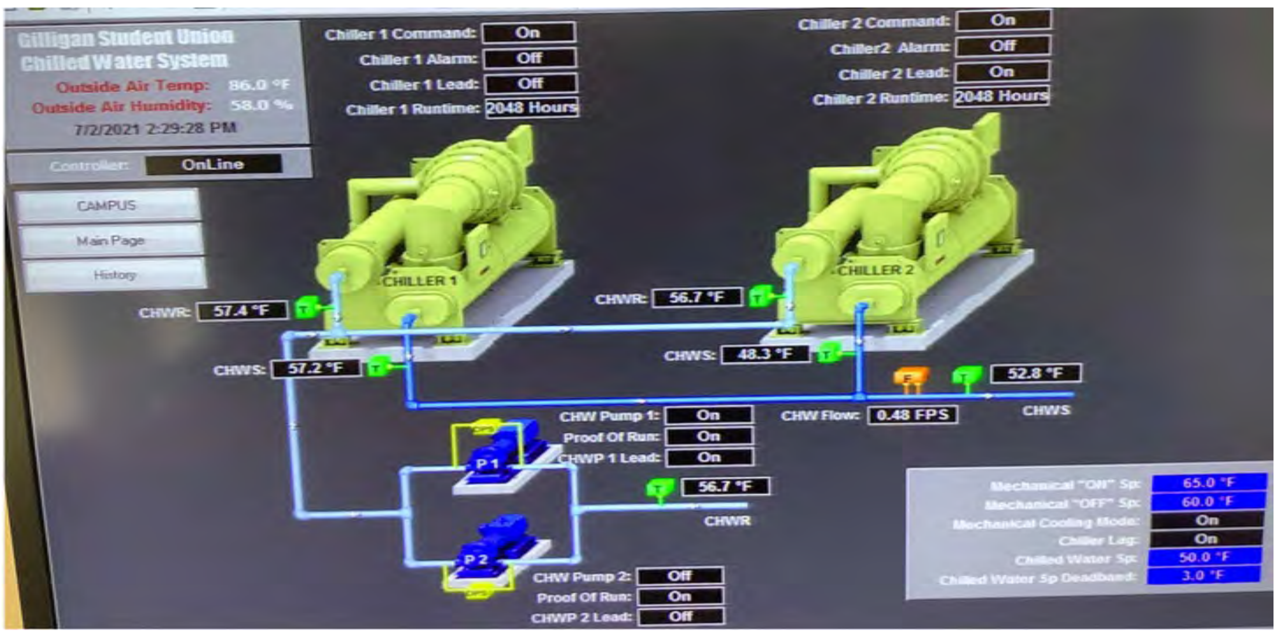
The chiller plant consists of two, 218-ton, McQuay air cooled screw chillers located on the roof. The chillers run simultaneously to meet the building cooling load. Chilled water is distributed to AHUs using two, 30 hp constant speed pumps. Installed in 2005, the chillers appear in fair condition and have been evaluated for replacement. Chilled water distribution system is three-way valves.

The chilled water setpoint is 50°F. At the time of the audit, the chiller water supply temperature was 52.8°F while the return water temperature was 56.7°F. The chilled water system is controlled by the building management system (EMS).



McQuay Air Cooled Screw Chiller

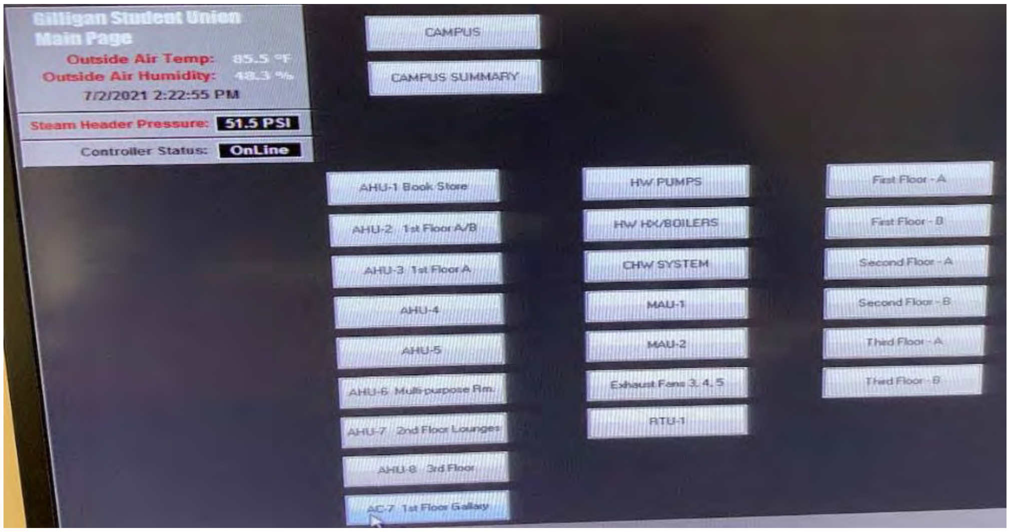
Chilled Water Pumps



Chilled Water Loop - EMS Screenshot

2.9 Building Energy Management Systems (EMS)

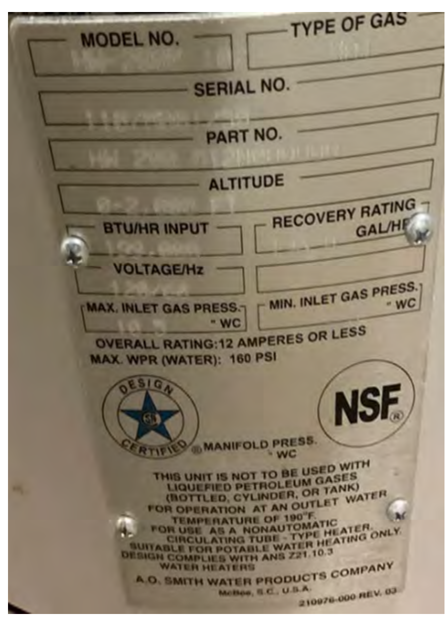
An Andover Triumph building EMS controls the HVAC equipment, chillers, air handlers, exhaust fans, makeup air units, and rooftop unit. The EMS provides equipment scheduling control and monitors and controls space temperatures, supply air temperatures, humidity, heating water loop temperatures, and chilled water loop temperatures.



EMS Main Page

2.10 Domestic Hot Water

Hot water is produced by a 119 gallon, 199 MBh gas-fired storage water heater with an efficiency rating of 80%. The water heater is 11 years old and in good condition. Three fractional horsepower circulating pumps distribute water to end uses. The domestic hot water pipes are partially insulated.



Domestic Storage Tank Water Heater

2.11 Food Service Equipment

The building houses the main campus cafeteria. The commercial kitchen has a mix of gas and electric equipment that are used to prepare a variety of food. Most cooking is done using convection gas-fired ovens. Bulk prepared foods are held in several electric holding cabinets. Equipment is a mix of high and standard efficiency and in good condition.

The dishwasher is a high temperature, conveyor type unit. It is equipped with a 30-kW electric booster pump.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.

Gas-Fired Cooking Equipment

Electric Food Holding Cabinet & High Temperature Dishwasher

2.12 Refrigeration

The kitchen and bookstore have stand-up refrigerators with solid and glass doors. Equipment is a mix of standard and high efficiency. The kitchen also has two air-defrost walk-in coolers and an electric defrost, low temperature walk-in freezer. The kitchen has a self-contained ice machine that is in good condition.

Visit https://www.energystar.gov/products/commercial_food_service_equipment for the latest information on high efficiency food service equipment.


Sand-up Solid & Glass Doors Refrigerators

Walk-in Indoor Evaporators

2.13

2.14 Plug Load and Vending Machines

There are 117 computer workstations throughout the facility. Plug loads include general café and office equipment.

There is a residential-style refrigerator and 22 mini-refrigerators throughout the building. There are also typical office loads such as copiers, small printers, televisions, microwaves, coffee machines and projectors. The building plug load equipment accounts for approximately 2% of the building total electric consumption.

There are three refrigerated vending machines and two non-refrigerated vending machines located in various spaces. They are not equipped with a control sensor.

Copier/Scanner & Coffee Machine

Refrigerated & Non-Refrigerated Vending Machines

2.15 Water-Using Systems

The building has restrooms with toilets, urinals, and sinks. They have a mix of low and high flow devices.

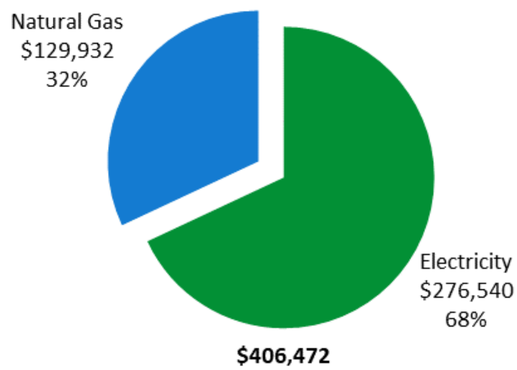
The high-flow faucet flow rates are at 2.2 gallons per minute (gpm) or higher. Toilets are rated at 2.5 gallons per flush (gpf) and urinals are rated at 2.5 gpf.

Low Flow Sinks

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	2,485,774 kWh	$276,540
Natural Gas	192,832 Therms	$129,932
Total		**$406,472**



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.

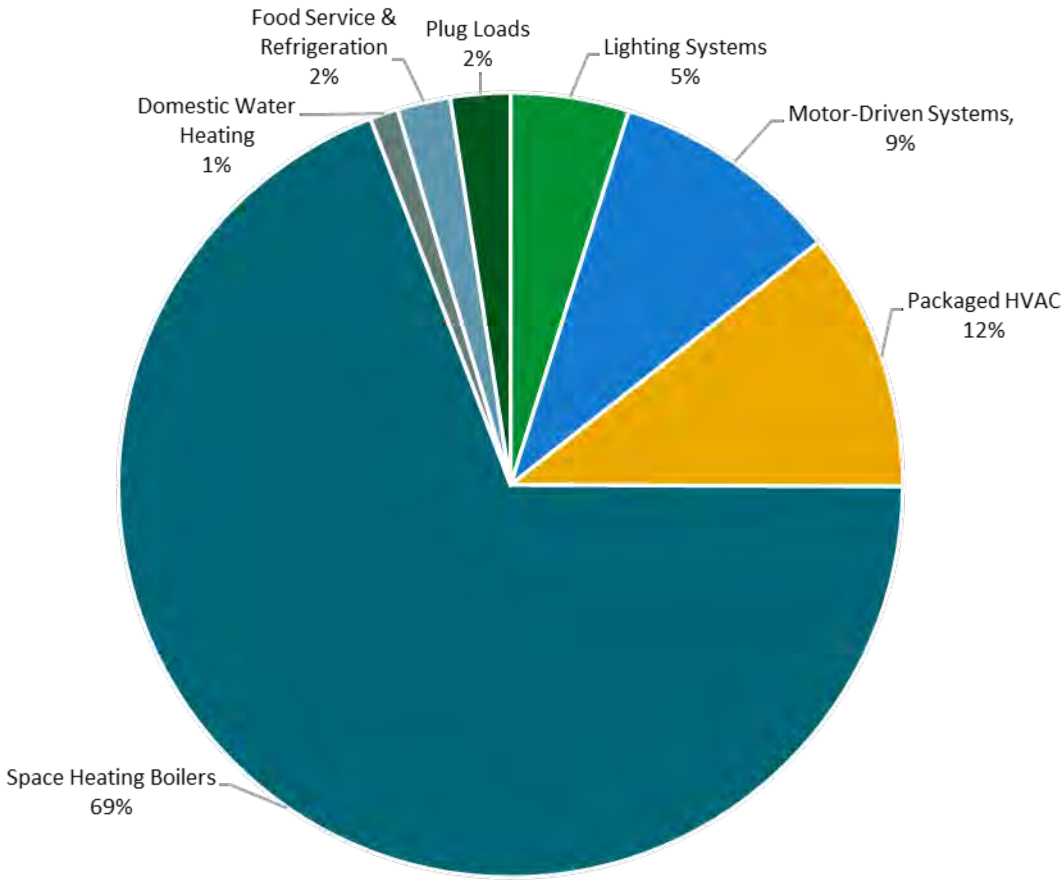
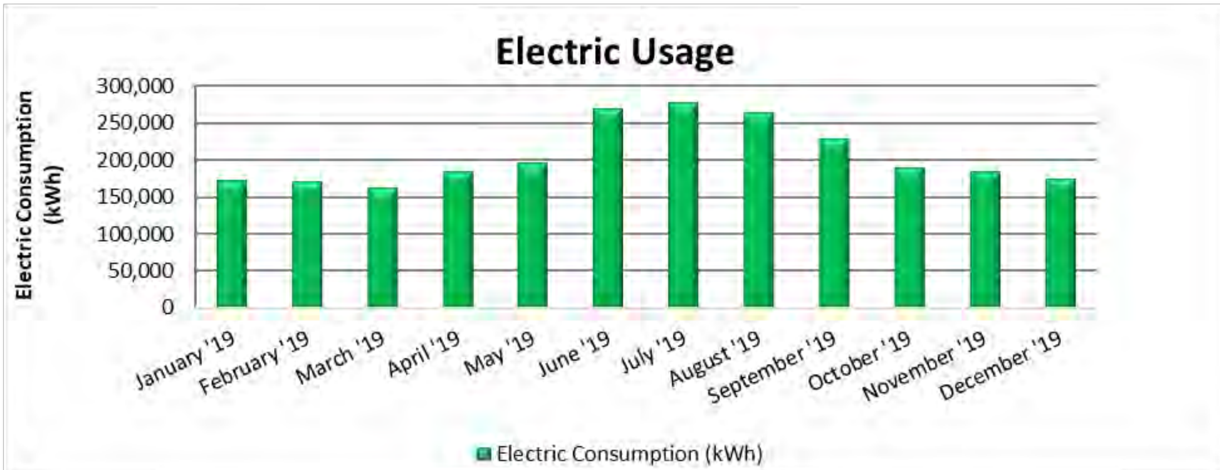


Figure 4 - Energy Balance

3.1 Electricity

PSE&G delivers electricity under rate class Large Power & Lighting Primary (LP&LP), with electric production provided by Direct Energy, a third-party supplier.



