



# Local Government Energy Audit Report

Elm St. Administration & Maintenance

October 25, 2024

*Prepared for:*

Westfield Board of Education

302 Elm St.

Westfield, New Jersey 07090

*Prepared by:*

TRC

317 George Street

New Brunswick, New Jersey 08901



## Disclaimer

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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 on 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.

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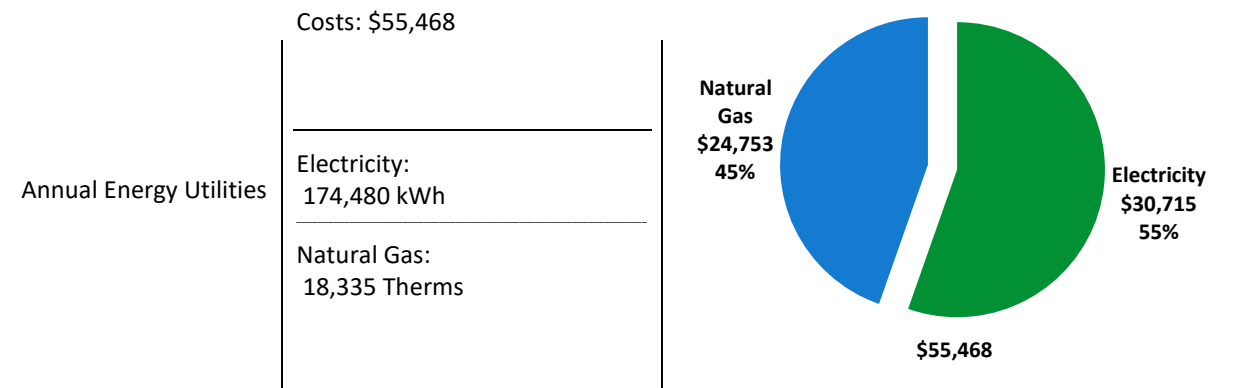


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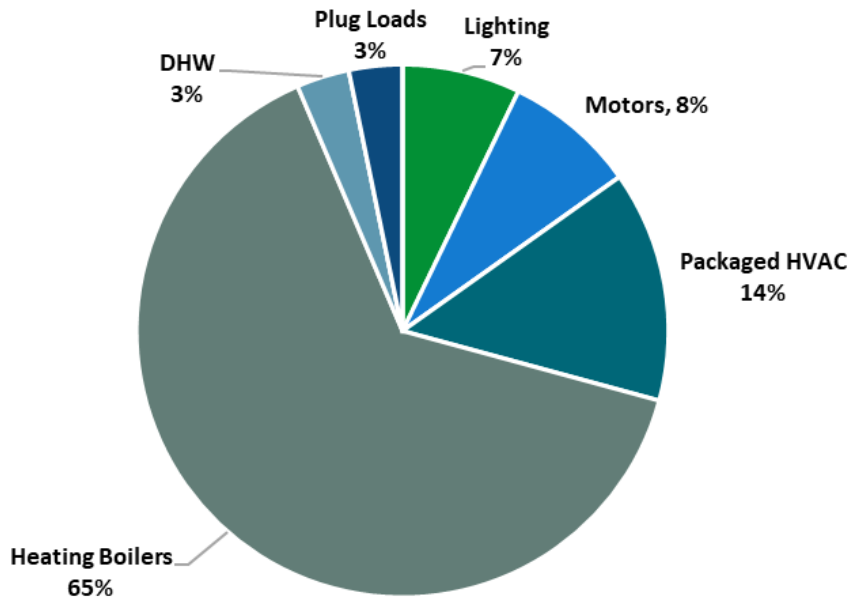
# 1 EXECUTIVE SUMMARY

The New Jersey Board of Public Utilities (NJBP) has sponsored this Local Government Energy Audit (LGEA) report for Elm St. Administration & Maintenance. 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



ENERGY STAR® Benchmarking Score	N/A <i>(1-100 scale)</i>	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.
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*Energy Use by System*

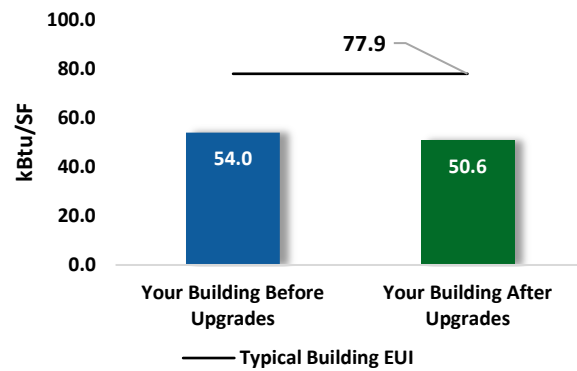
## POTENTIAL IMPROVEMENTS



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.

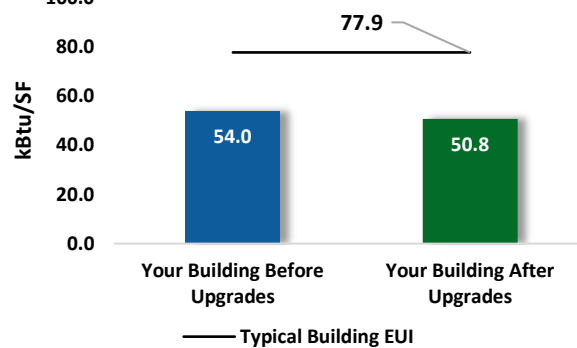
### Scenario 1: Full Package (All Evaluated Measures)

Installation Cost	\$40,680
Potential Rebates & Incentives <sup>1</sup>	\$4,850
Annual Cost Savings	\$4,774
Annual Energy Savings	Electricity: 21,132 kWh Natural Gas: 781 Therms
Greenhouse Gas Emission Savings	15 Tons
Simple Payback	7.5 Years
Site Energy Savings (All Utilities)	6%



### Scenario 2: Cost Effective Package<sup>2</sup>

Installation Cost	\$29,680
Potential Rebates & Incentives	\$4,650
Annual Cost Savings	\$4,511
Annual Energy Savings	Electricity: 19,953 kWh Natural Gas: 740 Therms
Greenhouse Gas Emission Savings	14 Tons
Simple Payback	5.5 Years
Site Energy Savings (all utilities)	6%



### On-site Generation Potential

Photovoltaic	None
Combined Heat and Power	None

<sup>1</sup> Incentives are based on previously run state rebate programs. Contact your utility provider for current program incentives that may apply.

<sup>2</sup> 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>			<b>6,867</b>	<b>1.4</b>	<b>-1</b>	<b>\$1,189</b>	<b>\$4,330</b>	<b>\$360</b>	<b>\$3,970</b>	<b>3.3</b>	<b>6,747</b>
ECM 1	Install LED Fixtures	Yes	154	0.0	0	\$27	\$380	\$10	\$370	13.8	152
ECM 2	Retrofit Fixtures with LED Lamps	Yes	3,243	1.1	-1	\$562	\$2,610	\$350	\$2,260	4.0	3,187
ECM 3	Install LED Exit Signs	Yes	3,469	0.3	-1	\$601	\$1,340	\$0	\$1,340	2.2	3,408
<b>Lighting Control Measures</b>			<b>12,914</b>	<b>3.3</b>	<b>-3</b>	<b>\$2,237</b>	<b>\$15,930</b>	<b>\$3,200</b>	<b>\$12,730</b>	<b>5.7</b>	<b>12,688</b>
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	11,400	2.9	-2	\$1,975	\$11,450	\$1,220	\$10,230	5.2	11,200
ECM 5	Install High/Low Lighting Controls	Yes	1,515	0.4	0	\$262	\$4,480	\$1,980	\$2,500	9.5	1,488
<b>Variable Frequency Drive (VFD) Measures</b>			<b>702</b>	<b>0.7</b>	<b>0</b>	<b>\$124</b>	<b>\$5,100</b>	<b>\$100</b>	<b>\$5,000</b>	<b>40.4</b>	<b>707</b>
ECM 6	Install Boiler Draft Fan VFDs	No	702	0.7	0	\$124	\$5,100	\$100	\$5,000	40.4	707
<b>Unitary HVAC Measures</b>			<b>477</b>	<b>0.3</b>	<b>0</b>	<b>\$84</b>	<b>\$4,300</b>	<b>\$0</b>	<b>\$4,300</b>	<b>51.2</b>	<b>480</b>
ECM 7	Install High Efficiency Air Conditioning Units	No	477	0.3	0	\$84	\$4,300	\$0	\$4,300	51.2	480
<b>Gas Heating (HVAC/Process) Replacement</b>			<b>0</b>	<b>0.0</b>	<b>65</b>	<b>\$884</b>	<b>\$8,900</b>	<b>\$1,000</b>	<b>\$7,900</b>	<b>8.9</b>	<b>7,667</b>
ECM 8	Install Infrared Heaters	Yes	0	0.0	65	\$884	\$8,900	\$1,000	\$7,900	8.9	7,667
<b>HVAC System Improvements</b>			<b>0</b>	<b>0.0</b>	<b>7</b>	<b>\$95</b>	<b>\$380</b>	<b>\$40</b>	<b>\$340</b>	<b>3.6</b>	<b>820</b>
ECM 9	Install Pipe Insulation	Yes	0	0.0	7	\$95	\$380	\$40	\$340	3.6	820
<b>Domestic Water Heating Upgrade</b>			<b>172</b>	<b>0.0</b>	<b>10</b>	<b>\$162</b>	<b>\$1,740</b>	<b>\$150</b>	<b>\$1,590</b>	<b>9.8</b>	<b>1,312</b>
ECM 10	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	4	\$56	\$1,600	\$100	\$1,500	27.0	482
ECM 11	Install Low-Flow DHW Devices	Yes	172	0.0	6	\$106	\$140	\$50	\$90	0.8	830
<b>TOTALS (COST EFFECTIVE MEASURES)</b>			<b>19,953</b>	<b>4.7</b>	<b>74</b>	<b>\$4,511</b>	<b>\$29,680</b>	<b>\$4,650</b>	<b>\$25,030</b>	<b>5.5</b>	<b>28,752</b>
<b>TOTALS (ALL MEASURES)</b>			<b>21,132</b>	<b>5.6</b>	<b>78</b>	<b>\$4,774</b>	<b>\$40,680</b>	<b>\$4,850</b>	<b>\$35,830</b>	<b>7.5</b>	<b>30,421</b>

\* - 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).

*All Evaluated Energy Improvements<sup>3</sup>*

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

<sup>3</sup> 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.



## 1.1 Planning Your Project

Careful planning makes for a successful energy project. When considering this scope of work, you will have some decision 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 and 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.

### Options from Your Utility Company

#### *Prescriptive and Custom Rebates*

For facilities wishing to pursue only selected individual measures (or planning to phase implementation of selected measures over multiple years), incentives are available through the Prescriptive and Custom Rebates program. To participate, you can use internal resources or an outside firm or contractor to perform the final design of the ECM(s) and install the equipment. Program pre-approval may be required for some incentives. Contact your utility company for more details prior to project installation.

#### *Direct Install*

The Direct Install program provides turnkey installation of multiple measures through an authorized contractor. This program can provide incentives up to 70% or 80% of the cost of selected measures. A Direct Install contractor will assess and verify individual measure eligibility and perform the installation work. The Direct Install program is available to sites with an average peak demand of less than 200 kW.

#### *Engineered Solutions*

The Engineered Solutions program provides tailored energy-efficiency assistance and turnkey engineering services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. The program provides all professional services from audit, design, construction administration, to commissioning and measurement and verification for custom whole-building energy-efficiency projects. Engineered Solutions allows you to install as many measures as possible under a single project as well as address measures that may not qualify for other programs.

For more details on these programs please contact your utility provider.

## **Options from New Jersey's Clean Energy Program**

### *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 is designed to promote self-investment in energy efficiency for the largest energy consumers in the state. Customers in this category spend about \$5 million a year on energy bills. This program 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.

For more details on these programs please visit [New Jersey's Clean Energy Program website](#).



## 2 EXISTING CONDITIONS

The New Jersey Board of Public Utilities (NJBP) has sponsored this Local Government Energy Audit (LGEA) report for Elm St. Administration & Maintenance. 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 March 13, 2024, TRC performed an energy audit at Elm St. Administration & Maintenance located in Westfield, New Jersey. TRC met with Sean McArthur to review the facility operations and help focus our investigation on specific energy-using systems.

There are two buildings in this facility, the Administration Building and a separate maintenance garage. Elm St. Administration and Maintenance is a multi-story, 45,000 square foot facility built in 1914 with the garage added later. The buildings share one electric and one gas meter. Spaces include offices, cafeteria, corridors, stairwells, storage areas, lobby, restrooms, and garage.

#### **Recent Improvements and Facility Concerns**

The facility has replaced most of its fluorescent fixtures with LED fixtures. Facility concerns include roof leakage and high electric bills.

