



Energy Audit

City Of Kent Vehicle Maintenance Facility

June 27, 2024

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Executive Summary

Greater Cleveland Partnership has completed an American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Level 2 Energy Audit of the City of Kent Vehicle Maintenance Facility at 590 PLUMB ST., KENT, OH 44240. The purpose of this energy audit is to identify cost effective Energy Conservation Measures (ECMs) to reduce energy consumption and greenhouse gas (GHG) emissions.

In the process of completing this audit, Greater Cleveland Partnership analyzed the facility's historical energy usage and completed a site visit to compile a detailed equipment inventory and schedule. From this data, Greater Cleveland Partnership identified ECMs, Operation & Maintenance Measures (OMMs), and Distributed and Renewable Measure (DRM).

SUMMARY OF BASELINE & PROPOSED SAVINGS

| Energy | Electricity (kWh) | Natural Gas (therms) | Site EUI | Total GHG Emissions (mtCO2e) |
|---------------|-------------------|----------------------|----------|------------------------------|
| Baseline | 26,438 | 2,381 | 33.52 | 39 |
| Proposed | 22,906 | 1,255 | 21.87 | 32 |
| Reduction (%) | 13.35% | 47.29% | 34.76% | 17.95% |

| Proposed Measure | Estimated Measure Cost (\$) | Annual Cost Savings (\$) | Simple Payback (yrs) | Estimated Energy Savings (kBtu) | Estimated GHG Savings (mtCO2e) | Estimated Electric Savings (kWh) | Estimated Gas Savings (therms) |
|--|-----------------------------|--------------------------|----------------------|---------------------------------|--------------------------------|----------------------------------|--------------------------------|
| Equipment Storage Roof Repair and Insulation Upgrade | 8,500 | 507 | 16.7 | 112,600 | 5.97 | - | 1,126 |
| Lighting Upgrade | 3,400 | 424 | 8.0 | 12,051 | 1.72 | 3,532 | - |
| Total | 11,900 | 931 | 12.8 | 124,651 | 7.69 | 3,532 | 1,126 |

Table 1: Existing Annual Energy Consumption and Proposed Savings

Introduction

Energy auditors from COSE conducted a comprehensive energy assessment on 6/11/24 at City of Kent Vehicle Maintenance Facility located at 590 Plumb ST., Kent, OH. The auditor was Robert Drennan.

The audited building systems included envelope, lighting, cooling, heating, domestic hot water, miscellaneous equipment, and operational/maintenance procedures.

The scope of this audit adheres to the guidelines developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) for a Level 2 audit. As described in ASHRAE's Procedures for Commercial Building Energy Audits, a Level 2 "Energy Survey and Analysis" will identify and provide the savings and cost analyses of all practical energy efficiency measures that meet the owner's/operator's constraints and economic criteria, along with the proposed changes to Operation and Maintenance (O&M) procedures.

A Level 2 audit includes a more detailed survey than a Level 1. Utility analysis is performed based on historical energy bills which may cover consumption data as well as peak demand. It may also provide a listing of potential capital-intensive improvements that require more thorough data collection and engineering analysis. Cost and savings analysis is performed for each measure recommended for implementation. This level of analysis should provide adequate information for the owner/operator to act upon recommendations for most buildings and for most measures.

Facility Description

The City of Kent Vehicle Maintenance Facility is a Repair Services (Vehicle, Shoe, Locksmith, etc) operated by the Client and has a total floor area of approximately 10,700 sq.ft.. The buildings were built in 1992 and is are 1-story structures. The facility is primarily Repair Services (Vehicle, Shoe, Locksmith, etc).

The City of Kent’s Vehicle Maintenance Facility is comprised of two, fabricated metal buildings, one serving as a vehicle maintenance & repair facility and the other as a heavy equipment storage facility.