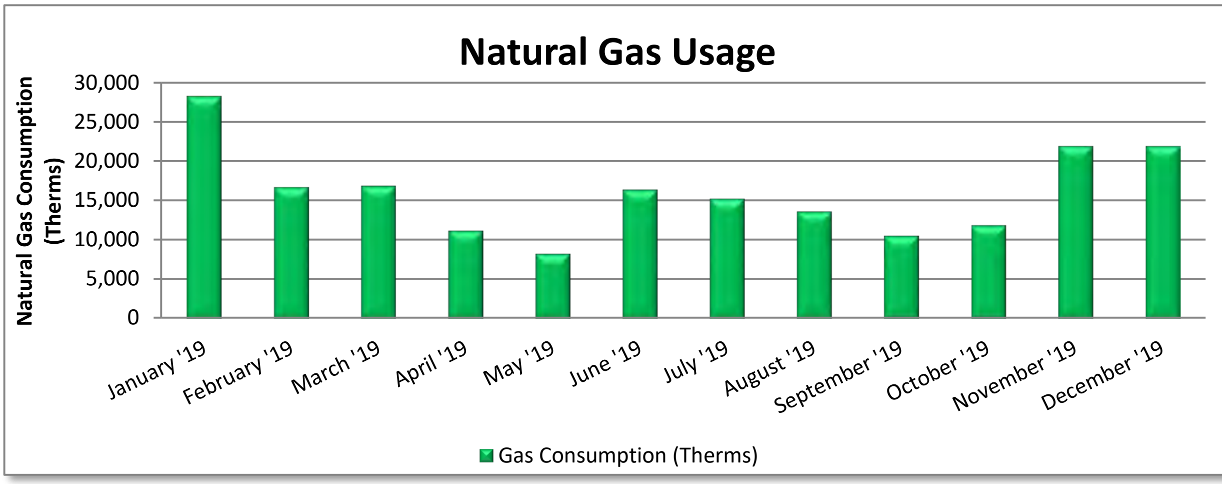
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
2/12/19	29	173,958	0	$0	$17,217
3/14/19	30	172,192	0	$0	$17,019
4/12/19	29	163,698	0	$0	$16,199
5/14/19	32	184,781	0	$0	$18,935
6/13/19	30	197,356	0	$0	$24,930
7/15/19	32	270,085	0	$0	$33,256
8/13/19	29	279,142	0	$0	$35,061
9/12/19	30	264,795	0	$0	$33,035
10/11/19	29	229,799	0	$0	$23,967
11/11/19	31	189,757	0	$0	$19,674
12/12/19	31	185,167	0	$0	$19,173
1/14/20	33	175,044	0	$0	$18,074
Totals	**365**	**2,485,774**	**0**	**$0**	**$276,540**
Annual	**365**	**2,485,774**	**0**	**$0**	**$276,540**

Notes:

- Electric data has been estimated based on a campus wide approach and utilization of the Central plant metered data.
- The peak demand for this facility was unavailable because the building is served with electricity from the Central plant master meter.
- The average purchased electric cost over the past 12 months was $0.111/kWh, which is the blended rate that includes energy supply, distribution, demand, and other charges. This report uses this blended rate to estimate energy cost savings.

3.2 Natural Gas

PSE&G delivers natural gas under rate class Large Volume Gas (LVG), with natural gas supply provided by Direct Energy, a third-party supplier.



Gas Billing Data			
Period Ending	**Days in Period**	**Natural Gas Usage (Therms)**	**Natural Gas Cost**
2/12/19	29	28,275	$20,378
3/14/19	30	16,704	$13,953
4/12/19	29	16,880	$9,497
5/14/19	32	11,192	$6,440
6/13/19	30	8,235	$4,705
7/15/19	32	16,387	$9,123
8/13/19	29	15,248	$8,511
9/12/19	30	13,623	$7,688
10/11/19	29	10,504	$6,034
11/11/19	31	11,856	$10,473
12/12/19	31	21,951	$16,628
1/14/20	33	21,977	$16,503
Totals	**365**	**192,832**	**$129,932**
Annual	**365**	**192,832**	**$129,932**

Notes:

- Natural gas data for steam production has been estimated based on a campus wide approach, allocated to the buildings that receive steam. This meter provides absorption cooling and building heating.
- This building also receives natural gas through a dedicated meter for limited space and water heating.
- The utility graph above comprises an estimate of total building gas use.
- The average gas cost for the past 12 months is $0.674/therm, which is the blended rate used throughout the analysis.

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 country, 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

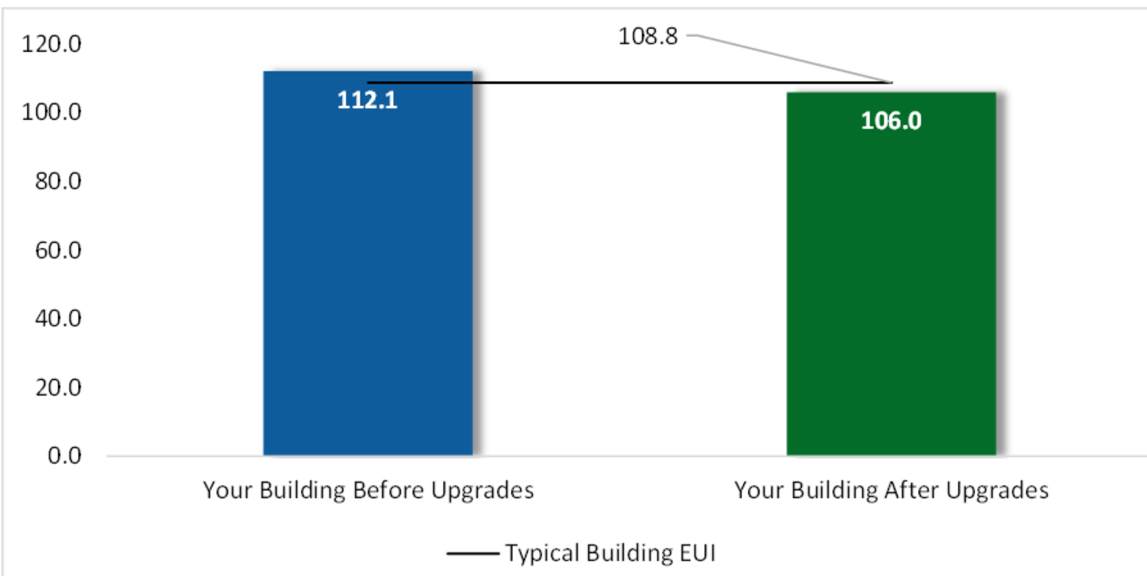


Figure 5 - Energy Use Intensity Comparison[3]

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.

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. Several factors can cause a building to vary from 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.

[3] Based on all evaluated ECMs

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.

4 ENERGY CONSERVATION MEASURES

The goal of this audit report is to identify and evaluate potential energy efficiency improvements and provide information about the cost effectiveness of those improvements. Most energy conservation measures have received preliminary analysis of feasibility, which identifies expected ranges of savings. 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 NJBPU. 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 previously run state rebate programs. New utility programs are expected to start rolling out in the spring and summer of 2021. Keep up to date with developments by visiting the NJCEP website. Some measures and proposed upgrades may be eligible for higher incentives than those shown below.

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	Cost Effective?	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades			**195,444**	**26.5**	**-40**	**$21,477**	**$57,126**	**$8,343**	**$48,783**	**2.3**	**192,180**
ECM 1	Install LED Fixtures	Yes	6,119	0.0	0	$681	$3,360	$600	$2,760	4.1	6,162
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	Yes	6,532	2.0	-1	$717	$4,787	$625	$4,162	5.8	6,417
ECM 3	Retrofit Fixtures with LED Lamps	Yes	182,794	24.5	-38	$20,078	$48,979	$7,118	$41,861	2.1	179,601
Lighting Control Measures			**39,763**	**5.5**	**-8**	**$4,368**	**$32,155**	**$6,395**	**$25,760**	**5.9**	**39,067**
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	34,174	5.1	-7	$3,754	$28,780	$3,490	$25,290	6.7	33,577
ECM 5	Install High/Low Lighting Controls	Yes	5,588	0.5	-1	$614	$3,375	$2,905	$470	0.8	5,491
Variable Frequency Drive (VFD) Measures			**93,290**	**21.6**	**65**	**$10,818**	**$167,472**	**$9,725**	**$157,747**	**14.6**	**101,573**
ECM 6	Install VFDs on Constant Volume (CV) Fans	Yes	45,604	8.4	0	$5,073	$33,855	$2,925	$30,930	6.1	45,923
ECM 7	Install VFDs on Chilled Water Pumps	No	29,967	11.1	0	$3,334	$113,151	$3,000	$110,151	33.0	30,176
ECM 8	Install VFDs on Heating Water Pumps	Yes	6,126	1.0	0	$682	$8,394	$1,800	$6,594	9.7	6,169
ECM 9	Install VFDs on Kitchen Hood Fan Motors	Yes	6,282	0.1	65	$1,138	$3,812	$200	$3,612	3.2	13,956
ECM 10	Install VFDs on Condensate Pumps	Yes	5,311	1.0	0	$591	$8,260	$1,800	$6,460	10.9	5,348
Unitary HVAC Measures			**17,073**	**6.1**	**2**	**$1,916**	**$67,005**	**$4,465**	**$62,540**	**32.6**	**17,484**
ECM 11	Install High Efficiency Air Conditioning Units	No	17,073	6.1	2	$1,916	$67,005	$4,465	$62,540	32.6	17,484
Electric Chiller Replacement			**76,181**	**-32.5**	**0**	**$8,475**	**$422,424**	**$40,112**	**$382,312**	**45.1**	**76,714**
ECM 12	Install High Efficiency Chillers	No	76,181	-32.5	0	$8,475	$422,424	$40,112	$382,312	45.1	76,714
Gas Heating (HVAC/Process) Replacement			**0**	**0.0**	**8**	**$53**	**$7,001**	**$500**	**$6,501**	**122.3**	**923**
ECM 13	Install High Efficiency Furnaces	No	0	0.0	8	$53	$7,001	$500	$6,501	122.3	923
HVAC System Improvements			**0**	**0.0**	**4**	**$24**	**$46**	**$16**	**$30**	**1.3**	**411**
ECM 14	Install Pipe Insulation	Yes	0	0.0	4	$24	$46	$16	$30	1.3	411
Domestic Water Heating Upgrade			**0**	**0.0**	**13**	**$90**	**$100**	**$50**	**$50**	**0.6**	**1,556**
ECM 15	Install Low-Flow DHW Devices	Yes	0	0.0	13	$90	$100	$50	$50	0.6	1,556
Food Service & Refrigeration Measures			**9,000**	**0.8**	**0**	**$1,001**	**$9,117**	**$745**	**$8,372**	**8.4**	**9,063**
ECM 16	Refrigerator/Freezer Case Electrically Commutated Motors	Yes	1,835	0.2	0	$204	$2,426	$320	$2,106	10.3	1,848
ECM 17	Refrigeration Controls	No	2,854	0.1	0	$317	$5,541	$275	$5,266	16.6	2,873
ECM 18	Vending Machine Control	Yes	4,312	0.5	0	$480	$1,150	$150	$1,000	2.1	4,342
TOTALS			**430,751**	**28.0**	**44**	**$48,220**	**$762,446**	**$70,351**	**$692,095**	**14.4**	**438,971**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

Figure 6 – All Evaluated ECMs

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**195,444**	**26.5**	**-40**	**$21,477**	**$57,126**	**$8,343**	**$48,783**	**2.3**	**192,180**
ECM 1	Install LED Fixtures	6,119	0.0	0	$681	$3,360	$600	$2,760	4.1	6,162
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	6,532	2.0	-1	$717	$4,787	$625	$4,162	5.8	6,417
ECM 3	Retrofit Fixtures with LED Lamps	182,794	24.5	-38	$20,078	$48,979	$7,118	$41,861	2.1	179,601
Lighting Control Measures		**39,763**	**5.5**	**-8**	**$4,368**	**$32,155**	**$6,395**	**$25,760**	**5.9**	**39,067**
ECM 4	Install Occupancy Sensor Lighting Controls	34,174	5.1	-7	$3,754	$28,780	$3,490	$25,290	6.7	33,577
ECM 5	Install High/Low Lighting Controls	5,588	0.5	-1	$614	$3,375	$2,905	$470	0.8	5,491
Variable Frequency Drive (VFD) Measures		**63,323**	**10.5**	**65**	**$7,484**	**$54,321**	**$6,725**	**$47,596**	**6.4**	**71,397**
ECM 6	Install VFDs on Constant Volume (CV) Fans	45,604	8.4	0	$5,073	$33,855	$2,925	$30,930	6.1	45,923
ECM 8	Install VFDs on Heating Water Pumps	6,126	1.0	0	$682	$8,394	$1,800	$6,594	9.7	6,169
ECM 9	Install VFDs on Kitchen Hood Fan Motors	6,282	0.1	65	$1,138	$3,812	$200	$3,612	3.2	13,956
ECM 10	Install VFDs on Condensate Pumps	5,311	1.0	0	$591	$8,260	$1,800	$6,460	10.9	5,348
HVAC System Improvements		**0**	**0.0**	**4**	**$24**	**$46**	**$16**	**$30**	**1.3**	**411**
ECM 14	Install Pipe Insulation	0	0.0	4	$24	$46	$16	$30	1.3	411
Domestic Water Heating Upgrade		**0**	**0.0**	**13**	**$90**	**$100**	**$50**	**$50**	**0.6**	**1,556**
ECM 15	Install Low-Flow DHW Devices	0	0.0	13	$90	$100	$50	$50	0.6	1,556
Food Service & Refrigeration Measures		**6,147**	**0.7**	**0**	**$684**	**$3,576**	**$470**	**$3,106**	**4.5**	**6,190**
ECM 16	Refrigerator/Freezer Case Electrically Commutated Motors	1,835	0.2	0	$204	$2,426	$320	$2,106	10.3	1,848
ECM 18	Vending Machine Control	4,312	0.5	0	$480	$1,150	$150	$1,000	2.1	4,342
TOTALS		**304,677**	**43.2**	**34**	**$34,125**	**$147,324**	**$21,999**	**$125,325**	**3.7**	**310,800**

* - All incentives presented in this table are included as placeholders for planning purposes and are based on previously run state rebate programs. Contact your utility provider for details on current programs.