### 2.2 Building Occupancy

The facility is occupied Monday through Friday during regular business hours. Janitorial services are performed after hours.

Building Name	Weekday/Weekend	Operating Schedule
Elm Street Administration & Garage	Weekday	7:00 AM- 6:00 PM
	Weekend	N/A

*Building Occupancy Schedule*

### 2.3 Building Envelope

Building walls are made from bricks. Roof areas are flat and covered with white membrane, and in fair condition.

Most of the windows are single pane and have metal frames. The glass-to-frame seals are in fair condition. The operable window weather seals are in fair condition, showing little evidence of excessive wear. Exterior doors have aluminum frames and are in fair condition with worn door seals. The garage building has rollup doors. Degraded window and door seals increase drafts and outside air infiltration.



*Rooftop*



*Doors*



*Facade*



*Window*

## 2.4 Lighting Systems

The primary interior lighting system uses linear LED lamps. There are also several 32-Watt T8 fixtures, compact fluorescent lamps (CFL), LED screw in lamps, and a metal halide fixture. Fixture types include 2-lamp, 3-lamp, or 4-lamp, 2-foot or 4-foot-long fixtures.

All exit signs are incandescent. Most fixtures are in fair condition. Interior lighting levels were generally sufficient.

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



*Incandescent Exit Sign*



*Garage LED High Bay Fixture*



*CFL Fixture*



*LED Linear Lamps*

Exterior fixtures include wall packs and floodlights with LED lamps, and the pole mounted flood fixtures incorporate LED lamps. Exterior light fixtures are controlled by a time clock.



*Floodlight*



*Wall Pack*



*LED Lamp*



*LED Lamp*

## 2.5 Air Handling Systems

### Unit Ventilators

Unit ventilators supply heating and ventilation to offices and other areas. They are equipped with supply fan motors connected to the steam distribution system. They provide heating and ventilation to the offices. This system is original to the building and appears to be in fair operating condition.

### Unitary Electric HVAC Equipment

Some of the offices are cooled by window air conditioning (AC) units. These are about 0.5 tons in capacity and vary between poor and fair condition. They range in efficiency between 9.8 EER to 10.88 EER. Several units are not ENERGY STAR labeled.



*Window AC #1*



*Window AC #2*

Some office areas are conditioned by split air conditioning (AC) and heat pump (HP) systems. These are all operating within their useful life, in fair condition, and are standard efficiency.

AC unit cooling capacities range between 2 tons and 5 tons with energy efficiency ratings (EER) ranging between 13 EER and 18 EER. Air source heat pump (HP) cooling capacities range between 0.75 tons and 2 ton, with heating capacities between 2.63 MBh and 10.71 MBh and heating seasonal performance factors between 10.6 and 13.



*Split system AC unit*



*Split air source Heat pump*

### **Unitary Heating Equipment**

Some offices and the conference room are heated by electric resistance heaters. These are about 1.5 kW in capacity. The units are in fair condition. Equipment is controlled by a manual dial thermostat.



*Electric Resistance Heater*



*Electric Resistance Heater*

### **Gas Fired Unit Heaters**

The garage area is heated by two suspended gas-fired unit heaters, each with a heating capacity of about 100 MBh. This equipment is operating beyond its useful life and is in poor condition. The units are controlled by a manual dial thermostat located within the space.

The temperature set point was set higher than the actual space temperature since the existing equipment cannot adequately meet the heating load. This is likely due to the age and condition of the units, and their replacement should be considered. Infrared heating is in general a recommended approach to provide heat to persons working in large open spaces.



Unit Heater

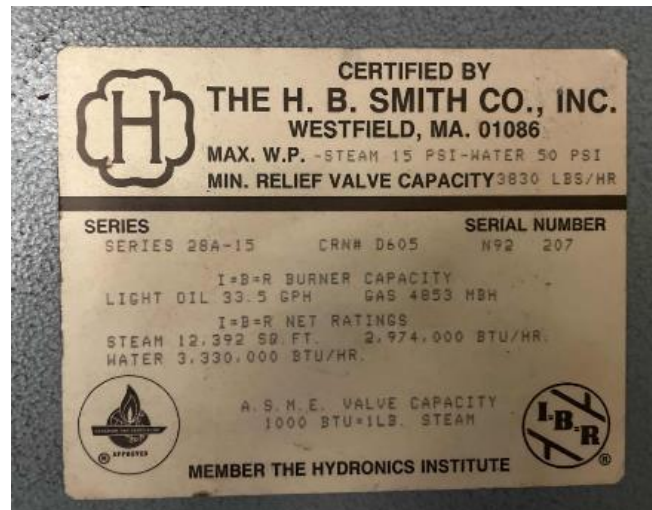
## 2.6 Heating Hot Water and Steam Systems

One HB Smith 2,974 MBh steam boiler serves the building's heating load. Installed in 1992, the boiler is in fair condition. There is a service contract in place. The 2.0 hp combustion air fan is non-modulating and is in fair condition. Two condensate pumps return condensate to supplement feedwater.

The steam boiler serves the building heating load through unit ventilators throughout the main building. The boiler is controlled by a timer to supply heating hot water during the day when the building is occupied and is set to a lower temperature when the building is unoccupied.



Steam Boiler



Boiler Nameplate





Combustion Air Fan



Steam Boiler Controls

## 2.7 Domestic Hot Water

Hot water for the main building is produced by a 50 gallon, 40 MBh gas-fired storage water heater with an efficiency rating of 80%. The domestic hot water pipes are not insulated. One, 0.04 hp circulation pump distributes water to end uses. The circulation pump operates continuously.

Hot water for the garage is produced by a 25-gallon, 1.5 kW electric storage water heater.



DHW (Main)



DHW (Garage)

## 2.8 Plug Load and Vending Machines

The location is doing a great job managing the electrical plug loads. This report makes additional suggestions for ECMs in this area as well as energy efficient best practices.

There are 92 computer workstations throughout the facility. Plug loads include general cafe and office equipment.

There are several residential-style refrigerators throughout the building that are used to store perishables. These vary in condition and efficiency.



*Desktop*



*Television*



*Refrigerator*



*Water Cooler*

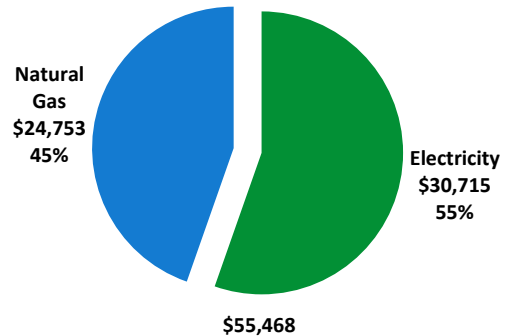
## 2.9 Water-Using Systems

EPA WaterSense® has set maximum flow rates for sanitary fixtures. They are: 1.28 gallons per flush (gpf) for toilets, 0.5 gpf for urinals, 1.5 gallons per minute (gpm) for lavatory faucets, and 2.0 gpm for showerheads. There are four restrooms with toilets, urinals, and sinks. Faucet flow rates are at 2.2 gpm or higher.

### 3 ENERGY USE AND COSTS

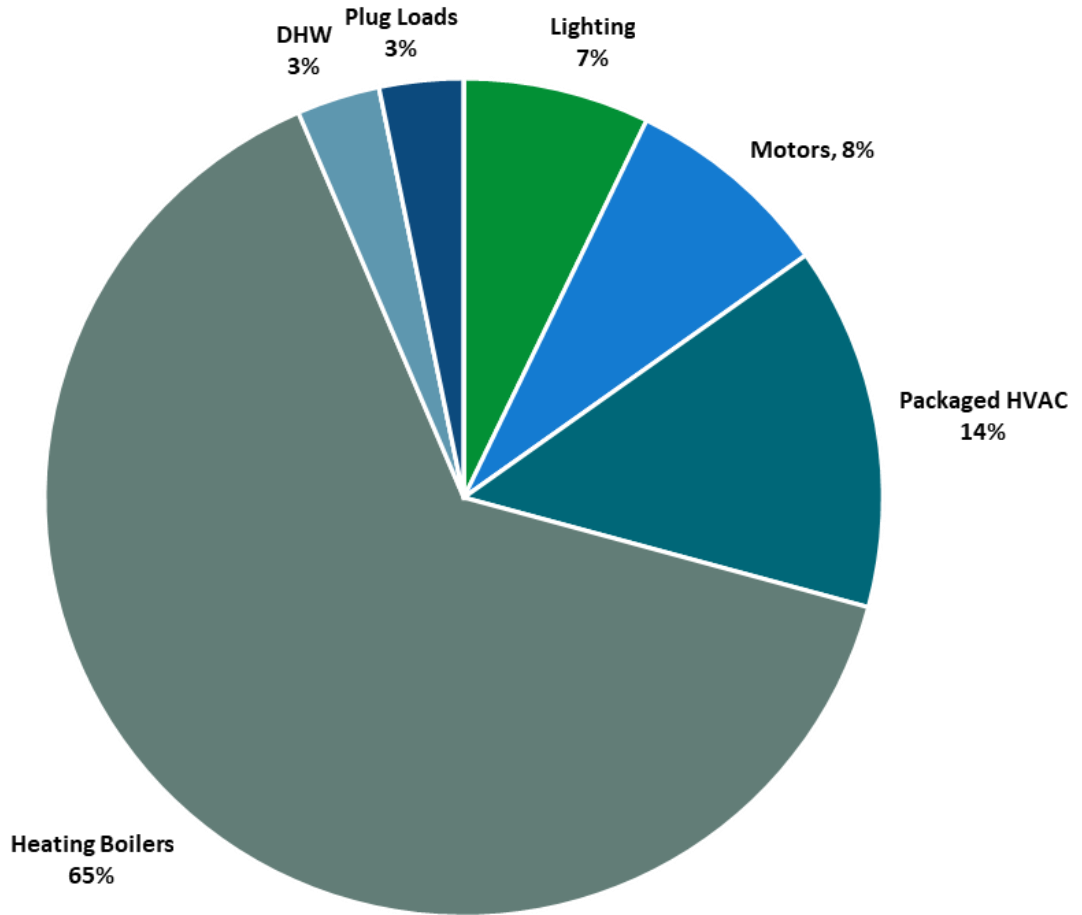
Twelve months of utility billing data are used to develop annual energy consumption and cost data. This information creates a profile of the annual energy consumption and energy costs.

Utility Summary		
Fuel	Usage	Cost
Electricity	174,480 kWh	\$30,715
Natural Gas	18,335 Therms	\$24,753
<b>Total</b>		<b>\$55,468</b>



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.

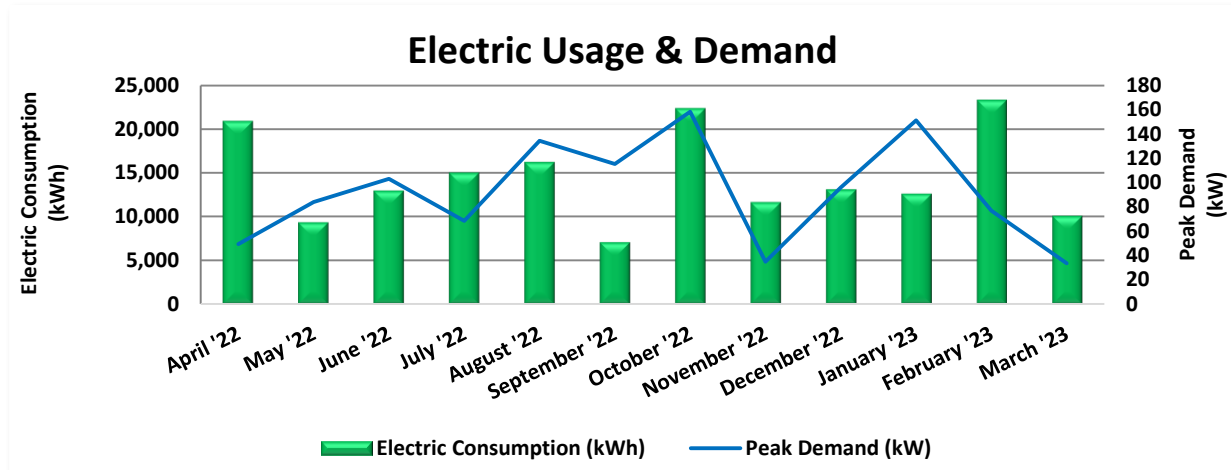
The energy auditor collects information regarding equipment operating hours, capacity, efficiency, and other operational parameters from facility staff, drawings, and on-site observations. This information is used as the inputs to calculate the existing conditions energy use for the site. The calculated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



*Energy Balance by System*

### 3.1 Electricity

PSE&G delivers electricity under rate class General Lighting & Power, with electric production provided by Constellation, a third-party supplier.