BUILDING ENVELOPE

| Application | Name | R-Value | Comments |
|-------------|----------------------------|---------|--------------|
| Wall | Metal framing and cladding | R-11 | Est. R-Value |

| Application | Name | R-Value | Comments |
|-------------|----------------------------|----------|---|
| Roof | Metal framing and cladding | R-11/R-2 | Large hole in ceiling of heavy equipment storage building has broken the thermal barrier between the outdoor and indoor environments. |

| Application | Name | R-Value | Comments |
|-------------|---------------------------------------|---------|----------|
| Window | No significant window units installed | - | - |

Tables: Construction

SPACE HEATING/SPACE COOLING/HVAC/AIR HANDLING (VENTILATION)

| Name | Quantity | Location Name |
|--|----------|---------------|
| VEHICLE MAINTENANCE / MAIN REPAIR BLDG / PLUMB ST. | 3 | Main |
| VEHICLE MAINTENANCE / EQUIPMENT STORAGE BLDG. / PLUMB ST. | 3 | Equip Storage |
| CARRIER / HEATING / M# CNPVP2414AL... / S# 3320X37178 / R-410A / 80% / ~2020 | 1 | Main |

| Name | Quantity | Location Name |
|-------------------|----------|----------------------|
| Waste Oil Furnace | 1 | Main Repair Building |

DOMESTIC HOT WATER

| Name | Quantity | Location Name |
|---|----------|---------------|
| A.O. SMITH / NAT. GAS / M# GCVL 40 200 / S# 1049A019401 / 40 GALLON / MFG. 2010 | 1 | Main |

LIGHTING

| Name | Quantity | Location Name | Watts (W) |
|---------------------------------|----------|---------------|-----------|
| 100W LED | 32 | Main | 100 |
| 2x4' 32W T8 Lamp, Elect Ballast | 38 | Equip Storage | 58.88 |
| 150 WATT LED | 7 | Exterior | 150 |

CONTROLS

The majority of the units are controlled by standard thermostats. The building temperature setpoints are often manually setback during unoccupied hours. Areas of the facility are not easily remotely monitored. In addition, the lack of ability to make program changes may result in longer operation of the equipment during unoccupied or lowly occupied periods.

PLUG LOADS

The plug load for the building is estimated based on the typical average plug load for warehouse buildings.

Energy Consumption Analysis

The historical energy usage at the City of Kent Vehicle Maintenance Facility was analyzed using utility data. This analysis of the building's energy use from January 2023 to December 2023. The information will be enhanced with the addition of Heating Degree Days (HDD) and Cooling Degree Days (CDD) to account for differences in weather across the reporting period. A summary of the facility's energy usage and expenses is shown in the table below.

| | Electric Usage (kWh) | Electric Total Cost (\$) | Total Energy Use (kBtu) | Total Cost (\$) | Site EUI (kBtu/SqFt) | Total Cost Per Square Foot (\$/SqFt) |
|--------|----------------------|--------------------------|-------------------------|-----------------|----------------------|--------------------------------------|
| 2023 | 26,330.21 | 1,133 | 281,017.68 | 2,507.72 | 26.26 | 0.23 |
| Annual | 26,330.21 | 1,133 | 281,017.68 | 2,507.72 | 26.26 | 0.23 |

Table: Energy Usage

ELECTRICITY CONSUMPTION

Electricity at the City of Kent Vehicle Maintenance Facility is provided by FirstEnergy. The monthly electricity consumption from January 2023 to December 2023 is displayed in the Table and Figure below.