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

Figure 7 – 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 ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Upgrades		**195,444**	**26.5**	**-40**	**$21,477**	**$57,126**	**$8,343**	**$48,783**	**2.3**	**192,180**
ECM 1	Install LED Fixtures	6,119	0.0	0	$681	$3,360	$600	$2,760	4.1	6,162
ECM 2	Retrofit Fluorescent Fixtures with LED Lamps and Drivers	6,532	2.0	-1	$717	$4,787	$625	$4,162	5.8	6,417
ECM 3	Retrofit Fixtures with LED Lamps	182,794	24.5	-38	$20,078	$48,979	$7,118	$41,861	2.1	179,601

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 is 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: Install LED Fixtures

Replace existing fixtures containing metal halide and high-pressure sodium lamps with new LED light fixtures. This measure saves energy by installing LEDs, which use less power than other technologies with a comparable light output.

In some cases, HID fixtures can be retrofit with screw-based LED lamps. Replacing an existing HID fixture with a new LED fixture will generally provide better overall lighting optics; however, replacing the HID lamp with a LED screw-in lamp is typically a less expensive retrofit. We recommend you work with your lighting contractor to determine which retrofit solution is best suited to your needs and will be compatible with the existing fixtures.

Maintenance savings may also be achieved since LED lamps last longer than other light sources and therefore do not need to be replaced as often.

Affected Building Areas: exterior fixtures.

ECM 2: Retrofit Fluorescent Fixtures with LED Lamps and Drivers

Retrofit fluorescent T12 fixtures by removing the fluorescent tubes and ballasts and replacing them with LED tubes and LED drivers (if necessary), which are designed to be used in retrofitted fluorescent fixtures.

The measure uses the existing fixture housing but replaces the electric components with more efficient lighting technology, which use less power than other lighting technologies but provides equivalent lighting output. Maintenance savings may also be achieved since LED tubes last longer than fluorescent tubes and, therefore, do not need to be replaced as often.

Affected Building Areas: MPRs and storage 204.

ECM 3: Retrofit Fixtures with LED Lamps

Replace fluorescent T5, T8, CFL, and halogen 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. Be sure to specify replacement lamps that are compatible with existing dimming controls, where applicable. In some circumstances, you may need to upgrade your dimming system for optimum performance.

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: all areas with fluorescent fixtures with T8 and T5 tubes, CFLs, and halogen lamps.

4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Lighting Control Measures		**39,763**	**5.5**	**-8**	**$4,368**	**$32,155**	**$6,395**	**$25,760**	**5.9**	**39,067**
ECM 4	Install Occupancy Sensor Lighting Controls	34,174	5.1	-7	$3,754	$28,780	$3,490	$25,290	6.7	33,577
ECM 5	Install High/Low Lighting Controls	5,588	0.5	-1	$614	$3,375	$2,905	$470	0.8	5,491

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 4: 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 that 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, conference and meeting rooms, restrooms, dining room, kitchen, and storage rooms.

ECM 5: Install High/Low Lighting Controls

Install occupancy sensors to provide dual level lighting control for lighting fixtures in spaces that are infrequently occupied but may require some level of continuous lighting for safety or security reasons.

Lighting fixtures with these controls operate at default low levels when the area is unoccupied to provide minimal lighting to meet security or safety code requirements for egress. Sensors detect occupancy using ultrasonic and/or infrared sensors. When an occupant enters the space, the lighting fixtures switch to full lighting levels. Fixtures automatically switch back to low level after a predefined period of vacancy. In parking lots and parking garages with significant ambient lighting, this control can sometimes be combined with photocell controls to turn the lights off when there is sufficient daylight.

The controller lowers the light level by dimming the fixture output. Therefore, the controlled fixtures need to have a dimmable ballast or driver. This will need to be considered when selecting retrofit lamps and bulbs for the areas proposed for high/low control.

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

This measure provides energy savings by reducing the light fixture power draw when reduced light output is appropriate.

Affected Building Areas: hallways, stairs, and lobbies.

4.3 Variable Frequency Drives (VFD)

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Variable Frequency Drive (VFD) Measures		**93,290**	**21.6**	**65**	**$10,818**	**$167,472**	**$9,725**	**$157,747**	**14.6**	**101,573**
ECM 6	Install VFDs on Constant Volume (CV) Fans	45,604	8.4	0	$5,073	$33,855	$2,925	$30,930	6.1	45,923
ECM 7	Install VFDs on Chilled Water Pumps	29,967	11.1	0	$3,334	$113,151	$3,000	$110,151	33.0	30,176
ECM 8	Install VFDs on Heating Water Pumps	6,126	1.0	0	$682	$8,394	$1,800	$6,594	9.7	6,169
ECM 9	Install VFDs on Kitchen Hood Fan Motors	6,282	0.1	65	$1,138	$3,812	$200	$3,612	3.2	13,956
ECM 10	Install VFDs on Condensate Pumps	5,311	1.0	0	$591	$8,260	$1,800	$6,460	10.9	5,348

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 inverter duty rated motor to conservatively account for the cost of an inverter duty rated motor.

ECM 6: 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 Systems: AHU-4, AC-7, MAU-1 & 2; exhaust fans MR 113, KX-2, and KX-4.

ECM 7: Install VFDs on Chilled Water Pumps

We evaluated installing 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: 30 hp chilled water pumps.

ECM 8: Install VFDs on Heating Water Pumps

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

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

Affected Pumps: 5 hp hot water pumps.

ECM 9: Install VFDs on Kitchen Hood Fan Motors

Install VFDs and sensors to control the kitchen hood fan motors. The air flow of the hood is varied based on two key inputs: temperature and smoke/cooking fumes. The VFD controls the amount of exhaust (and kitchen make-up air) based on temperature—the lower the temperature the lower the flow. If the optic sensor is triggered by smoke or cooking fumes, the speed of the fan ramps up to 100%.

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

Affected Systems: KX-1.

ECM 10: Install VFDs on Condensate Pumps

Install VFDs to control the condensate return pumps. The condensate pump flow will have to be controlled to work in conjunction with the boiler feed water pump. The VFD control feedback should be based on a pressure transducer located in the main steam header. Before implementing this measure co-ordinate with the pump and boiler manufacturer.

Energy savings result from reducing the pump motor speed (and power) at reduced condensate flow from the condensate receiver. The magnitude of energy savings is based on the estimated amount of time that the pumping system will operate at reduced load.

4.4 Unitary HVAC

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Unitary HVAC Measures		**17,073**	**6.1**	**2**	**$1,916**	**$67,005**	**$4,465**	**$62,540**	**32.6**	**17,484**
ECM 11	Install High Efficiency Air Conditioning Units	17,073	6.1	2	$1,916	$67,005	$4,465	$62,540	32.6	17,484

Replacing the unitary HVAC units has a long payback period and may not be justifiable based simply on energy considerations. However, most of the units are nearing or have reached the end of their normal useful life. Typically, the marginal cost of purchasing a high efficiency unit can be justified by the marginal savings from the improved efficiency. When the unitary HVAC units are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

ECM 11: Install High Efficiency Air Conditioning Units

We evaluated replacing standard efficiency packaged and Liebert condensing units with high efficiency packaged and condensing units. The McQuay and Greenheck MAU-2 packaged AC replacement will incorporate efficient gas furnaces. The magnitude of energy savings for this measure depends on the relative efficiency of the older unit versus the new high efficiency unit, the average cooling and heating load, and the estimated annual operating hours.

Affected Units: RTU-1, MAU-2, and Liebert condensing units.

4.5 Electric Chillers

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Electric Chiller Replacement		**76,181**	**-32.5**	**0**	**$8,475**	**$422,424**	**$40,112**	**$382,312**	**45.1**	**76,714**
ECM 12	Install High Efficiency Chillers	76,181	-32.5	0	$8,475	$422,424	$40,112	$382,312	45.1	76,714

ECM 12: Install High Efficiency Chillers

We evaluated replacing older inefficient electric chillers with new high efficiency chillers. The type of chiller to be installed depends on the magnitude of the cooling load and variability of the cooling load profile, for example:

- Positive displacement chillers are usually under 600 tons of cooling capacity, and centrifugal chillers generally start at 150 tons of cooling capacity.
- Constant speed chillers should be used to meet cooling loads with little or no variation, while variable speed chillers are more efficient for variable cooling load profiles.
- Water cooled chillers are more efficient than air cooled chillers but require cooling towers and additional pumps to circulate the cooling water.
- In any given size range, variable speed chillers tend to have better partial load efficiency, but worse full load efficiency, than constant speed chillers.

Energy savings result from the improvement in chiller efficiency and matching the right type of chiller to the cooling load. The energy savings are calculated based on the cooling capacity of the new chiller, the improvement in efficiency compared with the base case equipment, the cooling load profile, and the estimated annual operating hours of the chiller before and after the upgrade.

For the purposes of this analysis, we evaluated the replacement of chillers on a one-for-one basis with equipment of the same capacity. We recommend that you work with your design team to select chillers that are sized appropriately for the cooling load. In some cases, the plant energy use can be reduced by selecting multiple chillers that match the facility load profile, rather than one or two large chillers. This can also improve the chiller plant reliability through increased redundancy. Energy savings are maximized by proper selection of new equipment based on the cooling load profile.

Replacing the chillers has a long payback based on energy savings and may not be justifiable based simply on energy considerations. However, the chillers have reached the end of their normal useful life. Typically, the marginal cost of purchasing a high-efficiency chiller can be justified by the marginal savings from the improved efficiency. When the chillers are eventually replaced, consider purchasing equipment that exceed the minimum efficiency required by building codes.

4.6 Gas-Fired Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Gas Heating (HVAC/Process) Replacement		**0**	**0.0**	**8**	**$53**	**$7,001**	**$500**	**$6,501**	**122.3**	**923**
ECM 13	Install High Efficiency Furnaces	0	0.0	8	$53	$7,001	$500	$6,501	122.3	923

ECM 13: Install High Efficiency Furnaces

We evaluated replacing standard efficiency furnaces with condensing furnaces. Improved combustion technology and heat exchanger design optimize heat recovery from the combustion gases, which can significantly improve furnace efficiency. Savings result from improved system efficiency.

Note: these units produce acidic condensate that require proper drainage.

Affected Units: MAU-1.

4.7 HVAC Improvements

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
HVAC System Improvements		**0**	**0.0**	**4**	**$24**	**$46**	**$16**	**$30**	**1.3**	**411**
ECM 14	Install Pipe Insulation	0	0.0	4	$24	$46	$16	$30	1.3	411

ECM 14: Install Pipe Insulation

Install insulation on domestic hot water system piping. Distribution system losses are dependent on system fluid temperature, the size of the distribution system, and the level of insulation of the piping. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is exposed to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Affected Systems: domestic hot water piping.

4.8 Domestic Water Heating

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Domestic Water Heating Upgrade		**0**	**0.0**	**13**	**$90**	**$100**	**$50**	**$50**	**0.6**	**1,556**
ECM 15	Install Low-Flow DHW Devices	0	0.0	13	$90	$100	$50	$50	0.6	1,556

ECM 15: 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. Additional cost savings may result from reduced water usage.

4.9 Food Service & Refrigeration Measures

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings ($)	Estimated M&L Cost ($)	Estimated Incentive ($)*	Estimated Net M&L Cost ($)	Simple Payback Period (yrs)**	CO_2e Emissions Reduction (lbs)
Food Service & Refrigeration Measures		**9,000**	**0.8**	**0**	**$1,001**	**$9,117**	**$745**	**$8,372**	**8.4**	**9,063**
ECM 16	Refrigerator/Freezer Case Electrically Commutated Motors	1,835	0.2	0	$204	$2,426	$320	$2,106	10.3	1,848
ECM 17	Refrigeration Controls	2,854	0.1	0	$317	$5,541	$275	$5,266	16.6	2,873
ECM 18	Vending Machine Control	4,312	0.5	0	$480	$1,150	$150	$1,000	2.1	4,342

ECM 16: Refrigerator/Freezer Case Electrically Commutated Motors

Replace shaded pole or permanent split capacitor (PSC) motors with electronically commutated (EC) motors in walk-in coolers and freezers. Fractional horsepower EC motors are significantly more efficient than mechanically commutated, brushed motors, particularly at low speeds or partial load. By using variable-speed technology, EC motors can optimize fan usage. Because these motors are brushless and use DC power, losses due to friction and phase shifting are eliminated.

Savings for this measure consider both the increased efficiency of the motor as well as the reduction in refrigeration load due to motor heat loss.

ECM 17: Refrigeration Controls

We evaluated installing additional controls to optimize the operation of walk-in coolers and freezers.

Many walk-in coolers and freezers have continuously operating electric heaters on the doors to prevent condensation formation. This measure adds a control system feature to shut off the door heaters when the humidity level is low enough that condensation will not occur if the heaters are off. This is done by measuring the ambient humidity and temperature of the store, comparing that to the dewpoint, and using pulse width modulation to control the anti-sweat door heaters.

Defrost controllers can be used to override defrost of evaporator fans when the defrost operation is not necessary, which reduces annual energy consumption. This measure is applicable to existing evaporator fans with a traditional electric de-frost mechanism.

Many walk-in coolers and freezers have evaporator fans that run continuously. The measure adds a control system feature to automatically shut off evaporator fans when not needed.

Energy savings for each of the control measures account for reduction in compressor and fan operating hours as well as reduction in the refrigeration heat load as appropriate.

ECM 18: Vending Machine Control

Vending machines operate continuously, even during unoccupied hours. Install occupancy sensor controls to reduce energy use. These controls power down vending machines when the vending machine area has been vacant for some time, and they power up the machines at necessary regular intervals or when the surrounding area is occupied. Energy savings are dependent on the vending machine and activity level in the area surrounding the machines.

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.

Operation and maintenance (O&M) plans enhance the operational efficiency of HVAC and other energy intensive systems and could save 5% –20% of the energy usage in your building without substantial capital investment. A successful plan includes your records of energy usage trends and costs, building equipment lists, current maintenance practices, and planned capital upgrades, and it incorporates your ideas for improved building operation. Your plan will address goals for energy-efficient operation, provide detail on how to reach the goals, and outline procedures for measuring and reporting whether goals have been achieved.

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 cannot manage what you do not 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.

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 can lead to increased occupant comfort as well as heating and cooling savings, especially when combined with proper HVAC controls and adequate ventilation.

Lighting Maintenance

Clean lamps, reflectors and lenses of dirt, dust, oil, and smoke buildup every six to twelve months. Light levels decrease over time due to lamp aging, lamp and ballast failure, and buildup of dirt and dust. Together, this can reduce total light output by up to 60% while still drawing full power.