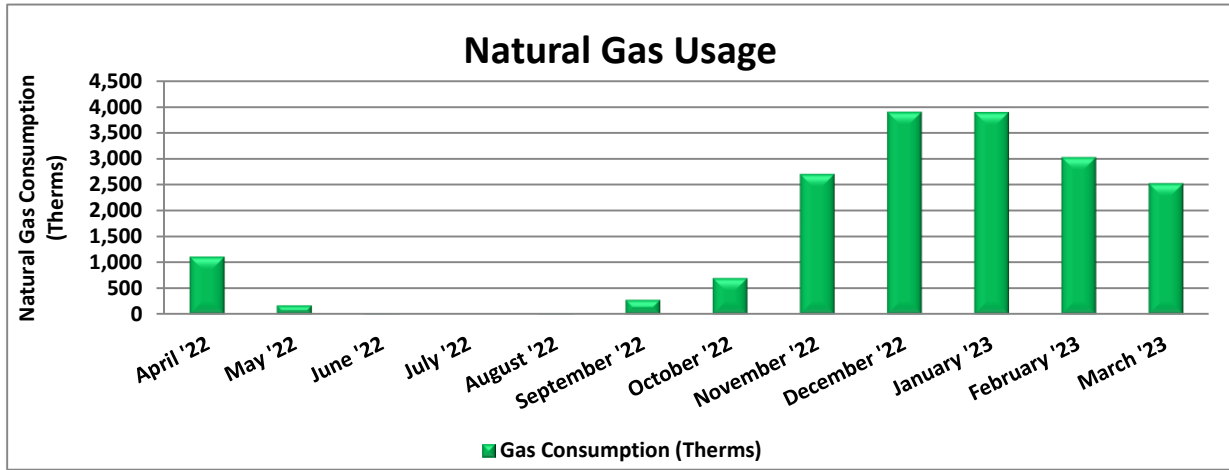
Electric Billing Data					
Period Ending	Days in Period	Electric Usage (kWh)	Demand (kW)	Demand Cost	Total Electric Cost
5/4/22	30	20,880	49	\$389	\$2,517
6/3/22	30	9,360	84	\$166	\$1,316
7/5/22	32	12,960	103	\$743	\$2,510
8/3/22	29	15,000	68	\$1,001	\$2,821
9/1/22	29	16,200	134	\$984	\$2,882
10/3/22	32	7,080	115	\$843	\$2,158
11/1/22	29	22,320	158	\$492	\$4,250
12/2/22	31	11,640	35	\$162	\$1,846
1/4/23	33	13,080	96	\$224	\$2,215
2/2/23	29	12,600	151	\$235	\$2,171
3/6/23	32	23,280	77	\$358	\$4,094
4/4/23	29	10,080	34	\$157	\$1,934
<b>Totals</b>	<b>365</b>	<b>174,480</b>	<b>158</b>	<b>\$5,755</b>	<b>\$30,715</b>
<b>Annual</b>	<b>365</b>	<b>174,480</b>	<b>158</b>	<b>\$5,755</b>	<b>\$30,715</b>

Notes:

- Peak demand of 158 kW occurred in October '22.
- Average demand over the past 12 months was 92 kW.
- The average electric cost over the past 12 months was \$0.176/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

Elizabethtown Gas delivers natural gas under rate class General Delivery Service- Transportation, 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
5/5/22	29	1,113	\$1,516
6/7/22	33	177	\$517
7/6/22	29	1	\$297
8/8/22	33	0	\$296
9/7/22	30	9	\$326
10/6/22	29	280	\$758
11/4/22	29	700	\$1,213
12/6/22	32	2,703	\$3,417
1/6/23	31	3,904	\$5,212
2/6/23	31	3,895	\$4,801
3/7/23	29	3,028	\$3,599
4/6/23	30	2,524	\$2,803
<b>Totals</b>	<b>365</b>	<b>18,335</b>	<b>\$24,753</b>
<b>Annual</b>	<b>365</b>	<b>18,335</b>	<b>\$24,753</b>

Notes:

- The average gas cost for the past 12 months is \$1.350/therm, which is the blended rate used throughout the analysis.

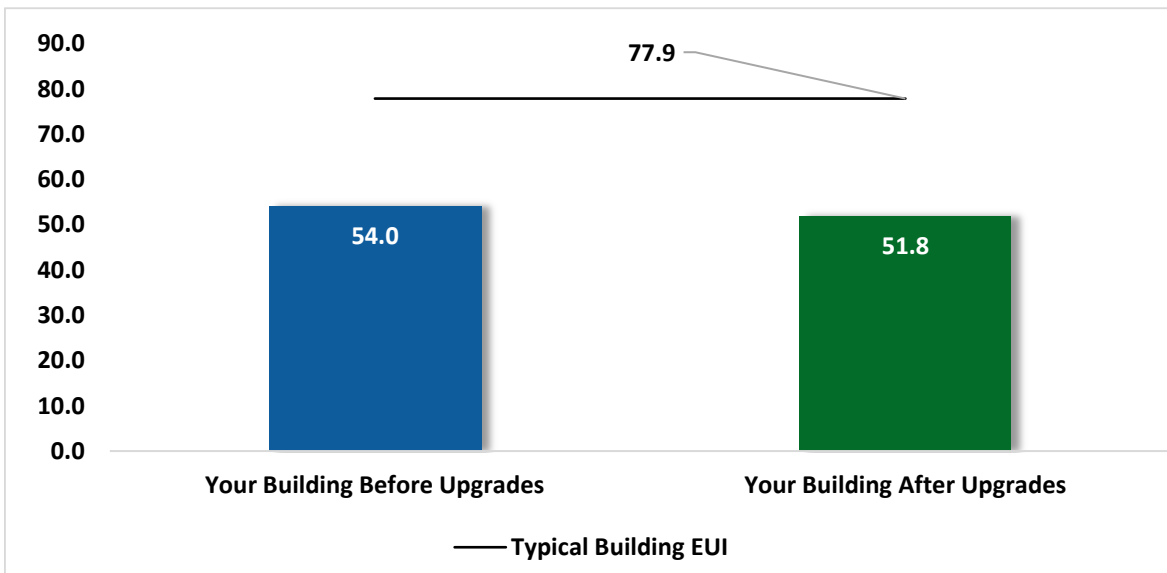
### 3.3 Benchmarking

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.

<b>Benchmarking Score</b>	<b>N/A</b>
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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 Comparison<sup>4</sup>*

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.

<sup>4</sup> Based on all evaluated ECMs

## **Tracking your Energy Performance**

Keeping track of your energy and water use on a monthly basis is one of the best ways to keep utility costs in check and keep your facility operating efficiently. 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 have already entered the monthly utility data shown above for you. Account login information for your account will be sent via email.**

Free online training is available to help you use ENERGY STAR Portfolio Manager to track your building's performance at: <https://www.energystar.gov/buildings/training>.

For more information on ENERGY STAR and Portfolio Manager, visit their [website](#).

## 3.4 Understanding Your Utility Bills

The State of New Jersey Department of the Public Advocate provides detailed information on how to read natural gas and electric bills. Your bills contain important information including account numbers, meter numbers, rate schedules, meter readings, and the supply and delivery charges. Gas and electric bills both provide comparisons of current energy consumption with prior usage.

Sample bills, with annotation, may be viewed at:

[https://www.nj.gov/rpa/docs/Understanding\\_Electric\\_Bill.pdf](https://www.nj.gov/rpa/docs/Understanding_Electric_Bill.pdf)

[https://www.nj.gov/rpa/docs/Understanding\\_Gas\\_Bill.pdf](https://www.nj.gov/rpa/docs/Understanding_Gas_Bill.pdf)

### **Why Utility Bills Vary**

Utility bills vary from one month to another for many reasons. For this reason, assessing the effects of your energy savings efforts can be difficult.

Billing periods vary, typically ranging between 28 and 33 days. Electric bills provide the kilowatt-hours (kWh) used per month while gas bills provide therms (or hundreds of cubic feet - CCF) per month consumption information. Monthly consumption information can be helpful as a tool to assess your efforts to reduce energy, particularly when compared to monthly usage from a similar calendar period in a prior year.

Bills typically vary seasonally, often with more gas consumed in the winter for heating, and more electricity used in the summer when air conditioning is used. Facilities with electric heating may experience higher electricity use in the winter. Seasonal variance will be impacted by the type of heating and cooling systems used. Normal seasonal fluctuations are further impacted by the weather. Extremely cold or hot weathers causes HVAC equipment to run longer, increasing usage. Other monthly fluctuations in usage can be caused by changes in building occupancy. Utility bills provide a comparison of usage between the current period and comparable billing month period of the prior year. Year-to-year monthly use comparisons can point to trends with energy savings for measures/projects that were implemented within the timeframe, but these comparisons do not account for changing weather or occupancy patterns.

The price of fuel and purchased power used to produce and delivery electricity and gas fluctuates. Any increase or decrease in these costs will be reflected in your monthly bill. Additionally, billing rates occasionally change after justification and approval of the NJBPU. For this reason, it is more useful to review energy use rather than cost when assessing energy use trends or the impact of energy conservation measures implemented.



## 4 ENERGY CONSERVATION MEASURES

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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 in this report are based on the previously run state rebate program SmartStart, which has been retired. Now, all investor-owned gas and electric utility companies are offering complementary energy efficiency programs directly to their customers. Some measures and proposed upgrades may be eligible for higher incentives than those shown below. The incentives in the summary tables should be used for high-level planning purposes. To verify incentives, reach out to your utility provider or visit the [NJCEP website](#) for more information.

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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>			<b>6,867</b>	<b>1.4</b>	<b>-1</b>	<b>\$1,189</b>	<b>\$4,330</b>	<b>\$360</b>	<b>\$3,970</b>	<b>3.3</b>	<b>6,747</b>
ECM 1	Install LED Fixtures	Yes	154	0.0	0	\$27	\$380	\$10	\$370	13.8	152
ECM 2	Retrofit Fixtures with LED Lamps	Yes	3,243	1.1	-1	\$562	\$2,610	\$350	\$2,260	4.0	3,187
ECM 3	Install LED Exit Signs	Yes	3,469	0.3	-1	\$601	\$1,340	\$0	\$1,340	2.2	3,408
<b>Lighting Control Measures</b>			<b>12,914</b>	<b>3.3</b>	<b>-3</b>	<b>\$2,237</b>	<b>\$15,930</b>	<b>\$3,200</b>	<b>\$12,730</b>	<b>5.7</b>	<b>12,688</b>
ECM 4	Install Occupancy Sensor Lighting Controls	Yes	11,400	2.9	-2	\$1,975	\$11,450	\$1,220	\$10,230	5.2	11,200
ECM 5	Install High/Low Lighting Controls	Yes	1,515	0.4	0	\$262	\$4,480	\$1,980	\$2,500	9.5	1,488
<b>Variable Frequency Drive (VFD) Measures</b>			<b>702</b>	<b>0.7</b>	<b>0</b>	<b>\$124</b>	<b>\$5,100</b>	<b>\$100</b>	<b>\$5,000</b>	<b>40.4</b>	<b>707</b>
ECM 6	Install Boiler Draft Fan VFDs	No	702	0.7	0	\$124	\$5,100	\$100	\$5,000	40.4	707
<b>Unitary HVAC Measures</b>			<b>477</b>	<b>0.3</b>	<b>0</b>	<b>\$84</b>	<b>\$4,300</b>	<b>\$0</b>	<b>\$4,300</b>	<b>51.2</b>	<b>480</b>
ECM 7	Install High Efficiency Air Conditioning Units	No	477	0.3	0	\$84	\$4,300	\$0	\$4,300	51.2	480
<b>Gas Heating (HVAC/Process) Replacement</b>			<b>0</b>	<b>0.0</b>	<b>65</b>	<b>\$884</b>	<b>\$8,900</b>	<b>\$1,000</b>	<b>\$7,900</b>	<b>8.9</b>	<b>7,667</b>
ECM 8	Install Infrared Heaters	Yes	0	0.0	65	\$884	\$8,900	\$1,000	\$7,900	8.9	7,667
<b>HVAC System Improvements</b>			<b>0</b>	<b>0.0</b>	<b>7</b>	<b>\$95</b>	<b>\$380</b>	<b>\$40</b>	<b>\$340</b>	<b>3.6</b>	<b>820</b>
ECM 9	Install Pipe Insulation	Yes	0	0.0	7	\$95	\$380	\$40	\$340	3.6	820
<b>Domestic Water Heating Upgrade</b>			<b>172</b>	<b>0.0</b>	<b>10</b>	<b>\$162</b>	<b>\$1,740</b>	<b>\$150</b>	<b>\$1,590</b>	<b>9.8</b>	<b>1,312</b>
ECM 10	Install High Efficiency Gas-Fired Water Heater	No	0	0.0	4	\$56	\$1,600	\$100	\$1,500	27.0	482
ECM 11	Install Low-Flow DHW Devices	Yes	172	0.0	6	\$106	\$140	\$50	\$90	0.8	830
<b>TOTALS</b>			<b>21,132</b>	<b>5.6</b>	<b>78</b>	<b>\$4,774</b>	<b>\$40,680</b>	<b>\$4,850</b>	<b>\$35,830</b>	<b>7.5</b>	<b>30,421</b>

\* - 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).