In addition to routine cleaning, developing a maintenance schedule can ensure that maintenance is performed regularly, and it can reduce the overall cost of fixture re-lamping and re-ballasting. Group re-lamping and re-ballasting maintains lighting levels and minimizes the number of site visits by a lighting technician or contractor, decreasing the overall cost of maintenance.

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

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. Adjust exterior lighting time clock controls seasonally as needed to match your lighting requirements.

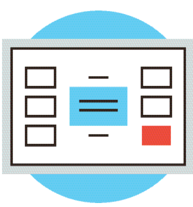
Motor Maintenance

Motors have many moving parts. As these parts degrade over time, the efficiency of the motor is reduced. Routine maintenance prevents damage to motor components. Routine maintenance should include cleaning surfaces and ventilation openings on motors to prevent overheating, lubricating moving parts to reduce friction, inspecting belts and pulleys for wear and to ensure they are at proper alignment and tension, and cleaning and lubricating bearings. Consult a licensed technician to assess these and other motor maintenance strategies.

Fans to Reduce Cooling Load

Install ceiling fans to supplement your cooling system. Thermostat settings can typically be increased by 4°F with no change in overall occupant comfort due to the wind chill effect of moving air.

Thermostat Schedules and Temperature Resets



Use thermostat setback temperatures and schedules to reduce heating and cooling energy use during periods of low or no occupancy. Thermostats should be programmed for a setback of 5°F-10°F during low occupancy hours (reduce heating setpoints and increase cooling setpoints). Cooling load can be reduced by increasing the facility's occupied setpoint temperature. In general, during the cooling season, thermostats should be set as high as possible without sacrificing occupant comfort.

Chiller Maintenance

Service chillers regularly to keep them operating properly. Chillers are responsible for a substantial portion of a commercial building's overall energy usage, and when they do not work well, there is usually a noticeable increase in energy bills and increased occupant complaints. Regular diagnostics and service can save 5% to 10% of the cost of operating your chiller. If you already have a maintenance contract in place, your existing service company should be able to provide these services.

AC System Evaporator/Condenser Coil Cleaning

Dirty evaporator and condenser coils restrict air flow and restrict heat transfer. This increases the loads on the evaporator and condenser fan and decreases overall cooling system performance. Keeping the coils clean allows the fans and cooling system to operate more efficiently.

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 and 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.

Ductwork Maintenance

Duct maintenance has two primary goals: keep the ducts clean to avoid air quality problems and seal leaks to save energy. Check for cleanliness, obstructions that block airflow, water damage, and leaks. Ducts should be inspected at least every two years.

The biggest symptoms of clogged air ducts are differing temperatures throughout the building and areas with limited airflow from supply registers. If a particular air duct is clogged, then air flow will only be cut off to some rooms in the building—not all of them. The reduced airflow will make it more difficult for those areas to reach the temperature setpoint, which will cause the HVAC system to run longer to cool or heat that area properly. If you suspect clogged air ducts, ensure that all areas in front of supply registers are clear of items that may block or restrict air flow, and you should check for fire dampers or balancing dampers that have failed closed.

Duct leakage in commercial buildings can account for 5%–25% of the supply airflow. In the case of rooftop air handlers, duct leakage can occur to the outside of the building wasting conditioned air. Check ductwork for leakage. Eliminating duct leaks can improve ventilation system performance and reduce heating and cooling system operation.

Distribution system losses are dependent on-air system temperature, the size of the distribution system, and the level of insulation of the ductwork. Significant energy savings can be achieved when insulation has not been well maintained. When the insulation is missing or worn, the system efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

Steam Trap Repair and Replacement

Steam traps are a crucial part of delivering heat from the boiler to the space heating units. Steam traps are automatic valves that remove condensate from the system. If the traps fail closed, condensate can build up in the steam supply side of the trap, which reduces the flow in the steam lines and thermal capacity of the radiators. Or they may fail open, allowing steam into the condensate return lines resulting in wasted energy, water, and hammering. Losses can be significantly reduced by testing and replacing equipment as they start to fail. Repair or replace traps that are blocked or allowing steam to pass. Inspect steam traps as part of a regular steam system maintenance plan.

Boiler Maintenance

Many boiler problems develop slowly over time, so regular inspection and maintenance is essential to keeping the heating system running efficiently and preventing expensive repairs. Annual tune-ups should include a combustion analysis to analyze the exhaust from the boilers and to ensure the boiler is operating safely and efficiently. Boilers should be cleaned according to the manufacturer's instructions to remove soot and scale from the boiler tubes to improve heat transfer.

Label HVAC Equipment

For improved coordination in maintenance practices, we recommend labeling or re-labeling the site HVAC equipment. Maintain continuity in labeling by following labeling conventions as indicated in the facility drawings or EMS building equipment list. Use weatherproof or heatproof labeling or stickers for permanence, but do not cover over original equipment nameplates, which should be kept clean and readable whenever possible. Besides equipment, label piping for service and direction of flow when possible. Ideally, maintain a log of HVAC equipment, including nameplate information, asset tag designation, areas served, installation year, service dates, and other pertinent information.

This investment in your equipment will enhance collaboration and communication between your staff and your contracted service providers and may help you with regulatory compliance.

Optimize HVAC Equipment Schedules

Energy management systems (EMS) typically provide advanced controls for building HVAC systems, including chillers, boilers, air handling units, rooftop units and exhaust fans. The EMS monitors and reports operational status, schedules equipment start and stop times, locks out equipment operation based on outside air or space temperature, and often optimizes damper and valve operation based on complex algorithms. These EMS features, when in proper adjustment, can improve comfort for building occupants and save substantial energy.

Know your EMS scheduling capabilities. Regularly monitor HVAC equipment operating schedules and match them to building operating hours in order to eliminate unnecessary equipment operation and save energy. Monitoring should be performed often at sites with frequently changing usage patterns – daily in some cases. We recommend using the *optimal start* feature of the EMS (if available) to optimize the building warmup sequence. Most EMS scheduling programs provide for holiday schedules, which can be used during reduced use or shutdown periods. Finally, many systems are equipped with a one-time override function, which can be used to provide additional space conditioning due to a one-time, special event. When available this override feature should be used rather than changing the base operating schedule.

Water Heater Maintenance

The lower the supply water temperature that is used for hand washing sinks, the less energy is needed to heat the water. Reducing the temperature results in energy savings and the change is often unnoticeable to users. Be sure to review the domestic water temperature requirements for sterilizers and dishwashers as you investigate reducing the supply water temperature.

Also, preventative maintenance can extend the life of the system, maintain energy efficiency, and ensure safe operation. At least once a year, follow manufacturer instructions to drain a few gallons out of the water heater using the drain valve. If there is a lot of sediment or debris, then a full flush is recommended. Turn the temperature down and then completely drain the tank. Annual checks should include checks for:

- Leaks or heavy corrosion on the pipes and valves.
- Corrosion or wear on the gas line and on the piping. If you noticed any black residue, soot, or charred metal, this is a sign you may be having combustion issues and you should have the unit serviced by a professional.
- For electric water heaters, look for signs of leaking such as rust streaks or residue around the upper and lower panels covering the electrical components on the tank.
- For water heaters more than three years old, have a technician inspect the sacrificial anode annually.

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[5] or download a copy of EPA's "WaterSense™ at Work: Best Management Practices for Commercial and Institutional Facilities"[6] 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.

---

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

[6] 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, 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.

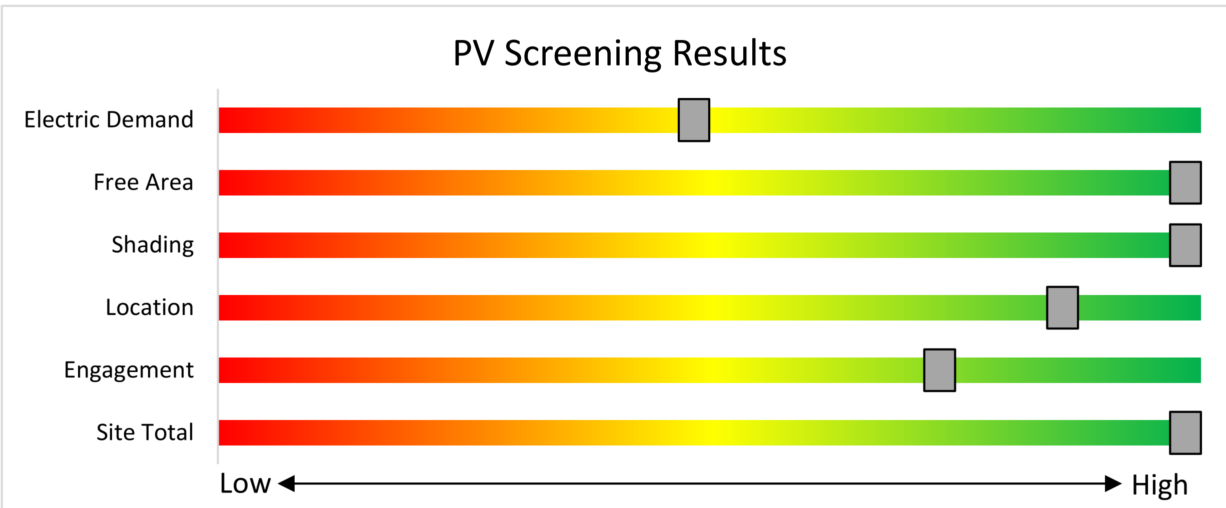
6.1 Solar Photovoltaic

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 high potential for installing a PV array.

The amount of free area, ease of installation (location), and the lack of shading elements contribute to the high potential. 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.



Potential	High	
System Potential	279	kW DC STC
Electric Generation	332,393	kWh/yr
Displaced Cost	$36,980	/yr
Installed Cost	$797,900	

Figure 8 - Photovoltaic Screening

Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The SuSI program is used to register and certify solar projects in New Jersey. Rebates are not available for solar projects. Solar projects may qualify to earn SREC- IIs (Solar Renewable Energy Certificates-II), however, the project owners *must* register their solar projects prior to the start of construction to establish the project's eligibility.

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:

Successor Solar Incentive Program (SuSI): https://www.njcleanenergy.com/renewable-energy/programs/susi-program

- **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 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.

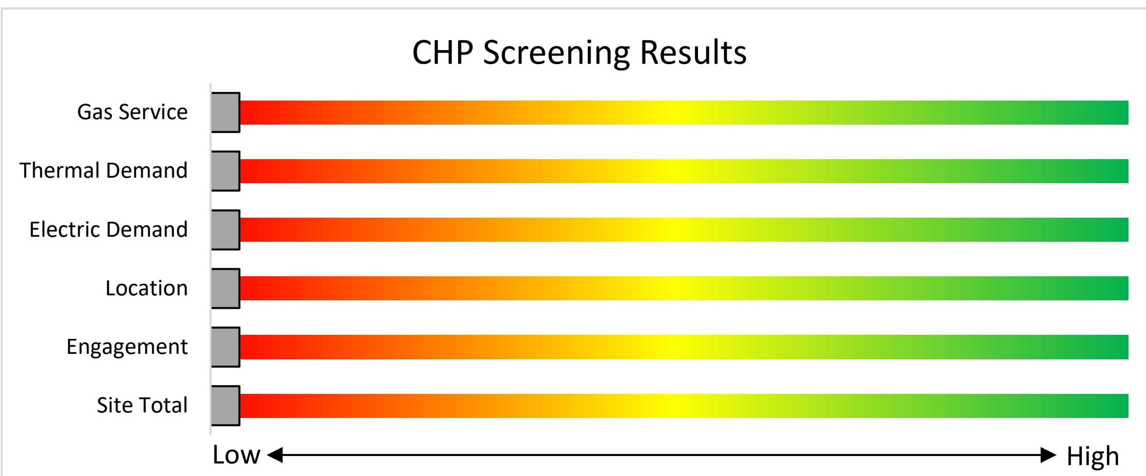


Figure 9 - Combined Heat and Power Screening

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? Your utility provider may be able to help.

7.1 Utility Energy Efficiency Programs

The Clean Energy Act, signed into law by Governor Murphy in 2018, requires New Jersey's investor-owned gas and electric utilities to reduce their customers' use by set percentages over time. To help reach these targets the New Jersey Board of Public Utilities approved a comprehensive suite of energy efficiency programs to be run by the utility companies.

These new utility programs are rolling out in the spring and summer of 2021. Keep up to date with developments by visiting:

https://www.njcleanenergy.com/transition

8 NEW JERSEY'S CLEAN ENERGY PROGRAMS

New Jersey's Clean Energy Program will continue to offer some energy efficiency programs.

8.1 Large Energy Users

The Large Energy Users Program (LEUP) is designed to foster self-directed investment in energy projects. This program is offered to New Jersey's largest energy customers that annually contribute at least $200,000 to the NJCEP aggregate of all buildings/sites. This equates to roughly $5 million in energy costs in the prior fiscal year.

Incentives

Incentives are based on the specifications below. The maximum incentive per entity is the lesser of:

- $4 million
- 75% of the total project(s) cost
- 90% of total NJCEP fund contribution in previous year
- $0.33 per projected kWh saved; $3.75 per projected Therm saved annually

How to Participate

To participate in LEUP, you will first need submit an enrollment application. This program requires all qualified and approved applicants to submit an energy plan that outlines the proposed energy efficiency work for review and approval. Applicants may submit a Draft Energy Efficiency Plan (DEEP), or a Final Energy Efficiency Plan (FEEP). Once the FEEP is approved, the proposed work can begin.

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

8.2 Combined Heat and Power

The Combined Heat & Power (CHP) program provides incentives for eligible CHP or waste heat to power (WHP) projects. Eligible CHP or WHP projects must achieve an annual system efficiency of at least 65% (lower heating value, or LHV), based on total energy input and total utilized energy output. Mechanical energy may be included in the efficiency evaluation.

Incentives

Eligible Technologies	Size (Installed Rated Capacity)[1]	Incentive ($/kW)	% of Total Cost Cap per Project[3]	$ Cap per Project[3]
Powered by non-renewable or renewable fuel source[4]	≤500 kW	$2,000	30-40%[2]	$2 million
Gas Internal Combustion Engine	>500 kW - 1 MW	$1,000		
Gas Combustion Turbine	> 1 MW - 3 MW	$550	30%	$3 million
Microturbine Fuel Cells with Heat Recovery	>3 MW	$350		
Waste Heat to Power*	<1 MW	$1,000	30%	$2 million
	> 1MW	$500		$3 million

*Waste Heat to Power: Powered by non-renewable fuel source, heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine).

Check the NJCEP website for details on program availability, current incentive levels, and requirements.

How to Participate

You will work with a qualified developer or consulting firm to complete the CHP application. Once the application is approved the project can be installed. Information about the CHP program can be found at www.njcleanenergy.com/CHP.

8.3 Successor Solar Incentive Program (SuSI)

The SuSI program replaces the SREC Registration Program (SRP) and the Transition Incentive (TI) program. The program is used to register and certify 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 SREC-IIs (Solar Renewable Energy Certificates-II). SuSI consists of two sub-programs. The Administratively Determined Incentive (ADI) Program and the Competitive Solar Incentive (CSI) Program.

Administratively Determined Incentive (ADI) Program

The ADI Program provides administratively set incentives for net metered residential projects, net metered non-residential projects 5 MW or less, and all community solar projects.

After the registration is accepted, construction is complete, and a complete final as-built packet has been submitted, the project is issued a New Jersey certification number, which enables it to generate New Jersey SREC- IIs.

Market Segments	Size MW dc	Incentive Value ($/SREC II)	Public Entities Incentive Value - $20 Adder ($/SRECII)
Net Metered Residential	All types and sizes	$90	N/A
Small Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects smaller than 1 MW	$100	$120
Large Net Metered Non-Residential located on Rooftop, Carport, Canopy and Floating Solar	Projects 1 MW to 5 MW	$90	$110
Small Net Metered Non-Residential Ground Mount	Projects smaller than 1 MW	$85	$105
Large Net Metered Non-Residential Ground Mount	Projects 1 MW to 5 MW	$80	$100
LMI Community Solar	Up to 5 MW	$90	N/A
Non-LMI Community Solar	Up to 5 MW	$70	N/A
Interim Subsection (t)	All types and sizes	$100	N/A

Eligible projects may generate SREC-IIs for 15 years following the commencement of commercial operations which is defined as permission to operate (PTO) from the Electric Distribution Company. After 15 years, projects may be eligible for a NJ Class I REC.

SREC-IIs will be purchased monthly by the SREC-II Program Administrator who will allocate the SREC-IIs to the Load Serving Entities (BGS Providers and Third-Party Suppliers) annually based on their market share of retail electricity sold during the relevant Energy Year.

The ADI Program online portal is now open to new registrations effective August 28, 2021.

Competitive Solar Incentive Program

The Competitive Solar Incentive (CSI) Program will provide competitively set incentives for grid supply projects and net metered non-residential projects greater than 5MW. The program is currently under development with the goal of holding the first solicitation by early-to-mid 2022. For updates, please continue to check the Solar Proceedings page on the New Jersey's Clean Energy Program website.

Solar projects help the State of New Jersey reach renewable energy goals outlined in the state's Energy Master Plan.

If you are considering installing solar photovoltaics on your building, visit the following link for more information: https://njcleanenergy.com/renewable-energy/programs/susi-program.

8.4 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 into contracts to help finance building energy upgrades. Annual payments are lower than the savings projected from the energy conservation measures (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 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.

9 Project Development

Energy conservation measures (ECMs) have been identified for your site, and their energy and economic analyses are provided within this LGEA report. Note that some of the identified projects may be mutually exclusive, such as replacing equipment versus upgrading motors or controls. The next steps with project development are to set goals and create a comprehensive project plan. The graphic below provides an overview of the process flow for a typical energy efficiency or renewable energy project. We recommend implementing as many ECMs as possible prior to undertaking a feasibility study for a renewable project. The cyclical nature of this process flow demonstrates the ongoing work required to continually improve building energy efficiency over time. If your building(s) scope of work is relatively simple to implement or small in scope, the measurement and verification (M&V) step may not be required. It should be noted through a typical project cycle, there will be changes in costs based on specific scopes of work, contractor selections, design considerations, construction, etc. The estimated costs provided throughout this LGEA report demonstrate the unburdened turn-key material and labor cost only. There will be contingencies and additional costs at the time of implementation. We recommend comprehensive project planning that includes the review of multiple bids for project work, incorporates potential operations and maintenance (O&M) cost savings, and maximizes your incentive potential.

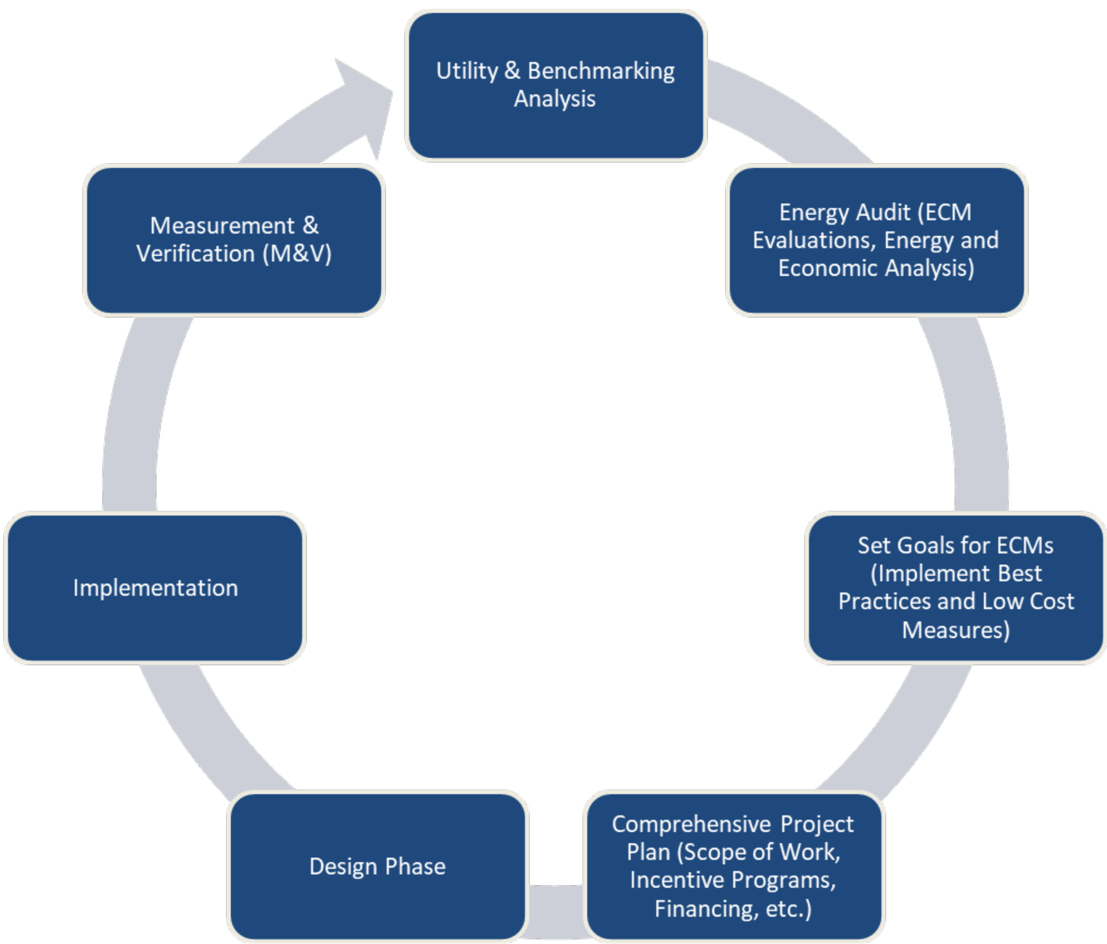


Figure 10 – Project Development Cycle

10 Energy Purchasing and Procurement Strategies

10.1 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. 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[7].

10.2 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 fluctuate monthly. The utility provides basic gas supply service 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[8].

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

[8] 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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
1st Floor Area	9	Compact Fluorescent: (1) 23W A19 Screw-In Lamp	Timeclock		23	5,110	3	Relamp	No	9	LED Lamps: A19 Lamps	Timeclock	17	5,110	0.0	304	0	$33	$155	$9	4.4
1st Floor Area	2	Compact Fluorescent: (1) 40W Double Biaxial Plug-In Lamp	Timeclock		40	5,110	3	Relamp	No	2	LED Lamps: PL-L (Biax) Lamps	Timeclock	28	5,110	0.0	135	0	$15	$27	$2	1.7
1st Floor Area	8	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Timeclock		26	5,110	3	Relamp	No	8	LED Lamps: G25 Lamps	Timeclock	19	5,110	0.0	315	0	$35	$202	$16	5.4
1st Floor Area	18	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3, 5	Relamp	Yes	18	LED Lamps: G25 Lamps	High/Low Control	19	3,301	0.2	1,221	0	$134	$1,129	$666	3.5
1st Floor Area	8	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	5,110	3	Relamp	No	8	LED Lamps: G25 Lamps	Timeclock	37	5,110	0.1	675	0	$74	$404	$32	5.0
1st Floor Area	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
1st Floor Area	2	LED - Fixtures: Downlight Solid State Retrofit	Timeclock		10	5,110		None	No	2	LED - Fixtures: Downlight Solid State Retrofit	Timeclock	10	5,110	0.0	0	0	$0	$0	$0	0.0
1st Floor Area	2	LED - Fixtures: Downlight Solid State Retrofit	Timeclock		17	5,110		None	No	2	LED - Fixtures: Downlight Solid State Retrofit	Timeclock	17	5,110	0.0	0	0	$0	$0	$0	0.0
1st Floor Area	2	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,110	3	Relamp	No	2	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,110	0.1	410	0	$45	$66	$10	1.2
2nd Floor Hallway	6	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	8,760	3, 5	Relamp	Yes	6	LED Lamps: G25 Lamps	High/Low Control	37	6,044	0.1	1,530	0	$168	$528	$234	1.7
2nd Floor Hallway	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	8,760	3, 5	Relamp	Yes	1	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	6,044	0.0	205	0	$23	$33	$6	1.2
2nd Floor Middle Hallway	4	Compact Fluorescent: (1) 40W Double Biaxial Plug-In Lamp	Wall Switch	S	40	8,760	3, 5	Relamp	Yes	4	LED Lamps: PL-L (Biax) Lamps	High/Low Control	28	6,044	0.1	797	0	$88	$279	$144	1.5
2nd Floor Middle Hallway	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
2nd Floor Middle Hallway	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	8,760	3, 5	Relamp	Yes	2	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	6,044	0.0	410	0	$45	$65	$12	1.2
2nd Floor North Elevator Lobby	32	Compact Fluorescent: (2) 13W G25 Screw-In Lamps	Wall Switch	S	26	8,760	3, 5	Relamp	Yes	32	LED Lamps: G25 Lamps	High/Low Control	19	6,044	0.3	3,975	-1	$437	$2,739	$1,248	3.4
2nd Floor North Elevator Lobby	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
3rd Floor Elevator Lobby	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 Elevator Lobby	7	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	6,570	3	Relamp	No	7	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	6,570	0.2	1,846	0	$203	$230	$35	1.0
3rd Floor Hallway North	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
3rd Floor Hallway North	16	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	6,570	3	Relamp	No	16	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	6,570	0.4	4,221	-1	$464	$525	$80	1.0
3rd Floor Hallway South	8	Exit Signs: LED - 2 W Lamp	None		6	8,760		None	No	8	Exit Signs: LED - 2 W Lamp	None	6	8,760	0.0	0	0	$0	$0	$0	0.0
3rd Floor Hallway South	1	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	6,570	3	Relamp	No	1	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	6,570	0.0	264	0	$29	$33	$5	1.0
3rd 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
3rd Floor Mechanical Room	16	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.4	2,779	-1	$305	$584	$160	1.4
AC-7 Room	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	442	0	$49	$189	$40	3.1

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Book Store	9	Compact Fluorescent: (1) 14W A19 Screw-In Lamp	Wall Switch	S	14	4,784	3, 4	Relamp	Yes	9	LED Lamps: A19 Lamps	Occupancy Sensor	10	3,301	0.0	336	0	$37	$425	$44	10.3
Book Store	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
Book Store	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Photocell		62	4,380	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Photocell	29	4,380	0.0	159	0	$17	$37	$10	1.5
Book Store	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Photocell		62	4,380	3	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Photocell	33	4,380	0.0	140	0	$15	$72	$10	4.1
Cafeteria	19	Compact Fluorescent: (1) 13W G25 Screw-In Lamp	Timeclock		13	5,110	3	Relamp	No	19	LED Lamps: G25 Lamps	Timeclock	10	5,110	0.0	320	0	$35	$479	$38	12.5
Cafeteria	4	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	5,110	3	Relamp	No	4	LED Lamps: G25 Lamps	Timeclock	37	5,110	0.0	337	0	$37	$202	$16	5.0
Cafeteria	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
Cafeteria	9	LED Lamps: (1) 10W G25 Screw-In Lamp	Timeclock		10	5,110		None	No	9	LED Lamps: (1) 10W G25 Screw-In Lamp	Timeclock	10	5,110	0.0	0	0	$0	$0	$0	0.0
Cafeteria	23	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,110	3	Relamp	No	23	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,110	0.6	4,719	-1	$518	$755	$115	1.2
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	47	0	$5	$37	$10	5.1
Closet	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	47	0	$5	$37	$10	5.1
Conference 123	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,239	0	$136	$705	$95	4.5
Conference 127	10	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	10	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.3	2,064	0	$227	$995	$135	3.8
Conference Room 111A	6	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Occupancy Sensor	S	52	3,301	3	Relamp	No	6	LED Lamps: G25 Lamps	Occupancy Sensor	37	3,301	0.1	327	0	$36	$303	$24	7.8
Conference Room 111A	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Occupancy Sensor	S	62	3,301	3	Relamp	No	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.0	240	0	$26	$73	$20	2.0
Control Room	6	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.2	1,326	0	$146	$489	$95	2.7
Copy Room	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	413	0	$45	$261	$40	4.9
Corridor 323	7	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Occupancy Sensor	S	33	3,301	3	Relamp	No	7	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	407	0	$45	$228	$42	4.2
Dining Office	12	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	12	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.3	2,477	-1	$272	$1,140	$155	3.6
Elevator 2	1	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	1,300	2	Relamp & Reballast	No	1	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	58	1,300	0.1	169	0	$19	$118	$20	5.3
Elevator 3	2	Linear Fluorescent - T12: 4' T12 (40W) - 4L	Wall Switch	S	176	1,300	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	897	0.2	389	0	$43	$353	$60	6.9
Entrance Doors	2	Compact Fluorescent: (1) 32W G25 Screw-In Lamp	Timeclock		32	5,110	3	Relamp	No	2	LED Lamps: G25 Lamps	Timeclock	23	5,110	0.0	101	0	$11	$50	$4	4.2
Exterior Loading Dock	1	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3	Relamp	No	1	LED Lamps: G25 Lamps	Wall Switch	19	4,784	0.0	33	0	$4	$25	$2	6.2
Exterior Wallpack	1	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	4,745	3	Relamp	No	1	LED Lamps: G25 Lamps	Timeclock	37	4,745	0.0	71	0	$8	$50	$4	5.9
Exterior Wallpack	1	Compact Fluorescent: (2) 32W G25 Screw-In Lamps	Timeclock		64	4,745	3	Relamp	No	1	LED Lamps: G25 Lamps	Timeclock	45	4,745	0.0	90	0	$10	$50	$4	4.6