*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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>6,867</b>	<b>1.4</b>	<b>-1</b>	<b>\$1,189</b>	<b>\$4,330</b>	<b>\$360</b>	<b>\$3,970</b>	<b>3.3</b>	<b>6,747</b>
ECM 1	Install LED Fixtures	154	0.0	0	\$27	\$380	\$10	\$370	13.8	152
ECM 2	Retrofit Fixtures with LED Lamps	3,243	1.1	-1	\$562	\$2,610	\$350	\$2,260	4.0	3,187
ECM 3	Install LED Exit Signs	3,469	0.3	-1	\$601	\$1,340	\$0	\$1,340	2.2	3,408
<b>Lighting Control Measures</b>		<b>12,914</b>	<b>3.3</b>	<b>-3</b>	<b>\$2,237</b>	<b>\$15,930</b>	<b>\$3,200</b>	<b>\$12,730</b>	<b>5.7</b>	<b>12,688</b>
ECM 4	Install Occupancy Sensor Lighting Controls	11,400	2.9	-2	\$1,975	\$11,450	\$1,220	\$10,230	5.2	11,200
ECM 5	Install High/Low Lighting Controls	1,515	0.4	0	\$262	\$4,480	\$1,980	\$2,500	9.5	1,488
<b>Gas Heating (HVAC/Process) Replacement</b>		<b>0</b>	<b>0.0</b>	<b>65</b>	<b>\$884</b>	<b>\$8,900</b>	<b>\$1,000</b>	<b>\$7,900</b>	<b>8.9</b>	<b>7,667</b>
ECM 8	Install Infrared Heaters	0	0.0	65	\$884	\$8,900	\$1,000	\$7,900	8.9	7,667
<b>HVAC System Improvements</b>		<b>0</b>	<b>0.0</b>	<b>7</b>	<b>\$95</b>	<b>\$380</b>	<b>\$40</b>	<b>\$340</b>	<b>3.6</b>	<b>820</b>
ECM 9	Install Pipe Insulation	0	0.0	7	\$95	\$380	\$40	\$340	3.6	820
<b>Domestic Water Heating Upgrade</b>		<b>172</b>	<b>0.0</b>	<b>6</b>	<b>\$106</b>	<b>\$140</b>	<b>\$50</b>	<b>\$90</b>	<b>0.8</b>	<b>830</b>
ECM 11	Install Low-Flow DHW Devices	172	0.0	6	\$106	\$140	\$50	\$90	0.8	830
<b>TOTALS</b>		<b>19,953</b>	<b>4.7</b>	<b>74</b>	<b>\$4,511</b>	<b>\$29,680</b>	<b>\$4,650</b>	<b>\$25,030</b>	<b>5.5</b>	<b>28,752</b>

\* - 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).

*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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Upgrades</b>		<b>6,867</b>	<b>1.4</b>	<b>-1</b>	<b>\$1,189</b>	<b>\$3,410</b>	<b>\$360</b>	<b>\$3,050</b>	<b>2.6</b>	<b>6,747</b>
ECM 1	Install LED Fixtures	154	0.0	0	\$27	\$300	\$10	\$290	10.8	152
ECM 2	Retrofit Fixtures with LED Lamps	3,243	1.1	-1	\$562	\$2,060	\$350	\$1,710	3.0	3,187
ECM 3	Install LED Exit Signs	3,469	0.3	-1	\$601	\$1,050	\$0	\$1,050	1.7	3,408

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 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.

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:** corridor 4

### **ECM 2: Retrofit Fixtures with LED Lamps**

Replace linear and compact fluorescent 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:** lobby 1, mechanical 1, stairs 3, storage 2, office 1, and corridor 2

### **ECM 3: Install LED Exit Signs**

Replace incandescent exit signs with LED exit signs. LED exit signs require virtually no maintenance and have a life expectancy of at least 20 years. This measure saves energy by installing LED fixtures, which use less power than other technologies with an equivalent lighting output. Maintenance savings and improved reliability may also be achieved, as the longer-lasting LED lamps will not need to be replaced as often as the existing lamps.

## 4.2 Lighting Controls

#	Energy Conservation Measure	Annual Electric Savings (kWh)	Peak Demand Savings (kW)	Annual Fuel Savings (MMBtu)	Annual Energy Cost Savings (\$)	Estimated M&L Cost (\$)	Estimated Incentive (\$)*	Estimated Net M&L Cost (\$)	Simple Payback Period (yrs)**	CO <sub>2</sub> e Emissions Reduction (lbs)
<b>Lighting Control Measures</b>		<b>12,914</b>	<b>3.3</b>	<b>-3</b>	<b>\$2,237</b>	<b>\$15,930</b>	<b>\$3,200</b>	<b>\$12,730</b>	<b>5.7</b>	<b>12,688</b>
ECM 4	Install Occupancy Sensor Lighting Controls	11,400	2.9	-2	\$1,975	\$11,450	\$1,220	\$10,230	5.2	11,200
ECM 5	Install High/Low Lighting Controls	1,515	0.4	0	\$262	\$4,480	\$1,980	\$2,500	9.5	1,488

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 rooms, restrooms, and storage areas

### **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:** corridors and stairwells

### 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Variable Frequency Drive (VFD) Measures</b>		<b>702</b>	<b>0.7</b>	<b>0</b>	<b>\$124</b>	<b>\$4,500</b>	<b>\$100</b>	<b>\$4,400</b>	<b>35.6</b>	<b>707</b>
ECM 7	Install Boiler Draft Fan VFDs	702	0.7	0	\$124	\$4,500	\$100	\$4,400	35.6	707

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 Boiler Draft Fan VFDs**

We evaluated replacing the existing volume control devices on boiler draft fans, such as inlet vanes or dampers, with VFDs. Inlet vanes or dampers are an inefficient means of controlling the air volume compared to VFDs. The existing volume control device will be removed or permanently disabled, and the control signal will be redirected to the VFD to determine proper fan motor speed.

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

Additional maintenance savings may result from this measure. VFDs are solid state electronic devices, which generally require less maintenance than mechanical air volume control devices.

### 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Unitary HVAC Measures</b>		<b>477</b>	<b>0.3</b>	<b>0</b>	<b>\$84</b>	<b>\$4,000</b>	<b>\$0</b>	<b>\$4,000</b>	<b>47.6</b>	<b>480</b>
ECM 8	Install High Efficiency Air Conditioning Units	477	0.3	0	\$84	\$4,000	\$0	\$4,000	47.6	480

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 AC units are eventually replaced, consider purchasing equipment that exceeds the minimum efficiency required by building codes.

#### **ECM 7: Install High Efficiency Air Conditioning Units**

We evaluated replacing standard efficiency packaged air conditioning units with high efficiency packaged air conditioning units. 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:** five older window AC units located in offices

## 4.5 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Gas Heating (HVAC/Process) Replacement</b>		<b>0</b>	<b>0.0</b>	<b>65</b>	<b>\$884</b>	<b>\$8,900</b>	<b>\$1,000</b>	<b>\$7,900</b>	<b>8.9</b>	<b>7,667</b>
ECM 8	Install Infrared Heaters	0	0.0	65	\$884	\$8,900	\$1,000	\$7,900	8.9	7,667

### **ECM 8: Install Infrared Heaters**

Replace forced air heating equipment with low-intensity infrared heating units with an enclosed flame, rather than an open flame on a ceramic or metal surface.

Forced air furnaces heat all of the air in the space served, which is inefficient for large volume spaces with relatively few occupants, areas with high ceilings, or areas with high outside air infiltration. Infrared heaters heat objects and surfaces directly, including the occupants of the space, rather than heating large volumes of air. Infrared heaters also heat the floor, which then re-radiates the heat. As a result, infrared heaters are more effective and efficient at maintaining occupant comfort at significantly lower cost for certain space types.

For the purposes of this report, the proposed capacity of the infrared heaters is 80% of the existing capacity for forced air heating equipment. This is a conservative estimate based on collaboration with an expert in infrared heating technology. We recommend that you work with a mechanical contractor who specializes in the installation of infrared heaters for exact system sizing and costs.

**Affected Building Areas:** garage 1

## 4.6 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>HVAC System Improvements</b>		<b>0</b>	<b>0.0</b>	<b>7</b>	<b>\$95</b>	<b>\$380</b>	<b>\$40</b>	<b>\$340</b>	<b>3.6</b>	<b>820</b>
ECM 9	Install Pipe Insulation	0	0.0	7	\$95	\$380	\$40	\$340	3.6	820

### **ECM 9: Install Pipe Insulation**

Install insulation on domestic hot water system piping. Distribution system thermal losses are dependent on system fluid temperature, the size of the distribution system, and the extent and condition of piping insulation. When the insulation has been damaged due to exposure to water, when the insulation has been removed from some areas of the pipe, or when valves have not been properly insulated, system thermal efficiency can be significantly reduced. This measure saves energy by reducing heat transfer in the distribution system.

**Affected Systems:** domestic hot water piping

## 4.7 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 <sub>2</sub> e Emissions Reduction (lbs)
<b>Domestic Water Heating Upgrade</b>		<b>172</b>	<b>0.0</b>	<b>10</b>	<b>\$162</b>	<b>\$1,740</b>	<b>\$150</b>	<b>\$1,590</b>	<b>9.8</b>	<b>1,312</b>
ECM 10	Install High Efficiency Gas-Fired Water Heater	0	0.0	4	\$56	\$1,600	\$100	\$1,500	27.0	482
ECM 11	Install Low-Flow DHW Devices	172	0.0	6	\$106	\$140	\$50	\$90	0.8	830

### **ECM 10: Install High Efficiency Gas-Fired Water Heater**

We evaluated replacing the existing tank water heater with a high efficiency condensing tank water heater. Energy savings result from the increased efficiency of the unit, which uses less gas to heat water, and fewer operating hours to maintain the tank water temperature.

### **ECM 11: 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.

## 4.8 Measures for Future Consideration

There are additional opportunities for improvement that Westfield Board of Education may wish to consider. These potential upgrades typically require further analysis, involve substantial capital investment, and/or include significant system reconfiguration. These measure(s) are therefore beyond the scope of this energy audit. These measure(s) are described here to support a whole building approach to energy efficiency and sustainability.

Westfield Board of Education may wish to consider the Energy Savings Improvement Program (ESIP) or other whole building approach. With interest in implementing comprehensive, largescale and/or complex system wide projects, these measures may be pursued during development of a future energy savings plan. We recommend that you work with your energy service company (ESCO) and/or design team to:

- Evaluate these measures further.
- Develop firm costs.
- Determine measure savings.
- Prepare detailed implementation plans.



Other modernization or capital improvement funds may be leveraged for these types of refurbishments. As you plan for capital upgrades, be sure to consider the energy impact of the building systems and controls being specified.

### **Heating System Conversion from Steam to Hot Water**

Replacing the steam boilers and heat exchangers with natural gas fired high-efficiency water boilers was of interest to facility personnel. This type of system upgrade/conversion has significant up-front capital costs. However, there are benefits with modular hot water boiler system designs with advanced control strategies. Advantages associated with configuring a boiler plant around several modular boilers include the better system performance at low load conditions, and the modular boilers will often take less space than multiple old large boilers.

Steam and condensate return piping will need to be capped off, removed, or replaced in most cases. If distribution systems are mainly hydronic, replacing a steam boiler will likely be more cost effective than for situations where steam is supplied to the end uses, for instance, where steam coils or fin tube radiators are used. In such cases, end use distribution points will need to be modified to accommodate the circulation of hot water.

As the existing boilers are approaching the end of their useful life, it is recommended that reconfiguring the boiler plant be further evaluated. We recommend that you work with your mechanical design team to select boilers that are sized appropriately for the heating load.

Replacing the boilers has a long payback, and it may not be justifiable based simply on energy considerations. However, the boilers have reached the end of their normal useful life, and the facility has reported an interest in converting from steam to hot water. We also recommend working with your mechanical design team to determine whether a hot water heating system can operate with return water temperatures below 130°F, which would allow for operating condensing boilers at efficiencies above 90%. Energy savings results from improved combustion efficiency and reduced standby losses at low loads. Further analysis should be conducted for the feasibility of this measure. This measure is a capital improvement measure for future consideration.

### **Upgrade to a Heat Pump System**

Electric resistance heating units work by passing an electric current through wires to heat them. The system is 100% efficient since for every unit of electricity consumed, one unit of heat is produced.

But there is a way to convert electricity to create heat at better than a 1:1 ratio. Heat pumps operate on a more efficient principle, the refrigeration cycle. Instead of directly converting electricity to heat, electricity does the work, via a compressor, of moving refrigerant through a system that transfers heat from a cooler place to a warmer place. That system can move three to five as much energy as is available using electric resistance heating methods. Heat pumps work in a similar manner to an air conditioner, except they reverse the cooling process to circulate warm air instead of cold air. Also, heat pumps are generally capable of dispensing refrigerated air as they can typically be operated in air conditioning mode.

An electric furnace or boiler has no flue loss through a chimney. The AFUE rating for an all-electric furnace or boiler is between 95% and 100%. The lower values are for units installed outdoors because they have greater jacket heat loss. However, despite their high efficiency, the higher cost of electricity in most parts of the country makes all-electric furnaces or boilers an uneconomic choice. If you are interested in electric heating, consider installing a heat pump system.

Electric resistance heat, including electric furnaces and baseboard heaters, can be inexpensive to install but often expensive to run. Facilities with these systems can save substantial energy at a moderate cost by installing a heat pump when they replace a central air conditioner.

Even in buildings without central air-conditioning, there are opportunities to save energy when an existing electric furnace needs to be replaced, as well as opportunities to install ductless electric heat pumps in buildings with baseboard electric heaters and electric fan coils. Unit ventilators with built-in electric resistance heaters can be replaced with unit ventilators with integrated heat pumps.

Electric heat pumps have high coefficient of performance (COP) ratings and are substantially more efficient than traditional electric heating systems. Further investigation is required to determine whether installing a heat pump system is a cost-effective solution when replacing existing electrical heating systems.

### **Window Replacements**

Energy efficient windows are an important consideration when improving the building envelope. The heat transfer through the glass panes is responsible for a significant portion of the facility's heating and cooling energy consumption. We recommend replacing single-pane windows with double-pane windows, and we recommend models that are gas-filled with low-e coatings to reduce heat loss. Windows should be selected with low U-factors to maximize energy savings. The U-factor is the rate at which the window conducts non-solar heat flow and is a key indicator of performance. The lower the U-factor, the higher the efficiency of the window. Window frames and sashes should be efficient as well. If metal frames are specified or required by code, the frame extrusions should have a thermal break to reduce conduction through the frame. As part of the installation, the window frames should be properly sealed with caulk materials to ensure the mitigation of air infiltration. Building envelopes that limit air infiltration and that have adequate fenestrations play a key role in optimizing heating and cooling efficiency, controlling moisture, and providing occupant comfort. Window system replacement is an expensive upgrade that generally involves architectural elements. We recommend this as a measure for further study.

## 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<sup>5</sup>. 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.

### **Window Treatments/Coverings**

Use high-reflectivity films or cover windows with shades or shutters to reduce solar heat gain and reduce the load on cooling and heating systems. Older, single-pane windows and east- or west-facing windows are especially prone to solar heat gain. In addition, use shades or shutters at night during cold weather to reduce heat loss.

### **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.

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<sup>5</sup> <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 Controls**

Electric motors often run unnecessarily, and this is an overlooked opportunity to save energy. These motors should be identified and turned off when appropriate. For example, exhaust fans often run unnecessarily when ventilation requirements are already met. Whenever possible, use automatic devices such as twist timers or occupancy sensors to turn off motors when they are not needed.

## **Motor Short Cycling Reduction**

Frequent stopping and starting of motors places substantial stress on rotors and other parts. This leads to wear and tear, lower efficiency, and higher maintenance costs. Adjust the load on the motor to limit the amount of unnecessary stopping and starting to improve motor performance.

## **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.

## **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.

## **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 BAS 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 (BAS) typically provide advanced controls for building HVAC systems, including chillers, boilers, air handling units, rooftop units and exhaust fans. The BAS 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 BAS features, when in proper adjustment, can improve comfort for building occupants and save substantial energy.

Know your BAS scheduling capabilities. Regularly monitor HVAC equipment operating schedules and match them to building operating hours 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 BAS (if available) to optimize the building warmup sequence. Most BAS 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.

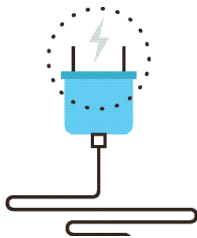
## **Compressed Air System Maintenance**

Compressed air systems require periodic maintenance to operate at peak efficiency. A maintenance plan for compressed air systems should include:

- Inspection, cleaning, and replacement of inlet filter cartridges.
- Cleaning of drain traps.
- Daily inspection of lubricant levels to reduce unwanted friction.
- Inspection of belt condition and tension.
- Check for leaks and adjust loose connections.
- Overall system cleaning.
- Reduce pressure setting to minimum needed for air operated equipment.
- Turn off compressor if not routinely needed.
- Use low pressure blower air rather than high pressure compressed air.

Contact a qualified technician for help with setting up periodic maintenance schedule.

## **Plug Load Controls**



Reducing plug loads is a common way to decrease your electrical use. Limiting the energy use of plug loads can include increasing occupant awareness, removing under-used equipment, installing hardware controls, and using software controls. Consider enabling the most aggressive power settings on existing devices or install load sensing or occupancy sensing (advanced) power strips<sup>6</sup>. Your local utility may offer incentives or rebates for this equipment.

## **Computer Monitor Replacement**

ENERGY STAR labeled computer monitors can be up to 25% more efficient than standard monitors. ENERGY STAR rated monitors have power consumption requirements for different operating modes such as on, idle, and sleep.

## **Computer Power Management Software**

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

## **Procurement Strategies**

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

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<sup>6</sup> For additional information refer to “Assessing and Reducing Plug and Process Loads in Office Buildings” <http://www.nrel.gov/docs/fy13osti/54175.pdf>, or “Plug Load Best Practices Guide” <http://www.advancedbuildings.net/plug-load-best-practices-guide-offices>.

## 6 ON-SITE GENERATION

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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.

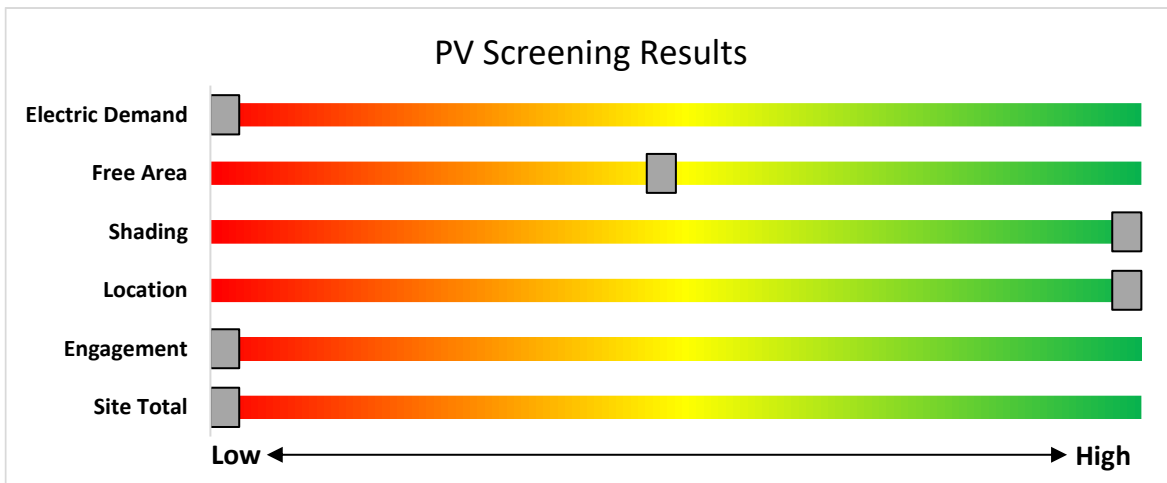
## 6.1 Solar Photovoltaic

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 no potential for installing a PV array.

This facility does not appear to meet the minimum criteria for a cost-effective solar PV installation. To be cost-effective, a solar PV array needs certain minimum criteria, such as sufficient and sustained electric demand and sufficient flat or south-facing rooftop or other unshaded space on which to place the PV panels.

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.



*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:** <http://www.njcleanenergy.com/whysolar>
- ◆ **NJ Solar Market FAQs:** [www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs](http://www.njcleanenergy.com/renewable-energy/program-updates-and-background-information/solar-transition/solar-market-faqs)
- ◆ **Approved Solar Installers in the NJ Market:** [http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved\\_vendorsearch/?id=60&start=1](http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/?id=60&start=1)

## 6.2 Combined Heat and Power

Combined heat and power (CHP) generates electricity at the facility and puts waste heat energy to good use. Common types of CHP systems are reciprocating engines, microturbines, fuel cells, backpressure steam turbines, and (at large facilities) gas turbines.

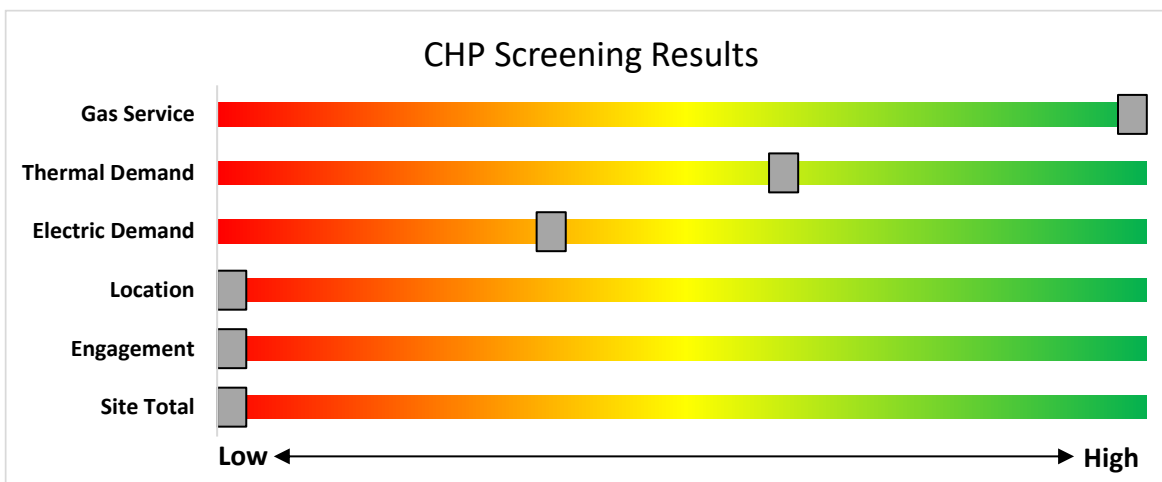
CHP systems typically produce a portion of the electric power used on-site, with the balance of electric power needs supplied by the local utility company. The heat is used to supplement (or replace) existing boilers and provide space heating and/or domestic hot water heating. Waste heat can also be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

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

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

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

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



*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/](http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/tools-and-resources/tradeally/approved_vendorsearch/)

## 7 ELECTRIC VEHICLES

All electric vehicles (EVs) have an electric motor instead of an internal combustion engine. EVs function by plugging into a charge point, taking electricity from the grid, and then storing it in rechargeable batteries. Although electricity production may contribute to air pollution, the U.S. EPA categorizes all electric vehicles as zero-emission vehicles because they produce no direct exhaust or tailpipe emissions.

EVs are typically more expensive than similar conventional and hybrid vehicles, although some cost can be recovered through fuel savings, federal tax credit, or state incentives

### 7.1 EV Charging

EV charging stations provide a means for electric vehicle operators to recharge their batteries at a facility. While many EV drivers charge at home, others do not have access to regular home charging, and the ability to charge at work or in public locations is critical to making EVs practical for more drivers. Charging can also be used for electric fleet vehicles, which can reduce fuel and maintenance costs for fleets that replace gas or diesel vehicles with EVs.

EV charging comes in three main types. For this assessment, the screening considers addition of Level 2 charging, which is most common at workplaces and other public locations. Depending on the site type and usage, other levels of charging power may be more appropriate.

The preliminary assessment of EV charging at the facility shows that there is medium potential for adding EV chargers to the facility's parking, based on potential costs of installation and other site factors.

The primary costs associated with installing EV charging are the charger hardware and the cost to extend power from the facility to parking spaces. This may include upgrades to electric panels to serve increased loads.