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Exterior Wallpack	5	High-Pressure Sodium: (1) 100W Lamp	Photocell		138	4,380	1	Fixture Replacement	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	30	4,380	0.0	2,365	0	$263	$1,313	$250	4.0
Exterior Wallpack	1	LED - Fixtures: Wall Pack	Photocell		27	4,380		None	No	1	LED - Fixtures: Wall Pack	Photocell	27	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Wallpack	6	LED - Fixtures: Wall Pack	Photocell		54	4,380		None	No	6	LED - Fixtures: Wall Pack	Photocell	54	4,380	0.0	0	0	$0	$0	$0	0.0
Exterior Wallpack	6	Metal Halide: (1) 100W Lamp	Timeclock		128	4,745	1	Fixture Replacement	No	6	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	30	4,745	0.0	2,790	0	$310	$1,576	$300	4.1
Exterior Wallpack	1	Metal Halide: (1) 250W Lamp	Photocell		295	4,380	1	Fixture Replacement	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Photocell	75	4,380	0.0	964	0	$107	$471	$50	3.9
Fire Pump Room	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.2	1,105	0	$121	$453	$85	3.0
Food Pantry	9	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	9	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	1,007	0	$111	$563	$89	4.3
Freight Elevator	1	Linear Fluorescent - T8: 4' T8 (32W) - 3L	Wall Switch	S	93	8,760	3	Relamp	No	1	LED - Linear Tubes: (3) 4' Lamps	Wall Switch	44	8,760	0.0	477	0	$52	$55	$15	0.8
Garage Lower Level A	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
Garage Lower Level A	97	LED - Fixtures: High-Bay	Photocell		65	4,380		None	No	97	LED - Fixtures: High-Bay	Photocell	65	4,380	0.0	0	0	$0	$0	$0	0.0
Garage Lower Level A	6	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	8,760	3, 5	Relamp	Yes	6	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	High/Low Control	26	6,044	0.2	2,567	-1	$282	$422	$240	0.6
Garage Upper Level B	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
Garage Upper Level B	9	LED - Fixtures: High-Bay	Photocell		65	4,380		None	No	9	LED - Fixtures: High-Bay	Photocell	65	4,380	0.0	0	0	$0	$0	$0	0.0
Garage Upper Level B	6	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	8,760	3, 5	Relamp	Yes	6	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	High/Low Control	26	6,044	0.2	2,567	-1	$282	$422	$240	0.6
Hallway By 111	11	Compact Fluorescent: (2) 40W Double Biaxial Plug-In Lamps	Timeclock		80	6,205	3	Relamp	No	11	LED Lamps: PL-L (Biax) Lamps	Timeclock	56	6,205	0.2	1,802	0	$198	$297	$22	1.4
Hallway By 111	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
Hallway Room 109	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	8,760	3, 5	Relamp	Yes	3	LED - Linear Tubes: (2) 2' Lamps	High/Low Control	17	6,044	0.0	615	0	$68	$323	$123	3.0
Janitorial	1	Linear Fluorescent - EST12: 4' T12 (34W) - 1L	Occupancy Sensor	S	43	3,301	2	Relamp & Reballast	No	1	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,301	0.0	103	0	$11	$51	$5	4.0
Janitorial	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Janitorial 115	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Kitchen	6	Compact Fluorescent: (1) 23W A19 Screw-In Lamp	Wall Switch	S	23	4,784	3, 4	Relamp	Yes	6	LED Lamps: A19 Lamps	Occupancy Sensor	17	3,301	0.0	356	0	$39	$103	$6	2.5
Kitchen	2	Compact Fluorescent: (1) 23W A19 Screw-In Lamp	Timeclock		23	5,475	3	Relamp	No	2	LED Lamps: A19 Lamps	Timeclock	17	5,475	0.0	72	0	$8	$34	$2	4.1
Kitchen	31	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	5,475	3	Relamp	No	31	LED Lamps: G25 Lamps	Timeclock	37	5,475	0.3	2,800	-1	$308	$1,564	$124	4.7
Kitchen	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
Kitchen	11	Halogen Incandescent: (1) 100W MR8 Plug-In Lamp	Timeclock		100	5,475	3	Relamp	No	11	LED Lamps: LED Lamps	Timeclock	15	5,475	0.7	5,631	-1	$619	$189	$11	0.3

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	LED - Fixtures: Shelf-Mounted Display and Task Lights	Timeclock		11	5,475		None	No	1	LED - Fixtures: Shelf-Mounted Display and Task Lights	Timeclock	11	5,475	0.0	0	0	$0	$0	$0	0.0
Kitchen	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	448	0	$49	$130	$24	2.2
Kitchen	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	884	0	$97	$416	$75	3.5
Kitchen	32	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	32	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.9	6,606	-1	$726	$3,129	$425	3.7
Kitchen Storage	1	Linear Fluorescent - EST12: 4' T12 (34W) - 2L	Wall Switch	S	72	1,872	2	Relamp & Reballast	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,872	0.0	89	0	$10	$69	$10	6.0
Kitchen Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,872	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,292	0.1	173	0	$19	$189	$40	7.8
Kitchen Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,872	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,292	0.1	173	0	$19	$189	$40	7.8
Lobby 1St Floor	5	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	5,475	3	Relamp	No	5	LED Lamps: G25 Lamps	Timeclock	37	5,475	0.1	452	0	$50	$252	$20	4.7
Lobby 1St Floor	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
Lobby 2nd Floor	2	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	8,760	3, 5	Relamp	Yes	2	LED Lamps: G25 Lamps	High/Low Control	19	6,044	0.0	248	0	$27	$50	$4	1.7
Lobby 2nd Floor	8	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	8,760	3, 5	Relamp	Yes	8	LED Lamps: G25 Lamps	High/Low Control	37	6,044	0.2	2,041	0	$224	$854	$312	2.4
Lobby Entrance	2	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	8,760	3	Relamp	No	2	LED Lamps: G25 Lamps	Wall Switch	37	8,760	0.0	289	0	$32	$101	$8	2.9
Lobby Entrance	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
Lobby Freight Elevator	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
Lobby Freight Elevator	2	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	4,784	3	Relamp	No	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	4,784	0.0	184	0	$20	$37	$10	1.3
Lobby Freight Elevator	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Locker Room- Female	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Locker Room- Male	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Main Entrance	3	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	5,475	3	Relamp	No	3	LED Lamps: G25 Lamps	Timeclock	37	5,475	0.0	271	0	$30	$151	$12	4.7
Main Entrance	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
Mechanical Room 113	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
Mechanical Room 113	36	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	36	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.9	6,252	-1	$687	$1,315	$360	1.4
MPR A	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
MPR A	15	Halogen Incandescent: (1) 100W MR8 Plug-In Lamp	Wall Switch	S	100	4,784	3, 4	Relamp	Yes	15	LED Lamps: LED Lamps	Occupancy Sensor	15	3,301	1.0	7,077	-1	$777	$528	$50	0.6
MPR A	5	Halogen Incandescent: (1) 60W PAR30 Screw-In Lamp	Wall Switch	S	60	4,784	3, 4	Relamp	Yes	5	LED Lamps: PAR30 Lamps	Occupancy Sensor	9	3,301	0.2	1,415	0	$155	$116	$15	0.7

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
MPR A	6	U-Bend Fluorescent - EST12: U T12 (34W) - 2L	Wall Switch	S	72	4,784	2, 4	Relamp & Reballast	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,554	0	$171	$898	$95	4.7
MPR A	9	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	9	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.3	2,103	0	$231	$565	$80	2.1
MPR B	24	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3, 4	Relamp	Yes	24	LED Lamps: G25 Lamps	Occupancy Sensor	19	3,301	0.2	1,628	0	$179	$1,145	$118	5.7
MPR B	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
MPR B	40	Halogen Incandescent: (1) 100W MR8 Plug-In Lamp	Wall Switch	S	100	4,784	3, 4	Relamp	Yes	40	LED Lamps: LED Lamps	Occupancy Sensor	15	3,301	2.6	18,871	-4	$2,073	$1,499	$145	0.7
MPR B	1	Halogen Incandescent: (1) 60W PAR30 Screw-In Lamp	Wall Switch	S	60	4,784	3	Relamp	No	1	LED Lamps: PAR30 Lamps	Wall Switch	9	4,784	0.0	268	0	$29	$23	$3	0.7
MPR B	8	U-Bend Fluorescent - EST12: U T12 (34W) - 2L	Wall Switch	S	72	4,784	2, 4	Relamp & Reballast	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.3	2,073	0	$228	$1,108	$115	4.4
MPR C	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
MPR C	1	Halogen Incandescent: (1) 100W MR8 Plug-In Lamp	Wall Switch	S	100	4,784	3	Relamp	No	1	LED Lamps: LED Lamps	Wall Switch	15	4,784	0.1	447	0	$49	$17	$1	0.3
MPR C	5	Halogen Incandescent: (1) 60W PAR30 Screw-In Lamp	Wall Switch	S	60	4,784	3, 4	Relamp	Yes	5	LED Lamps: PAR30 Lamps	Occupancy Sensor	9	3,301	0.2	1,415	0	$155	$116	$15	0.7
MPR C	2	U-Bend Fluorescent - EST12: U T12 (34W) - 2L	Wall Switch	S	72	4,784	2, 4	Relamp & Reballast	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	518	0	$57	$325	$40	5.0
Office	4	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	3,301	0.2	1,557	0	$171	$562	$115	2.6
Office	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	3,301	0.1	779	0	$86	$262	$60	2.4
Office 104	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	448	0	$49	$400	$59	6.9
Office 104	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	442	0	$49	$73	$20	1.1
Office 109A	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,239	0	$136	$705	$95	4.5
Office 109B	5	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	5	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	1,032	0	$113	$632	$85	4.8
Office 109C	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	448	0	$49	$400	$59	6.9
Office 109D	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	3,301	3	Relamp	No	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	421	0	$46	$290	$40	5.4
Office 111B	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Office 111C	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Office 111D	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Office 111E	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Office 111F	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Office 111G	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.0	336	0	$37	$214	$38	4.8

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Office 125	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 2' Lamps	Wall Switch	17	4,784	0.0	84	0	$9	$33	$6	2.9
Office 125C (1)	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Occupancy Sensor	S	62	3,301	3	Relamp	No	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	421	0	$46	$290	$40	5.4
Office 125D	6	Compact Fluorescent: (3) 40W Double Biaxial Plug-In Lamps	Occupancy Sensor	S	120	3,301	3	Relamp	No	6	LED Lamps: PL-L (Biax) Lamps	Occupancy Sensor	84	3,301	0.2	784	0	$86	$243	$18	2.6
Office 127A	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,239	0	$136	$705	$95	4.5
Office 127A (1)	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,652	0	$181	$850	$115	4.0
Office 127B	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,652	0	$181	$850	$115	4.0
Office 127B (1)	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,652	0	$181	$850	$115	4.0
Restroom - All Gender	5	Compact Fluorescent: (2) 40W Double Biaxial Plug-In Lamps	Wall Switch	S	80	4,784	3, 4	Relamp	Yes	5	LED Lamps: PL-L (Biax) Lamps	Occupancy Sensor	56	3,301	0.1	1,088	0	$120	$405	$45	3.0
Restroom - All Gender (1)	5	Compact Fluorescent: (2) 40W Double Biaxial Plug-In Lamps	Wall Switch	S	80	4,784	3, 4	Relamp	Yes	5	LED Lamps: PL-L (Biax) Lamps	Occupancy Sensor	56	3,301	0.1	1,088	0	$120	$405	$45	3.0
Restroom - All Gender (1)	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Wall Switch	S	32	4,784	3, 4	Relamp	Yes	3	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	3,301	0.0	347	0	$38	$55	$15	1.0
Restroom - Female	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.0	224	0	$25	$335	$12	13.1
Restroom - Female	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Restroom - Female	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Photocell		33	4,380	3	Relamp	No	4	LED - Linear Tubes: (2) 2' Lamps	Photocell	17	4,380	0.0	308	0	$34	$130	$24	3.1
Restroom - Female	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Photocell		32	4,380	3	Relamp	No	3	LED - Linear Tubes: (1) 4' Lamp	Photocell	15	4,380	0.0	253	0	$28	$55	$15	1.4
Restroom - Male	4	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Photocell		33	4,380	3	Relamp	No	4	LED - Linear Tubes: (2) 2' Lamps	Photocell	17	4,380	0.0	308	0	$34	$130	$24	3.1
Restroom - Male	3	Linear Fluorescent - T8: 4' T8 (32W) - 1L	Photocell		32	4,380	3	Relamp	No	3	LED - Linear Tubes: (1) 4' Lamp	Photocell	15	4,380	0.0	253	0	$28	$55	$15	1.4
Restroom - Male	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Restroom - Male	3	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	32	4,784	4	None	Yes	3	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	32	3,301	0.0	157	0	$17	$270	$35	13.7
Roof	7	Compact Fluorescent: (1) 34W A19 Screw-In Lamp	Photocell		34	4,380	3	Relamp	No	7	LED Lamps: A19 Lamps	Photocell	24	4,380	0.1	337	0	$37	$121	$7	3.1
Room 100	5	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.2	1,105	0	$121	$453	$85	3.0
Room 101D	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Photocell		62	4,380	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Photocell	29	4,380	0.0	159	0	$17	$37	$10	1.5
Room 102 Art Gallery	3	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3, 4	Relamp	Yes	3	LED Lamps: G25 Lamps	Occupancy Sensor	19	3,301	0.0	203	0	$22	$346	$41	13.6
Room 102 Art Gallery	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
Room 102 Art Gallery	35	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	4,784	4	None	Yes	35	LED Lamps: (1) 10W A19 Screw-In Lamp	Occupancy Sensor	10	3,301	0.1	571	0	$63	$810	$105	11.2
Room 106	1	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	5,475	3	Relamp	No	1	LED Lamps: G25 Lamps	Timeclock	37	5,475	0.0	90	0	$10	$50	$4	4.7