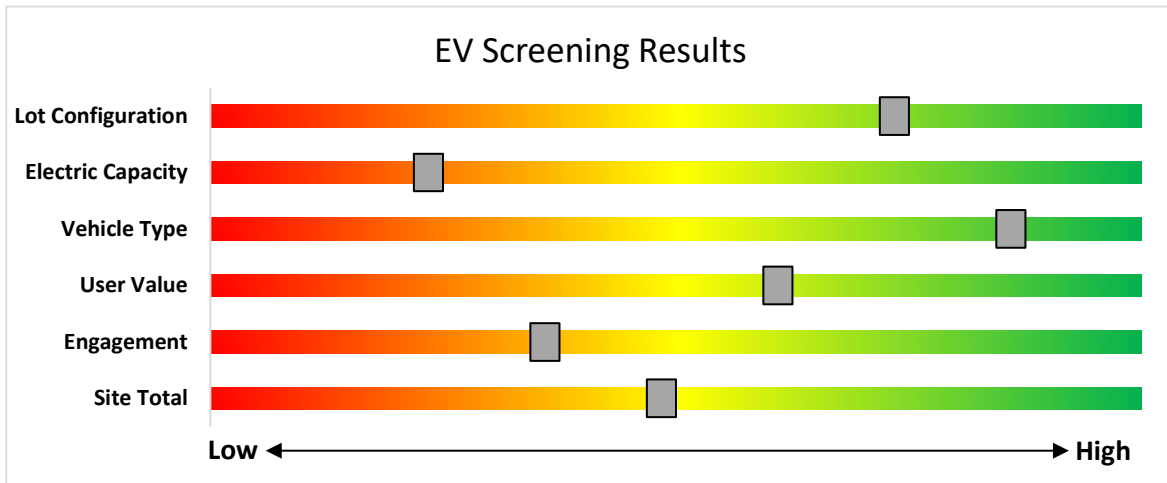
The type and size of the parking area impact the costs and feasibility of adding EV charging. Parking structure installations can be less costly than surface lot installations as power may be readily available, and equipment and wiring can be surface mounted. Parking lot installations often require trenching through concrete or asphalt surface. Large parking areas provide greater flexibility in charger siting than smaller lots.

The location and capacity of facility electric panels also impact charger installation costs. A Level 2 charger generally requires a dedicated 208-240V, 40 Amp circuit. The electric panel nearest the planned installation may not have available capacity and may need to be upgraded to serve new EV charging loads. Alternatively, chargers could be powered from a more distant panel. The distance from the panel to the location of charging stations ties directly to costs, as conduits, cables, and potential trenching costs all increase on a per-foot basis. The more charging stations planned, the more likely it is that additional electrical capacity will be needed.

Other factors to consider when planning for EV charging at a facility include who the intended users are, how long they park vehicles at the site, and whether they will need to pay for the electricity they use.



The graphic below displays the results of the EV charging assessment conducted as part of this audit. The position of each slider indicates the impact each factor has on the feasibility of installing EV charging at the site.



EV Charger Screening

### Electric Vehicle Programs Available

New Jersey is leading the way on electric vehicle (EV) adoption on the East Coast. There are several programs designed to encourage EV adoption in New Jersey, which is crucial to reaching a 100% clean energy future.

NJCEP offers a variety of EV programs for vehicles, charging stations, and fleets. Certain EV charging stations that receive electric utility service from Atlantic City Electric Company (ACE), Public Service Electric and Gas Company (PSE&G) or Jersey Central Power and Light (JCP&L), may be eligible for additional electric vehicle charging incentives directly from the utility. Projects may be eligible for both the incentives offered by this BPU program and incentives offered by ACE, PSE&G or JCP&L, up to 90% of the combined charger purchase and installation costs. Please check ACE, PSE&G or JCP&L program eligibility requirements before purchasing EV charging equipment, as additional conditions on types of eligible chargers may apply for utility incentives.

EV Charging incentive information is available from Atlantic City Electric, PSE&G and JCP&L. For more information and to keep up to date on all EV programs please visit <https://www.njcleanenergy.com/commercial-industrial/programs/electric-vehicle-programs>

## 8 PROJECT FUNDING AND INCENTIVES

Ready to improve your building's performance? New Jersey's Clean Energy Programs and Utility Energy Efficiency Programs can help. Pick the program that works best for you. This section provides an overview of currently available incentive programs in New Jersey.

### NJBPU and NJCEP Administered Programs



- New Construction (residential, commercial, industrial, government)
  - Large Energy Users
  - Energy Savings Improvement Program (financing)
  - State Facilities Initiative\*
  - Local Government Energy Audits
  - Combined Heat & Power & Fuel Cells
- \*State facilities are also eligible for utility programs

### Utility Administered Programs



- Existing buildings (residential, commercial, industrial, government)
- Efficient Products
  - Lighting & Marketplace
  - HVAC
  - Appliance Rebates
  - Appliance Recycling

## 8.1 New Jersey's Clean Energy Program

Save money while saving the planet! New Jersey's Clean Energy Program is a statewide program that offers incentives, programs, and services that benefit New Jersey residents, businesses, educational, non-profit, and government entities to help them save energy, money, and the environment.

### 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. To qualify entities must have incurred at least \$5 million in total 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 (FEED). Once the FEED is approved, the proposed work can begin.

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

## 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<sup>7</sup>

Eligible Technology	Size (Installed Rated Capacity)	Incentive (\$/Watt) <sup>5</sup>	% of Total Cost Cap per Project	\$ Cap per Project
CHPs powered by non-renewable or renewable fuel source, or a combination: <sup>4</sup> - Gas Internal Combustion Engine - Gas Combustion Turbine - Microturbine	≤500 kW <sup>1</sup>	\$2.00	30-40% <sup>2</sup>	\$2 million
	>500 kW - 1 MW <sup>1</sup>	\$1.00		
	> 1 MW - 3 MW <sup>1</sup>	\$0.55	30%	\$3 million
	>3 MW <sup>1</sup>	\$0.35		
Fuel Cells ≥60%	Same as above <sup>1</sup>	Applicable amount above	30%	\$1 million
Waste Heat to Power (WHP) <sup>3</sup> Powered by non-renewable fuel source. Heat recovery or other mechanical recovery from existing equipment utilizing new electric generation equipment (e.g. steam turbine)	≤1MW <sup>1</sup>	\$1.00	30%	\$2 million
	> 1MW <sup>1</sup>	\$.50	30%	\$3 million

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<sup>1</sup> Incentives are tiered, which means the incentive levels vary based upon the installed rated capacity, as listed in the chart above. For example, a 4 MW CHP system would receive \$2.00/watt for the first 500 kW, \$1.00/watt for the second 500 kW, \$0.55/watt for the next 2 MW and \$0.35/watt for the last 1 MW (up to the caps listed).

<sup>2</sup> The maximum incentive will be limited to 30% of total project. For CHP projects up to 1 MW, this cap will be increased to 40% where a cooling application is used or included with the CHP system (e.g. absorption chiller).

<sup>3</sup> Projects will be eligible for incentives shown above, not to exceed the lesser of % of total project cost per project cap or maximum \$ per project cap. Projects installing CHP or FC with WHP will be eligible for incentive shown above, not to exceed the lesser caps of the CHP or FC incentive. Minimum efficiency will be calculated based on annual total electricity generated, utilized waste heat at the host site (i.e. not lost/rejected), and energy input.

<sup>4</sup> Systems fueled by a Class 1 Renewable Fuel Source, as defined by N.J.A.C. 14:8-2.5, are eligible for a 30% incentive bonus. If the fuel is mixed, the bonus will be prorated accordingly. For example, if the mix is 60/40 (60% being a Class 1 renewable), the bonus will be 18%. This bonus will be included in the final performance incentive payment, based on system performance and fuel mix consumption data. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.

<sup>5</sup> CHP-FC systems located at Critical Facility and incorporating blackstart and islanding technology are eligible for a 25% incentive bonus. This bonus incentive will be paid with the second/Installation incentive payment. Total incentive, inclusive of bonus, shall not exceed above stipulated caps.



### **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 <http://www.njcleanenergy.com/CHP>.



## 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.

### **Competitive Solar Incentive (CSI) Program**

The CSI Program opened on April 15, 2023, and will serve as the permanent program within the SuSI Program providing incentives to larger solar facilities. The CSI Program is open to qualifying grid supply solar facilities, non-residential net metered solar installations with a capacity greater than five (5) megawatts (“MW”), and to eligible grid supply solar facilities installed in combination with energy storage.

CSI eligible facilities will only be allowed to register in the CSI program upon award of a bid pursuant to N.J.A.C. 14:8-11.10.

The CSI program structure has separate categories, or tranches, to ensure that a range of solar project types, including those on preferred sites, are able to participate despite potentially different project cost profiles. The Board has approved four tranches for grid supply and large net metered solar and an additional fifth tranche for storage in combination with grid supply solar. The following table lists procurement targets for the first solicitation:

Tranche	Project Type	MW (dc) Targets
Tranche 1.	Basic Grid Supply	140
Tranche 2.	Grid Supply on the Built Environment	80
Tranche 3.	Grid Supply on Contaminated Sites and Landfills	40
Tranche 4.	Net Metered Non- Residential	40
Tranche 5.	*Storage Paired with Grid	160 MWh

\*The storage tranche of 160 MWh corresponds to a 4-hour storage pairing of 40 MW of solar

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 on your building, visit the following link for more information: <https://njcleanenergy.com/renewable-energy/programs/susi-program>

## 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 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](http://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.*

## Demand Response (DR) Energy Aggregator

Demand Response Energy Aggregator is a program designed to reduce the electric load when electric wholesale prices are high or when the reliability of the electric grid is threatened due to peak demand. Grid operators call upon curtailment service providers and commercial facilities to reduce electric usage during times of peak demand, making the grid more reliable and reducing transmission costs for all ratepayers. Curtailment service providers provide regular payments to medium and large consumers of electric power for their participation in DR programs. Program participation is voluntary, and participants receive payments whether or not their facility is called upon to curtail its electric usage.

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

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

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

The first step toward participation in a DR program is to contact a curtailment service provider. A list of these providers is available on the website of the independent system operator, PJM, and it includes contact information for each company, as well as the states where they have active business<sup>8</sup>. PJM also posts training materials for program members interested in specific rules and requirements regarding DR activity along with a variety of other DR program information<sup>9</sup>.

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

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<sup>8</sup> <http://www.pjm.com/markets-and-operations/demand-response.aspx>.

<sup>9</sup> <http://www.pjm.com/training/training-events.aspx>.

## 8.2 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.

### Prescriptive and Custom

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

#### **Equipment Examples**

*Lighting*

*Lighting Controls*

*HVAC Equipment*

*Refrigeration*

*Gas Heating*

*Gas Cooling*

*Commercial Kitchen Equipment*

*Food Service Equipment*

*Variable Frequency Drives*

*Electronically Commutate Motors*

*Variable Frequency Drives*

*Plug Loads Controls*

*Washers and Dryers*

*Agricultural*

*Water Heating*

The Prescriptive program provides fixed incentives for specific energy efficiency measures. Prescriptive incentives vary by equipment type. The Custom program provides incentives for more unique or specialized technologies or systems that are not addressed through prescriptive incentives.

### Direct Install

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

#### **Incentives**

The program pays up to 70% of the total installed cost of eligible measures.

#### **How to Participate**

To participate in Direct Install, you will work with a participating contractor. The contractor will be paid the measure incentives directly by the program, which will pass on to you in the form of reduced material and implementation costs. This means up to 70% of eligible costs are covered by the Direct Install program, subject to program rules and eligibility, while the remaining percent of the cost is paid to the contractor by the customer.



## Engineered Solutions

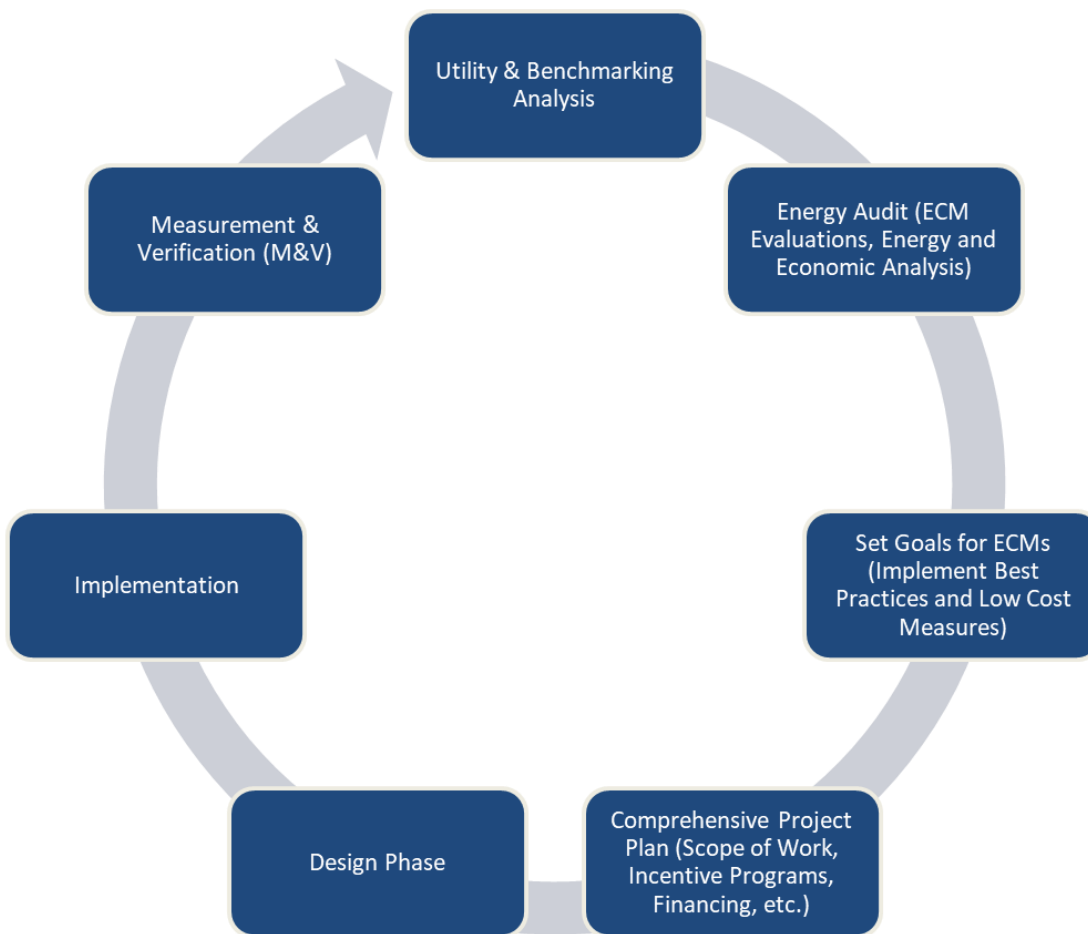
The Engineered Solutions Program provides tailored energy-efficiency assistance and services to municipalities, universities, schools, hospitals, and healthcare facilities (MUSH), non-profit entities, and multifamily buildings. Customers receive expert guided services, including investment-grade energy auditing, engineering design, installation assistance, construction administration, commissioning, and measurement and verification (M&V) services to support the implementation of cost-effective and comprehensive efficiency projects. Engineered Solutions is generally a good option for medium to large sized facilities with a peak demand over 200 kW looking to implement as many measures as possible under a single project to achieve deep energy savings. Engineered Solutions has an added benefit of addressing measures that may not qualify for other programs. Many facilities pursuing an Energy Savings Improvement Program loan also use this program. Incentives for this program are based on project scope and energy savings achieved.

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For more information on any of these programs, contact your local utility provider or visit <https://www.njcleanenergy.com/transition>.

## 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.



*Project Development Cycle*

## 10 ENERGY PURCHASING AND PROCUREMENT STRATEGIES

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### 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<sup>10</sup>.

### 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<sup>11</sup>.

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<sup>10</sup> [www.state.nj.us/bpu/commercial/shopping.html](http://www.state.nj.us/bpu/commercial/shopping.html)

<sup>11</sup> [www.state.nj.us/bpu/commercial/shopping.html](http://www.state.nj.us/bpu/commercial/shopping.html)



# APPENDIX A: EQUIPMENT INVENTORY & RECOMMENDATIONS

## Lighting Inventory & Recommendations

Location	Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis							
	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
Corridor 1	3	Exit Signs: Incandescent	None		30	8,760	3	Fixture Replacement	No	3	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	694	0	\$120	\$210	\$0	1.7
Corridor 1	3	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,700	6	None	Yes	3	LED Lamps: (1) 10W A19 Screw-In Lamp	High/Low Control	10	1,863	0.0	28	0	\$5	\$230	\$110	25.1
Corridor 1	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	6	None	Yes	8	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,863	0.1	214	0	\$37	\$460	\$280	4.9
Exterior 1	7	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	2,700	5	None	Yes	7	LED Lamps: (1) 10W A19 Screw-In Lamp	Photocell	10	4,380	0.0	-118	0	-\$21	\$400	\$0	-19.3
Exterior 1	1	LED Lamps: (2) 10W A19 Screw-In Lamps	Timeclock		20	5,475		None	No	1	LED Lamps: (2) 10W A19 Screw-In Lamps	Timeclock	20	5,475	0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		15	5,475		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	15	5,475	0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		25	5,475		None	No	1	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	25	5,475	0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		50	5,475		None	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	50	5,475	0.0	0	0	\$0	\$0	\$0	0.0
IT Office	22	LED - Fixtures: Ambient 1x4 Fixture	Occupancy Sensor	S	35	2,700		None	No	22	LED - Fixtures: Ambient 1x4 Fixture	Occupancy Sensor	35	2,700	0.0	0	0	\$0	\$0	\$0	0.0
Lobby 1	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,700		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	2,700	0.0	0	0	\$0	\$0	\$0	0.0
Lobby 1	1	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,700	0.0	98	0	\$17	\$40	\$10	1.8
Mechanical 1	7	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	2,700	2	Relamp	No	7	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,700	0.2	686	0	\$119	\$280	\$70	1.8
Office - Open Plan 2	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,700	4	None	Yes	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Occupancy Sensor	10	1,863	0.0	9	0	\$2	\$0	\$0	0.0
Office - Open Plan 2	8	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	2,700	4	None	Yes	8	LED - Linear Tubes: (1) 4' Lamp	Occupancy Sensor	15	1,863	0.0	107	0	\$18	\$0	\$0	0.0
Office - Open Plan 2	24	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.2	641	0	\$111	\$240	\$40	1.8
Restroom - Female 1	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	53	0	\$9	\$270	\$40	24.9
Restroom - Male 1	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	53	0	\$9	\$270	\$40	24.9
Stairs 1	7	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	2,700	6	None	Yes	7	LED Lamps: (1) 10W A19 Screw-In Lamp	High/Low Control	10	1,863	0.0	64	0	\$11	\$460	\$250	18.8
Stairs 2	7	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch		10	2,700	6	None	Yes	7	LED Lamps: (1) 10W A19 Screw-In Lamp	High/Low Control	10	1,863	0.0	64	0	\$11	\$460	\$250	18.8
Stairs 3	1	Compact Fluorescent: (3) 25W Biaxial Plug-In Lamps	Wall Switch		75	2,700	2, 6	Relamp	Yes	1	LED Lamps: GX23 (Plug-In) Lamps	High/Low Control	53	1,863	0.0	114	0	\$20	\$40	\$0	2.0
Stairs 3	1	Compact Fluorescent: (1) 30W Spiral Plug-In Lamp	Wall Switch		30	2,700	2, 6	Relamp	Yes	1	LED Lamps: GX23 (Plug-In) Lamps	High/Low Control	21	1,863	0.0	46	0	\$8	\$20	\$0	2.5
Stairs 3	2	LED - Linear Tubes: (1) 4' Lamp	Wall Switch		15	2,700	6	None	Yes	2	LED - Linear Tubes: (1) 4' Lamp	High/Low Control	15	1,863	0.0	27	0	\$5	\$230	\$70	34.6
Storage 1	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,500		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,500	0.0	0	0	\$0	\$0	\$0	0.0
Storage 1	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	1,500		None	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.0	0	0	\$0	\$0	\$0	0.0
Storage 2	11	Compact Fluorescent: (3) 30W Biaxial Plug-In Lamps	Wall Switch	S	90	1,500	2, 4	Relamp	Yes	11	LED Lamps: GX23 (Plug-In) Lamps	Occupancy Sensor	63	1,035	0.4	845	0	\$146	\$710	\$30	4.6

Location	Existing Conditions						Proposed Conditions						Energy Impact & Financial Analysis								
	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
Storage 2	1	Exit Signs: Incandescent	None		30	8,760	3	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	231	0	\$40	\$70	\$0	1.7
Storage 2	7	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,500	4	None	Yes	7	LED Lamps: (1) 10W A19 Screw-In Lamp	Occupancy Sensor	10	1,035	0.0	36	0	\$6	\$270	\$0	43.5
Storage 2	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	S	45	1,500		None	No	2	LED - Fixtures: Ambient 2x4 Fixture	Occupancy Sensor	45	1,500	0.0	0	0	\$0	\$0	\$0	0.0
Storage 2	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	1,500	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.0	59	0	\$10	\$270	\$0	26.3
Storage 2	21	Linear Fluorescent - T8: 4' T8 (32W) - 2L	Wall Switch	S	62	1,500	2, 4	Relamp	Yes	21	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,035	0.6	1,455	0	\$252	\$1,380	\$210	4.6
Conference 1	16	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	16	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	427	0	\$74	\$540	\$70	6.4
Corridor 4	4	Exit Signs: Incandescent	None		30	8,760	3	Fixture Replacement	No	4	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	925	0	\$160	\$280	\$0	1.7
Corridor 4	10	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	6	None	Yes	10	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,863	0.1	267	0	\$46	\$460	\$350	2.4
Corridor 4	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	6	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,863	0.0	53	0	\$9	\$230	\$70	17.3
Corridor 4	1	Metal Halide: (1) 75W Lamp	Wall Switch	S	75	2,700	1	Fixture Replacement	No	1	LED - Fixtures: Ceiling Mount	Wall Switch	23	2,700	0.0	154	0	\$27	\$300	\$10	10.8
Multipurpose 1	1	Exit Signs: Incandescent	None		30	8,760	3	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	231	0	\$40	\$70	\$0	1.7
Multipurpose 1	36	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,700	4	None	Yes	36	LED Lamps: (1) 10W A19 Screw-In Lamp	Occupancy Sensor	10	1,863	0.1	331	0	\$57	\$810	\$110	12.2
Multipurpose 1	17	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,700	4	None	Yes	17	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,863	0.2	908	0	\$157	\$540	\$70	3.0
Office - Enclosed 1	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	S	45	2,700		None	No	1	LED - Fixtures: Ambient 2x4 Fixture	Wall Switch	45	2,700	0.0	0	0	\$0	\$0	\$0	0.0
Office - Enclosed 1	1	Linear Fluorescent - T8: 2' T8 (17W) - 2L	Wall Switch	S	33	2,700	2	Relamp	No	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	29	2,700	0.0	12	0	\$2	\$40	\$0	19.4
Office - Open Plan 3	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	107	0	\$18	\$120	\$20	5.4
Office - Open Plan 4	3	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	3	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	80	0	\$14	\$120	\$20	7.2
Office - Open Plan 5	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	53	0	\$9	\$120	\$20	10.8
Office - Open Plan 6	1	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	1	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	27	0	\$5	\$0	\$0	0.0
Office - Open Plan 6	31	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	31	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.2	828	0	\$143	\$360	\$60	2.1
Office - Open Plan 7	24	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	24	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.2	641	0	\$111	\$240	\$40	1.8
Office - Open Plan 8	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	240	0	\$42	\$120	\$20	2.4
Storage 3	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,500		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,500	0.0	0	0	\$0	\$0	\$0	0.0
Storage 3	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	S	15	1,500		None	No	1	LED - Linear Tubes: (1) 4' Lamp	Wall Switch	15	1,500	0.0	0	0	\$0	\$0	\$0	0.0
Corridor 3	3	Exit Signs: Incandescent	None		30	8,760	3	Fixture Replacement	No	3	LED Exit Signs: 2 W Lamp	None	6	8,760	0.1	694	0	\$120	\$210	\$0	1.7

Location	Existing Conditions						Proposed Conditions							Energy Impact & Financial Analysis							
	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
Corridor 3	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	6	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,863	0.0	107	0	\$18	\$230	\$140	4.9
Corridor 3	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	6	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	High/Low Control	29	1,863	0.0	53	0	\$9	\$230	\$70	17.3
Restroom - Female 2	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,700		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	2,700	0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Female 2	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	53	0	\$9	\$270	\$40	24.9
Restroom - Male 2	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	2,700		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	2,700	0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Male 2	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	53	0	\$9	\$270	\$40	24.9
Corridor 2	9	Compact Fluorescent: (3) 30W Biaxial Plug-In Lamps	Wall Switch	S	90	2,700	2, 6	Relamp	Yes	9	LED Lamps: GX23 (Plug-In) Lamps	High/Low Control	63	1,863	0.3	1,244	0	\$215	\$820	\$350	2.2
Corridor 2	2	Exit Signs: Incandescent	None		30	8,760	3	Fixture Replacement	No	2	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	463	0	\$80	\$140	\$0	1.7
Corridor 2	2	LED - Linear Tubes: (3) 2' Lamps	Wall Switch	S	26	2,700	6	None	Yes	2	LED - Linear Tubes: (3) 2' Lamps	High/Low Control	26	1,863	0.0	47	0	\$8	\$230	\$70	19.7
Office - Open Plan 10	8	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,700	4	None	Yes	8	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,863	0.1	427	0	\$74	\$120	\$20	1.4
Office - Open Plan 11	2	LED - Linear Tubes: (4) 2' Lamps	Wall Switch	S	34	2,700	4	None	Yes	2	LED - Linear Tubes: (4) 2' Lamps	Occupancy Sensor	34	1,863	0.0	63	0	\$11	\$0	\$0	0.0
Office - Open Plan 11	2	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	2	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	53	0	\$9	\$0	\$0	0.0
Office - Open Plan 11	17	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,700	4	None	Yes	17	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,863	0.2	908	0	\$157	\$240	\$40	1.3
Office - Open Plan 12	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	240	0	\$42	\$120	\$20	2.4
Office - Open Plan 13	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	240	0	\$42	\$120	\$20	2.4
Office - Open Plan 14	9	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	9	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	240	0	\$42	\$120	\$20	2.4
Office - Open Plan 9	10	LED - Linear Tubes: (4) 4' Lamps	Wall Switch	S	58	2,700	4	None	Yes	10	LED - Linear Tubes: (4) 4' Lamps	Occupancy Sensor	58	1,863	0.1	534	0	\$92	\$120	\$20	1.1
Storage 4	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,500		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,500	0.0	0	0	\$0	\$0	\$0	0.0
Storage 5	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	S	10	1,500		None	No	1	LED Lamps: (1) 10W A19 Screw-In Lamp	Wall Switch	10	1,500	0.0	0	0	\$0	\$0	\$0	0.0
Office - Open Plan 15	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	214	0	\$37	\$120	\$20	2.7
Office - Open Plan 16	8	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	8	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	214	0	\$37	\$120	\$20	2.7
Office - Open Plan 17	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	107	0	\$18	\$120	\$20	5.4
Office - Open Plan 18	20	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	534	0	\$92	\$240	\$40	2.2
Office - Open Plan 19	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	107	0	\$18	\$120	\$20	5.4
Office - Open Plan 20	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	107	0	\$18	\$120	\$20	5.4