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Room 109	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
Room 109	15	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	15	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.2	1,679	0	$184	$758	$125	3.4
Room 111	15	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	15	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.2	1,679	0	$184	$758	$125	3.4
Room 125	8	Compact Fluorescent: (3) 40W Double Biaxial Plug-In Lamps	Wall Switch	S	120	4,784	3, 4	Relamp	Yes	8	LED Lamps: PL-L (Biax) Lamps	Occupancy Sensor	84	3,301	0.4	2,612	-1	$287	$594	$59	1.9
Room 125	3	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Timeclock		52	5,475	3	Relamp	No	3	LED Lamps: G25 Lamps	Timeclock	37	5,475	0.0	271	0	$30	$151	$12	4.7
Room 125	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
Room 129	5	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	4,784	3, 4	Relamp	Yes	5	LED Lamps: G25 Lamps	Occupancy Sensor	37	3,301	0.1	696	0	$77	$522	$55	6.1
Room 129	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
Room 129	35	Halogen Incandescent: (1) 40W MR16 Plug-In Lamp	Wall Switch	S	40	4,784	3, 4	Relamp	Yes	35	LED Lamps: MR16 Lamps	Occupancy Sensor	6	3,301	0.9	6,605	-1	$725	$1,761	$140	2.2
Room 129	20	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.6	4,419	-1	$485	$1,270	$270	2.1
Room 206 Faculty Dinning	6	Compact Fluorescent: (1) 23W A19 Screw-In Lamp	Wall Switch	S	23	4,784	3, 4	Relamp	Yes	6	LED Lamps: A19 Lamps	Occupancy Sensor	17	3,301	0.0	356	0	$39	$373	$41	8.5
Room 206 Faculty Dinning	12	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3, 4	Relamp	Yes	12	LED Lamps: G25 Lamps	Occupancy Sensor	19	3,301	0.1	814	0	$89	$573	$59	5.7
Room 206 Faculty Dinning	27	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	4,784	3, 4	Relamp	Yes	27	LED Lamps: G25 Lamps	Occupancy Sensor	37	3,301	0.5	3,761	-1	$413	$1,902	$178	4.2
Room 206 Faculty Dinning	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
Room 210 server	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	442	0	$49	$189	$40	3.1
Room 211	3	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	4,784	3, 4	Relamp	Yes	3	LED Lamps: G25 Lamps	Occupancy Sensor	37	3,301	0.1	418	0	$46	$421	$47	8.2
Room 211	8	LED - Fixtures: Ambient 2x2 Fixture	Wall Switch	S	40	4,784	4	None	Yes	8	LED - Fixtures: Ambient 2x2 Fixture	Occupancy Sensor	40	3,301	0.1	522	0	$57	$270	$35	4.1
Room 212	8	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.3	1,869	0	$205	$533	$75	2.2
Room 215	8	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.3	1,869	0	$205	$533	$75	2.2
Room 216	4	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3, 4	Relamp	Yes	4	LED Lamps: G25 Lamps	Occupancy Sensor	19	3,301	0.0	271	0	$30	$371	$43	11.0
Room 216	12	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	12	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.4	2,804	-1	$308	$664	$95	1.8
Room 217	4	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3, 4	Relamp	Yes	4	LED Lamps: G25 Lamps	Occupancy Sensor	19	3,301	0.0	271	0	$30	$371	$43	11.0
Room 217	12	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	12	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.4	2,804	-1	$308	$664	$95	1.8
Room 218	4	Compact Fluorescent: (1) 26W G25 Screw-In Lamp	Wall Switch	S	26	4,784	3, 4	Relamp	Yes	4	LED Lamps: G25 Lamps	Occupancy Sensor	19	3,301	0.0	271	0	$30	$371	$43	11.0
Room 218	12	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	12	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.4	2,804	-1	$308	$664	$95	1.8

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Room 300	3	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	619	0	$68	$487	$65	6.2
Room 301	20	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	20	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.6	4,129	-1	$454	$1,989	$270	3.8
Room 301B	5	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	5	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	560	0	$61	$433	$65	6.0
Room 302	10	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	10	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.3	2,337	0	$257	$598	$85	2.0
Room 303	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	4,784	0.0	153	0	$17	$72	$10	3.7
Room 304	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
Room 304	4	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.1	935	0	$103	$401	$55	3.4
Room 305	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.3	2,210	0	$243	$635	$135	2.1
Room 306 Meeting	12	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	4,784	3, 4	Relamp	Yes	12	LED Lamps: G25 Lamps	Occupancy Sensor	37	3,301	0.2	1,672	0	$184	$875	$83	4.3
Room 306 Meeting	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
Room 306 Meeting	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	884	0	$97	$416	$75	3.5
Room 307	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	442	0	$49	$189	$40	3.1
Room 308	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
Room 308	1	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) U-Lamp	Wall Switch	33	4,784	0.0	153	0	$17	$72	$10	3.7
Room 308A	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Room 308B	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Room 308C	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Room 308D	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Room 309	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.3	2,210	0	$243	$635	$135	2.1
Room 310	6	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	6	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,239	0	$136	$705	$95	4.5
Room 311 Storage	10	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	10	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.3	2,210	0	$243	$635	$100	2.2
Room 314	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,652	0	$181	$850	$115	4.0
Room 314 (1)	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,652	0	$181	$850	$115	4.0
Room 315 server	3	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	663	0	$73	$380	$65	4.3
Room 317 Meeting	9	Compact Fluorescent: (2) 26W G25 Screw-In Lamps	Wall Switch	S	52	4,784	3, 4	Relamp	Yes	9	LED Lamps: G25 Lamps	Occupancy Sensor	37	3,301	0.2	1,254	0	$138	$724	$71	4.7

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Room 317 Meeting	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
Room 317 Meeting	8	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	895	0	$98	$530	$83	4.5
Room 317 Meeting	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Room 318	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,652	0	$181	$850	$115	4.0
Room 318A	8	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.2	1,652	0	$181	$850	$115	4.0
Room 318B	4	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	826	0	$91	$560	$75	5.3
Room 318C	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.0	224	0	$25	$181	$32	6.1
Room 319	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	3,301	0.1	413	0	$45	$261	$40	4.9
Room 321	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	442	0	$49	$189	$40	3.1
Room 321A	4	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	3,301	0.1	884	0	$97	$416	$75	3.5
Room 323	2	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.0	224	0	$25	$181	$32	6.1
Room 325A	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.0	336	0	$37	$214	$38	4.8
Room 325B	3	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	3	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.0	336	0	$37	$214	$38	4.8
Room 325C	8	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	4,784	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) 2' Lamps	Occupancy Sensor	17	3,301	0.1	895	0	$98	$530	$83	4.5
Room 327 Meeting	2	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Wall Switch	S	62	4,784	3, 4	Relamp	Yes	2	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Occupancy Sensor	26	3,301	0.1	467	0	$51	$182	$30	3.0
Room 329 Electric Room	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	4,784	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	4,784	0.0	174	0	$19	$37	$10	1.4
Stairs	10	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,475	3	Relamp	No	10	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,475	0.3	2,198	0	$241	$328	$50	1.2
Stairs Middle	14	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,475	3	Relamp	No	14	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,475	0.4	3,077	-1	$338	$459	$70	1.2
Stairs 4	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
Stairs 4	6	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,475	3	Relamp	No	6	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,475	0.2	1,319	0	$145	$197	$30	1.2
Stairs 4	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
Stairs	6	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,475	3	Relamp	No	6	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,475	0.2	1,319	0	$145	$197	$30	1.2
Stairs 5	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
Stairs 5	6	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,475	3	Relamp	No	6	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,475	0.2	1,319	0	$145	$197	$30	1.2
Stairs A	18	Linear Fluorescent - T5HO: 4' T5HO (54W) - 1L	Timeclock		62	5,475	3	Relamp	No	18	LED - Linear Tubes: (1) 4' T5HO (25W) Lamp	Timeclock	26	5,475	0.5	3,957	-1	$435	$591	$90	1.2

	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Stairs Cafeteria	8	LED - Fixtures: Downlight Solid State Retrofit	Timeclock		17	5,475		None	No	8	LED - Fixtures: Downlight Solid State Retrofit	Timeclock	17	5,475	0.0	0	0	$0	$0	$0	0.0
Storage	2	Linear Fluorescent - T8: 4' T8 (32W) - 4L	Wall Switch	S	114	1,300	3, 4	Relamp	Yes	2	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	897	0.1	212	0	$23	$262	$40	9.6
Storage	8	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3, 4	Relamp	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	897	0.2	480	0	$53	$562	$80	9.1
Storage 125F	4	Linear Fluorescent - T12: 4' T12 (40W) - 2L	Wall Switch	S	88	1,300	2, 4	Relamp & Reballast	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	897	0.2	389	0	$43	$545	$40	11.8
Storage 125F	16	Linear Fluorescent - T12: 8' T12 (75W) - 2L	Wall Switch	S	158	1,300	2, 4	Relamp & Reballast	Yes	16	LED - Linear Tubes: (2) 8' Lamps	Occupancy Sensor	72	897	1.2	2,478	-1	$272	$2,599	$320	8.4
Storage 107	2	U-Bend Fluorescent - T8: U T8 (32W) - 2L	Wall Switch	S	62	1,300	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) U-Lamp	Occupancy Sensor	33	897	0.1	112	0	$12	$261	$20	19.5
Storage 109E	2	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3, 4	Relamp	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	897	0.1	120	0	$13	$189	$20	12.8
Storage 125E	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	47	0	$5	$37	$10	5.1
Storage 129B	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	47	0	$5	$37	$10	5.1
Storage 129B (1)	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	47	0	$5	$37	$10	5.1
Storage 204	6	Linear Fluorescent - EST12: 4' T12 (34W) - 1L	Wall Switch	S	43	1,300	2, 4	Relamp & Reballast	Yes	6	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	897	0.1	283	0	$31	$573	$30	17.5
Storage 204A	15	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3, 4	Relamp	Yes	15	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	897	0.5	901	0	$99	$818	$150	6.7
Storage 208A	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	47	0	$5	$37	$10	5.1
Storage 213	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,300	3	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	1,300	0.0	47	0	$5	$37	$10	5.1

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?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room 113	Chilled Water System	2	Chilled Water Pump	30.0	94.1%	No			W	1,680	7	No	94.1%	Yes	2	11.1	29,967	0	$3,334	$113,151	$3,000	33.0
Mechanical Room B5	Condensate Pumps	2	Condensate Pump	5.0	88.5%	No			W	1,680	10	No	88.5%	Yes	2	1.0	5,311	0	$591	$8,260	$1,800	10.9
Mechanical Room 113	Mechanical Room 113	1	Exhaust Fan	3.0	89.5%	No			W	3,294	6	No	89.5%	Yes	1	0.9	3,089	0	$344	$3,812	$200	10.5
Roof	KX-1 - Kitchen Hood Exhaust	1	Kitchen Hood Exhaust Fan	3.0	84.0%	No			W	3,294	9	No	89.5%	Yes	1	0.1	6,282	65	$1,138	$3,812	$200	3.2
Roof	KX-2, KX-4 - Exhaust Fan	2	Exhaust Fan	1.0	82.0%	No			W	3,294	6	No	85.5%	Yes	2	0.6	2,413	0	$268	$6,566	$150	23.9
Roof	EF-7 - Exhaust Fan	1	Exhaust Fan	0.3	65.0%	No			W	3,294		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-6 - Exhaust Fan	1	Exhaust Fan	0.3	65.0%	No			W	3,294		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	EF-3 - Exhaust Fan	1	Exhaust Fan	0.1	65.0%	No			W	3,294		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Various Locations	Fan Coil Units	32	Fan Coil Unit	0.1	65.0%	No			W	3,294		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room 113	HWP-3 & 4 - Hot Water System	2	Heating Hot Water Pump	5.0	89.5%	No			W	1,960	8	No	89.5%	Yes	2	1.0	6,126	0	$682	$8,394	$1,800	9.7
Mechanical Room 113	HWP-1 & 2 - Hot Water System	2	Heating Hot Water Pump	20.0	93.0%	Yes			W	1,960		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
Elevator Pump Room	Elevator 2	1	Other	30.0	74.0%	No			W	600		No	74.0%	No		0.0	0	0	$0	$0	$0	0.0
Elevator Pump Room	Elevator 3	1	Other	50.0	80.0%	No			W	600		No	80.0%	No		0.0	0	0	$0	$0	$0	0.0
Exterior Loading Dock	Dumpster Pump Motor	1	Other	10.0	89.5%	No			W	200		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU-5 - 3rd Floor	1	Supply Fan	20.0	93.0%	Yes			W	5,096		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU-5 - 3rd Floor	1	Return Fan	15.0	93.0%	Yes			W	5,096		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU-8 - 3rd Floor A/B	1	Supply Fan	15.0	92.4%	Yes			W	5,096		No	92.4%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU-8 - 3rd Floor A/B	1	Return Fan	7.5	88.5%	Yes			W	5,096		No	88.5%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU-6 - 3rd Floor Multipurpose Room	1	Supply Fan	20.0	93.0%	Yes			W	5,096		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU-6 - 3rd Floor Multipurpose Room	1	Return Fan	15.0	93.0%	Yes			W	5,096		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0

		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?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
3rd Floor Mechanical Room	AHU-7 - 2nd Floor Lounges	1	Supply Fan	20.0	93.0%	Yes			W	5,096		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
3rd Floor Mechanical Room	AHU-7 - 2nd Floor Lounges	1	Return Fan	10.0	91.7%	Yes			W	5,096		No	91.7%	No		0.0	0	0	$0	$0	$0	0.0
AC-7 Room	AC-7 - 1st Floor Gallay	1	Supply Fan	3.0	84.0%	No			W	5,096	6	No	89.5%	Yes	1	0.9	5,655	0	$629	$3,884	$200	5.9
AC-7 Room	AC-7 - 1st Floor Gallay	1	Return Fan	1.0	82.0%	No			W	5,096	6	No	85.5%	Yes	1	0.3	1,867	0	$208	$3,010	$75	14.1
Mechanical Room 113	AHU-4 - 1st Floor	1	Supply Fan	7.5	86.5%	No			W	5,096	6	No	91.0%	Yes	1	2.3	13,461	0	$1,498	$4,738	$1,000	2.5
Mechanical Room 113	AHU-4 - 1st Floor	1	Return Fan	5.0	87.5%	No			W	5,096	6	No	89.5%	Yes	1	1.5	8,474	0	$943	$4,076	$900	3.4
Mechanical Room 113	AHU-3 - 1st Floor A	1	Supply Fan	7.5	89.5%	Yes			W	5,096		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room 113	AHU-3 - 1st Floor A	1	Return Fan	5.0	89.5%	Yes			W	5,096		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room 113	AHU-2 - 1st Floor A/B	1	Supply Fan	20.0	93.0%	Yes			W	5,096		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room 113	AHU-2 - 1st Floor A/B	1	Return Fan	15.0	93.0%	Yes			W	5,096		No	93.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room 113	AHU-1 - 1st Floor Book Store	1	Supply Fan	5.0	89.5%	Yes			W	5,096		No	89.5%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-1	2	Combustion Air Fan	0.3	65.0%	No			B	600		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-1	2	Supply Fan	7.5	91.0%	Yes			B	5,096		No	91.0%	No		0.0	0	0	$0	$0	$0	0.0
Roof	RTU-1	2	Exhaust Fan	3.0	89.5%	No			B	5,096	6	No	89.5%	Yes	2	1.8	9,557	0	$1,063	$7,768	$400	6.9
Roof	MAU-1 - 2nd Floor A	1	Supply Fan	3.0	86.0%	No			B	5,096	6	No	89.5%	Yes	1	0.9	5,323	0	$592	$3,884	$200	6.2
Roof	MAU-2 - 2nd Floor A	1	Supply Fan	3.0	86.0%	No			B	5,096	6	No	89.5%	Yes	1	0.9	5,323	0	$592	$3,884	$200	6.2
Entrance - Lobby	DC-6, DC-7 - Door Curtains Fan Coil Units	2	Fan Coil Unit	0.2	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Entrance - Cafeteria	DC-4, DC-5 - Door Curtains Fan Coil Units	2	Fan Coil Unit	0.2	65.0%	No			W	2,745		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0
Room 100	Room 100	1	Fan Coil Unit	0.5	70.0%	No			W	2,745		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0
Mechanical Room 113	Backup Hydronic Heating System	2	Combustion Air Fan	0.5	70.0%	No			W	520		No	70.0%	No		0.0	0	0	$0	$0	$0	0.0

		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?	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room 113	Domestic Hot Water System	3	DHW Circulation Pump	0.1	65.0%	No			W	8,760		No	65.0%	No		0.0	0	0	$0	$0	$0	0.0

Packaged HVAC Inventory & Recommendations

		Existing Conditions									Proposed Conditions								Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Manufacturer	Model	Remaining Useful Life	ECM #	Install High Efficiency System?	System Quantity	System Type	Cooling Capacity per Unit (Tons)	Heating Capacity per Unit (MBh)	Cooling Mode Efficiency (SEER/IEER/EER)	Heating Mode Efficiency	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Roof	ACCU-2-1 - AHU-2-1 - Server Room	1	Split-System	1.50		10.50		Liebert	PFH020APL3	B	11	Yes	1	Split-System	1.50		16.00		0.3	825	0	$92	$5,678	$158	60.1
Roof	ACCU-2-2 - AHU-2-2 - Server Room	1	Split-System	1.50		10.50		Liebert	PFH020APL3	B	11	Yes	1	Split-System	1.50		16.00		0.3	825	0	$92	$5,678	$158	60.1
Roof	RTU-1	1	Package Unit	40.00	632.00	10.20	0.81025641025641 AFUE	AAON	RN-040-3-0	B	11	Yes	1	Package Unit	40.00	632.00	12.50	0.82 Et	4.3	12,122	1	$1,358	$38,575	$3,400	25.9
Control Room	AHU-1-1 - Control Room	1	Split-System	1.50		12.00		Liebert		B	11	Yes	1	Split-System	1.50		16.00		0.2	525	0	$58	$5,678	$158	94.5
Roof	MAU-1 - 2nd Floor A	1	Forced Air Furnace		240.00		0.8 AFUE	Greenheck	PVF300H	B	13	Yes	1	Forced Air Furnace		240.00		0.97 AFUE	0.0	0	8	$53	$7,001	$500	122.3
Roof	MAU-2 - 2nd Floor A (ACCU-1 DX)	1	Package Unit	7.50	240.00	10.70	0.8 AFUE			B	11	Yes	1	Package Unit	7.50	240.00	14.00	0.82 Et	1.0	2,776	1	$316	$11,397	$593	34.2
Fire Pump Room	Fire Pump Room	1	Electric Resistance Heat		17.07		1 COP	Dayton		W		No							0.0	0	0	$0	$0	$0	0.0
Restrooms All Gender	Restrooms All Gender	2	Electric Resistance Heat		10.24		1 COP			W		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)	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Roof	ACCH-1 & 2 - Chilled Water System	2	Air-Cooled Screw Chiller	218.00	McQuay	ALS218C27ER11	B	12	Yes	2	Air-Cooled Screw Chiller	Variable	218.00	1.24	0.73	-32.5	76,181	0	$8,475	$422,424	$40,112	45.1

Space Heating Boiler 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)	Manufacturer	Model	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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room 113	Backup Hydronic Heating System	2	Non-Condensing Hot Water Boiler	1,655	De Dietrich	GT 409A	W		No						0.0	0	0	$0	$0	$0	0.0
Central Plant	Steam Boiler (Proxy Boiler)	1	Forced Draft Steam Boiler	8,500	TRANE		B		No						0.0	0	0	$0	$0	$0	0.0

Pipe Insulation Recommendations

		Recommendation Inputs			Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Affected	ECM #	Length of Uninsulated Pipe (ft)	Pipe Diameter (in)	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room 113	Domestic Hot Water	14	8	1.00	0.0	0	4	$24	$46	$16	1.3

DHW Inventory & Recommendations

		Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
Location	Area(s)/System(s) Served	System Quantity	System Type	Manufacturer	Model	Remaining Useful Life	ECM #	Replace?	System Quantity	System Type	Fuel Type	System Efficiency	Efficiency Units	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Mechanical Room 113	Domestic Hot Water	1	Storage Tank Water Heater (> 50 Gal)	A O Smith	HW-200	W		No						0.0	0	0	$0	$0	$0	0.0
Kitchen	Electric Booster Water Heater	1	Booster Water Heater			W		No						0.0	0	0	$0	$0	$0	0.0

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	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Restrooms	15	14	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	13	$90	$100	$50	0.6

Walk-In Cooler/Freezer Inventory & Recommendations

	Existing Conditions				Proposed Conditions				Energy Impact & Financial Analysis						
Location	Cooler/ Freezer Quantity	Case Type/Temperature	Manufacturer	Model	ECM #	Install EC Evaporator Fan Motors?	Install Electric Defrost Control?	Install Evaporator Fan Control?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Cooler (35F to 55F)	Bohn	ADT104AK	16, 17	Yes	No	Yes	0.1	1,291	0	$144	$2,281	$155	14.8
Kitchen	1	Cooler (35F to 55F)	Bohn	ADT090AK	16, 17	Yes	No	Yes	0.1	1,251	0	$139	$2,281	$155	15.3
Kitchen	1	Low Temp Freezer (-35F to -5F)		LET160BJ	16, 17	Yes	Yes	Yes	0.1	2,146	0	$239	$3,406	$285	13.1

Commercial Refrigerator/Freezer Inventory & Recommendations

Existing Conditions						Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Refrigerator/ Freezer Type	Manufacturer	Model	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Book Store	1	Stand-Up Refrigerator, Glass Door (31 - 50 cu. ft.)	TRUE	GDM-45	No		No	0.0	0	0	$0	$0	$0	0.0
Book Store	1	Stand-Up Refrigerator, Glass Door (31 - 50 cu. ft.)	Imbera	VRD37 CO2	No		No	0.0	0	0	$0	$0	$0	0.0
Book Store	1	Stand-Up Refrigerator, Glass Door (31 - 50 cu. ft.)	TRUE	GDM-37EM	No		No	0.0	0	0	$0	$0	$0	0.0
Dining Office/Kitchen	3	Stand-Up Refrigerator, Solid Door (16 - 30 cu. ft.)	Metalfrio/Minus Forty		No		No	0.0	0	0	$0	$0	$0	0.0
Food Pantry/Kitchen	2	Stand-Up Refrigerator, Solid Door (≤15 cu. ft.)	Bison/True		No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	3	Stand-Up Refrigerator, Glass Door (31 - 50 cu. ft.)	TRUE	GDM-49EM	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Solid Door (≤15 cu. ft.)	TRUE	GDM-10-HC-LC	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Glass Door (>50 cu. ft.)	TRUE	TR2R-2G	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	2	Stand-Up Refrigerator, Glass Door (>50 cu. ft.)	Traulsen/True	AHT232WUT-FHG	No		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Stand-Up Refrigerator, Glass Door (31 - 50 cu. ft.)	Federal		No		No	0.0	0	0	$0	$0	$0	0.0

Commercial Ice Maker Inventory & Recommendations

Existing Conditions						Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Ice Maker Type	Manufacturer	Model	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	1	Self-Contained Unit (≥175 lbs/day), Batch	Hoshizaki	KM-1301SAH	No		No	0.0	0	0	$0	$0	$0	0.0

Cooking Equipment Inventory & Recommendations

	Existing Conditions					Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Equipment Type	Manufacturer	Model	High Efficiency Equipement?	ECM #	Install High Efficiency Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
Kitchen	2	Gas Combination Oven/Steam Cooker (<15 Pans)	Vulcan		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Fryer	Vulcan		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Combination Oven/Steam Cooker (<15 Pans)	Imperial		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Convection Oven (Full Size)	Blodgett		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Griddle (4 Feet Width)	Marsal		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	2	Gas Fryer	Pitco		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Convection Oven (Half Size)	Vulcan		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Convection Oven (Full Size)	Subway		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Electric Convection Oven (Half Size)	Subway		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)			Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Insulated Food Holding Cabinet (Full Size)	Metro		Yes		No	0.0	0	0	$0	$0	$0	0.0
Kitchen	1	Gas Steamer	Cleveland		Yes		No	0.0	0	0	$0	$0	$0	0.0

Dishwasher Inventory & Recommendations

	Existing Conditions							Proposed Conditions		Energy Impact & Financial Analysis						
Location	Quantity	Dishwasher Type	Manufacturer	Model	Water Heater Fuel Type	Booster Heater Fuel Type	ENERGY STAR Qualified?	ECM #	Install ENERGY STAR Equipment?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Payback w/ Incentives in Years
Kitchen	1	Single Tank Conveyor (High Temp)	Hobart	CRS66A	Electric	N/A	No		No	0.0	0	0	$0	$0	$0	0.0

Plug Load Inventory

Location	Existing Conditions					
	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Gilligan Student Union	6	Coffee Machine	800	No		
Gilligan Student Union	117	Desktop	270	No		
Gilligan Student Union	18	Microwave	1,000	No		
Gilligan Student Union	7	Kitchen Misc Equipment	1,000	No		
Gilligan Student Union	73	Printer (Medium/Small)	220	No		
Gilligan Student Union	5	Printer/Copier (Large)	600	No		
Gilligan Student Union	8	Projector	240	No		
Gilligan Student Union	22	Refrigerator (Mini)	250	No		
Gilligan Student Union	1	Refrigerator (Residential)	450	No		
Gilligan Student Union	5	Television	224	No		
Gilligan Student Union	2	Water Cooler	192	No		
Cafeteria	1	Commercial Coffee Machine	5,700	No		
Gilligan Student Union	3	Server Closets	3,000	No		
Gilligan Student Union	14	Misc Equipment	1,000	No		

Vending Machine Inventory & Recommendations

Location	Existing Conditions		Proposed Conditions		Energy Impact & Financial Analysis						
	Quantity	Vending Machine Type	ECM #	Install Controls?	Total Peak kW Savings	Total Annual kWh Savings	Total Annual MMBtu Savings	Total Annual Energy Cost Savings	Estimated M&L Cost ($)	Total Incentives	Simple Payback w/ Incentives in Years
1st floor area	2	Glass Fronted Refrigerated	18	Yes	0.3	2,418	0	$269	$460	$100	1.3
Room 125	1	Glass Fronted Refrigerated	18	Yes	0.1	1,209	0	$134	$230	$50	1.3
1st floor area	1	Non-Refrigerated	18	Yes	0.0	343	0	$38	$230	$0	6.0
Room 125	1	Non-Refrigerated	18	Yes	0.0	343	0	$38	$230	$0	6.0

APPENDIX B: ENERGY STAR® STATEMENT OF ENERGY PERFORMANCE

Energy use intensity (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.

energy LEARN MORE AT energystar.gov

ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

Central Plant Buildings (10 Buildings + Plant)

Primary Property Type: College/University
Gross Floor Area (ft²): 928,185
Built: 1929

For Year Ending: December 31, 2019
Date Generated: December 12, 2021

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
Central Plant Buildings (10 Buildings + Plant) 2039 Kennedy Boulevard Jersey City, New Jersey 07305	New Jersey City University 2039 Kennedy Boulevard Grossnickle Hall, Suite 327 Jersey City, NJ 07305 (631) 334-1812	Andre Pearson 2039 Kennedy Boulevard Grossnickle Hall, Suite 327 Jersey City, NJ 07305 (631) 334-1812 apearson@njcu.edu

Property ID: 16905054

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
131.7 kBtu/ft²

Source EUI
218.7 kBtu/ft²

Annual Energy by Fuel	
Electric - Grid (kBtu)	42,641,944 (35%)
Natural Gas (kBtu)	79,599,191 (65%)

National Median Comparison	
National Median Site EUI (kBtu/ft²)	108.8
National Median Source EUI (kBtu/ft²)	180.6
% Diff from National Median Source EUI	21%
Annual Emissions	
Greenhouse Gas Emissions (Metric Tons CO2e/year)	8,187

Signature & Stamp of Verifying Professional

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

LP Signature: ________________________ Date: ___________

Licensed Professional

____ _________
,
(____)____-______
____

Professional Engineer or Registered Architect 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.
TREC	*Transition Incentive Renewable Energy Certificate:* a factorized renewable energy certificate 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.