Location	Existing Conditions						Proposed Conditions								Energy Impact & Financial Analysis						
	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 - Open Plan 21	4	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	4	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.0	107	0	\$18	\$120	\$20	5.4
Office - Open Plan 22	20	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	534	0	\$92	\$240	\$40	2.2
Office - Open Plan 23	20	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	20	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	534	0	\$92	\$240	\$40	2.2
Exterior 1	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		15	5,475		None	No	5	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	15	5,475	0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock		75	5,475		None	No	2	LED - Fixtures: Outdoor Wall-Mounted Area Fixture	Timeclock	75	5,475	0.0	0	0	\$0	\$0	\$0	0.0
Garage 1	1	Exit Signs: Incandescent	None		30	8,760	3	Fixture Replacement	No	1	LED Exit Signs: 2 W Lamp	None	6	8,760	0.0	231	0	\$40	\$70	\$0	1.7
Garage 1	4	LED - Fixtures: High-Bay	Wall Switch	S	75	2,700	4	None	Yes	4	LED - Fixtures: High-Bay	Occupancy Sensor	75	1,863	0.1	276	0	\$48	\$880	\$140	15.5
Garage 1	22	LED - Linear Tubes: (2) 4' Lamps	Wall Switch	S	29	2,700	4	None	Yes	22	LED - Linear Tubes: (2) 4' Lamps	Occupancy Sensor	29	1,863	0.1	587	0	\$102	\$540	\$70	4.6

**Motor Inventory & Recommendations**

Location	Area(s)/System(s) Served	Existing Conditions									Proposed Conditions					Energy Impact & Financial Analysis						
		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 1	Mechanical 1	1	Combustion Air Fan	2.00	80.0%	No	Baldor	VM3255	W	900	7	No	85.5%	Yes	1	0.7	702	0	\$124	\$4,500	\$100	35.6
Mechanical 1	Mechanical 1	2	Condensate Pump	0.75	80.0%	No	Marathon	DM0005	W	900		No	80.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Office - Open Plan 2	Office - Open Plan 2	2	Exhaust Fan	0.50	65.0%	No	Unknown	Unknown	W	900		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Female 1	Restroom - Female 1	1	Exhaust Fan	0.50	65.0%	No	Unknown	Unknown	W	900		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Male 1	Restroom - Male 1	1	Exhaust Fan	0.50	65.0%	No	Unknown	Unknown	W	900		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Female 2	Restroom - Female 2	1	Exhaust Fan	0.50	65.0%	No	Unknown	Unknown	W	900		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Restroom - Male 2	Restroom - Male 2	1	Exhaust Fan	0.50	65.0%	No	Unknown	Unknown	W	900		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Mechanical 1	Mechanical 1	1	Other	50.00	80.0%	No	Unknown	Unknown	W	900		No	80.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Mechanical 1	Mechanical 1	1	Other	15.00	75.0%	No	Unknown	Unknown	W	900		No	75.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Office - Open Plan 2	Office - Open Plan 2	2	Other	5.00	70.0%	No	Jet	Unknown	W	900		No	70.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Mechanical 1	Mechanical 1	1	Water Supply Pump	0.04	68.0%	No	Taco	007-SF5	W	900		No	68.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Offices	Offices	54	Supply Fan	0.04	65.0%	No	Unknown	Unknown	W	900		No	65.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Garage 1	Garage 1	1	Air Compressor	5.00	85.0%	No	Baldor	M3218T-8	W	300		No	85.0%	No		0.0	0	0	\$0	\$0	\$0	0.0
Garage 1	Garage 1	1	Other	0.50	70.0%	No	Cornell cookson	MGH3311E	W	800		No	70.0%	No		0.0	0	0	\$0	\$0	\$0	0.0

**Packaged HVAC Inventory & Recommendations**

Location	Area(s)/System(s) Served	Existing Conditions									Proposed Conditions						Energy Impact & Financial Analysis							
		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
Exterior 1	Exterior 1	1	Split-System	2.00		13.00		Thermal Zone	TZAA-324-2A757	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	Exterior 1	1	Split-System	5.00		17.00		Luxaire	TC7B6021SA	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	Exterior 1	1	Split-System	5.00		17.00		Luxaire	TC7B6021SA	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	Exterior 1	1	Split-System	2.50		18.00		Luxaire	TC7B3021SA	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Offices/Conference Room	Offices/Conference Room	6	Electric Resistance Heat		5.12		1 COP	Unknown	Unknown	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	Exterior 1	1	Split-System Air-Source HP	1.00		10.00		Comfort Care	SMA12SA-0	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	Exterior 1	1	Split-System Air-Source HP	2.00	10.71	10.00	10.6 HSPF	Fujitsu	AOU24RLB	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Exterior 1	Exterior 1	1	Split-System Air-Source HP	0.75	2.63	10.80	13 HSPF	Fujitsu	AOU9RL2	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Offices	Offices	5	Window AC	0.50		9.80		Various	Various	B	8	Yes	5	Window AC	0.50		12.00	0.3	477	0	\$84	\$4,000	\$0	47.6
Offices	Offices	28	Window AC	0.50		10.88		Various	Various	W		No						0.0	0	0	\$0	\$0	\$0	0.0
Garage 1	Garage 1	2	Unit Heater		17.06		10 HSPF	Modine	Unknown	W		No						0.0	0	0	\$0	\$0	\$0	0.0

**Space Heating Boiler Inventory & Recommendations**

Location	Area(s)/System(s) Served	Existing Conditions						Proposed Conditions						Energy Impact & Financial Analysis							
		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	Whole building	1	Induced Draft Steam Boiler	3,330	HB Smith	28A-15	B		No					0.0	0	0	\$0	\$0	\$0	\$0	0.0

**Pipe Insulation Recommendations**

Location	Area(s)/System(s) Affected	Recommendation Inputs			Energy Impact & Financial Analysis						
		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	Domestic hot water pipe	9	20	1.50	0.0	0	13	\$181	\$330	\$40	1.6

**DHW Inventory & Recommendations**

Location	Area(s)/System(s) Served	Existing Conditions					Proposed Conditions							Energy Impact & Financial Analysis						
		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 1	Elm St building	1	Storage Tank Water Heater (≤ 50 Gal)	AO Smith	PGX 50 246	B	10	Yes	1	Storage Tank Water Heater (≤ 50 Gal)	Natural Gas	85.00%	UEF	0.0	0	13	\$169	\$1,400	\$100	7.7
Garage 1	Garage 1	1	Storage Tank Water Heater (≤ 50 Gal)	Rheem	Unknown	W		No						0.0	0	0	\$0	\$0	\$0	0.0

**Low-Flow Device Recommendations**

Location	Recommendation Inputs					Energy Impact & Financial Analysis						
	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
Garage	11	3	Faucet Aerator (Kitchen)	2.20	1.50	0.0	172	0	\$30	\$20	\$10	0.3
Elm st building	11	2	Faucet Aerator (Kitchen)	2.20	1.50	0.0	0	0	\$5	\$10	\$0	1.9
Elm st building	11	11	Faucet Aerator (Lavatory)	2.20	0.50	0.0	0	5	\$70	\$80	\$40	0.6

**Plug Load Inventory**

Location	Existing Conditions					
	Quantity	Equipment Description	Energy Rate (W)	ENERGY STAR Qualified?	Manufacturer	Model
Elm Street Admin Building	12	Coffee Machine	900	No	Various	Various
Elm Street Admin Building	3	Dehumidifier	150	No	Frigidaire	Unknown
Elm Street Admin Building	92	Desktop	150	No	Various	Various
Elm Street Admin Building	9	Microwave	1,000	No	Goldstar	Various
Elm Street Admin Building	11	Paper Shredder	150	No	Various	Various
Elm Street Admin Building	37	Printer (Medium/Small)	200	No	Various	Various
Elm Street Admin Building	8	Printer/Copier (Large)	600	No	Various	Various
Elm Street Admin Building	12	Refrigerator (Mini)	153	No	Various	Various
Elm Street Admin Building	4	Refrigerator (Residential)	172	No	Various	Various
Elm Street Admin Building	7	Television	160	No	Various	Various
Elm Street Admin Building	6	Toaster Oven	800	No	Various	Various
Elm Street Admin Building	3	Water Cooler	92	No	Various	Various
Garage 1	1	Desktop	150	No	Unknown	Unknown
Garage 1	1	Printer (Medium/Small)	200	No	Unknown	Unknown

# 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 STAR® Statement of Energy Performance

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N/A

### Elm Street Administration & Maintenance Garage

**Primary Property Type:** Office  
**Gross Floor Area (ft²):** 45,000  
**Built:** 1914

**For Year Ending:** March 31, 2023  
**Date Generated:** May 08, 2024

**ENERGY STAR®**  
Score<sup>1</sup>

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			
<b>Property Address</b>	<b>Property Owner</b>	<b>Primary Contact</b>	
Elm Street Administration & Maintenance Garage 302 Elm Street Westfield, New Jersey 07090	Westfield Board of Education 302 Elm Street Westfield, NJ 07090 (908) 789-4400	Sean McArthur 302 Elm Street Westfield, NJ 07090 (908) 789-4460 smcarthur@westfieldnj12.org	
<b>Property ID:</b> 3998643			
Energy Consumption and Energy Use Intensity (EUI)			
<b>Site EUI</b>	<b>Annual Energy by Fuel</b>	<b>National Median Comparison</b>	
51.8 kBtu/ft²	Electric - Grid (kBtu) 591,191 (25%) Natural Gas (kBtu) 1,738,182 (75%)	National Median Site EUI (kBtu/ft²)	77.9
		National Median Source EUI (kBtu/ft²)	116.4
		% Diff from National Median Source EUI	-34%
<b>Source EUI</b>		<b>Annual Emissions</b>	
77.3 kBtu/ft²		Total (Location-Based) GHG Emissions (Metric Tons CO2e/year)	145

### 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
<b>Blended Rate</b>	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.
<b>Btu</b>	<i>British thermal unit</i> : a unit of energy equal to the amount of heat required to increase the temperature of one pound of water by one-degree Fahrenheit.
<b>CHP</b>	<i>Combined heat and power</i> . Also referred to as cogeneration.
<b>COP</b>	<i>Coefficient of performance</i> : a measure of efficiency in terms of useful energy delivered divided by total energy input.
<b>Demand Response</b>	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.
<b>DCV</b>	<i>Demand control ventilation</i> : a control strategy to limit the amount of outside air introduced to the conditioned space based on actual occupancy need.
<b>US DOE</b>	<i>United States Department of Energy</i>
<b>EC Motor</b>	<i>Electronically commutated motor</i>
<b>ECM</b>	<i>Energy conservation measure</i>
<b>EER</b>	<i>Energy efficiency ratio</i> : a measure of efficiency in terms of cooling energy provided divided by electric input.
<b>EUI</b>	<i>Energy Use Intensity</i> : measures energy consumption per square foot and is a standard metric for comparing buildings' energy performance.
<b>Energy Efficiency</b>	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.
<b>ENERGY STAR</b>	ENERGY STAR is the government-backed symbol for energy efficiency. The ENERGY STAR program is managed by the EPA.
<b>EPA</b>	<i>United States Environmental Protection Agency</i>
<b>Generation</b>	The process of generating electric power from sources of primary energy (e.g., natural gas, the sun, oil).
<b>GHG</b>	<i>Greenhouse gas</i> 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.
<b>gpf</b>	<i>Gallons per flush</i>

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

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