| | Electric Usage (kWh) | | Electric Usage Cost (\$) | |
|-------|----------------------|-----------|--------------------------|---------|
| | 2023 | Average | 2023 | Average |
| Jan | 2,373.5 | 2,373.5 | 102 | 102 |
| Feb | 2,460.2 | 2,460.2 | 105.83 | 105.83 |
| Mar | 2,382.5 | 2,382.5 | 102.37 | 102.37 |
| Apr | 2,165.67 | 2,165.67 | 93.4 | 93.4 |
| May | 2,055.83 | 2,055.83 | 88 | 88 |
| Jun | 2,080.2 | 2,080.2 | 89.4 | 89.4 |
| Jul | 2,294.37 | 2,294.37 | 98.6 | 98.6 |
| Aug | 2,320.07 | 2,320.07 | 100.17 | 100.17 |
| Sep | 2,191.87 | 2,191.87 | 94.1 | 94.1 |
| Oct | 2,026 | 2,026 | 87.13 | 87.13 |
| Nov | 2,013 | 2,013 | 87 | 87 |
| Dec | 1,967 | 1,967 | 85 | 85 |
| Total | 26,330.21 | 26,330.21 | 1,133 | 1,133 |

Table: Monthly Electrical Consumption

Electricity Consumption and Degree Days

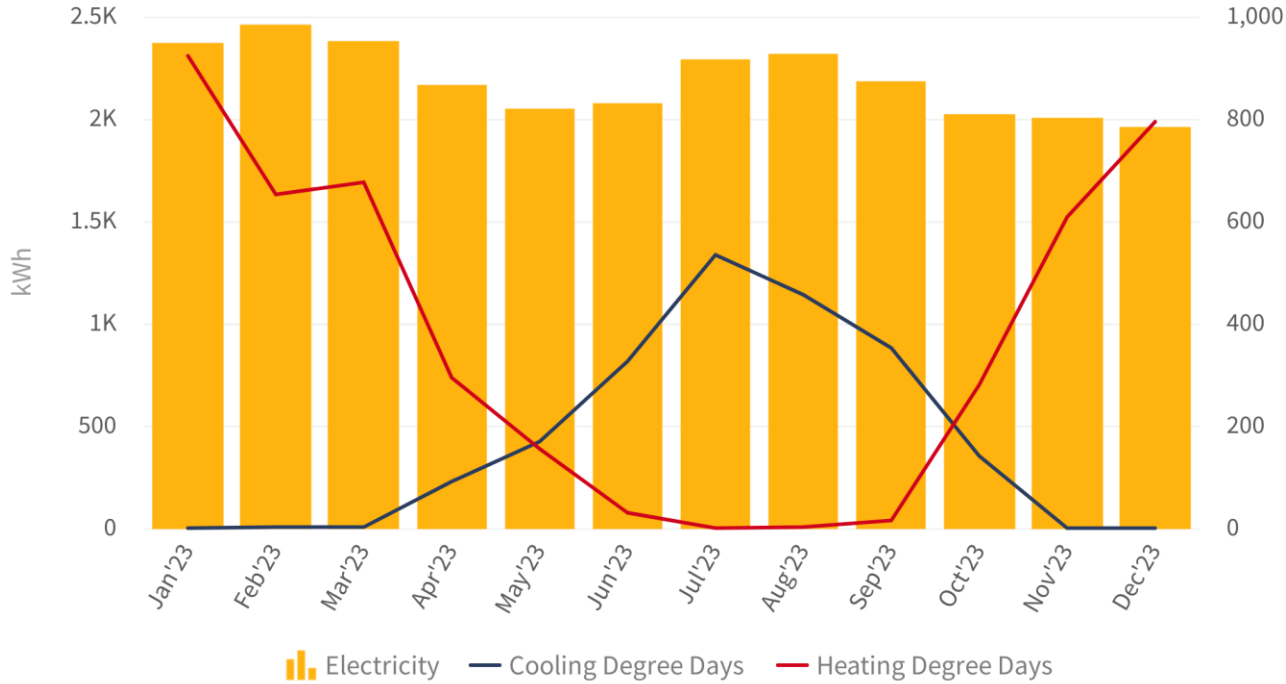


Figure: Average Monthly Electrical Consumption and Monthly Degree Days

NATURAL GAS CONSUMPTION

Natural Gas at the City of Kent Vehicle Maintenance Facility is provided by Dominion East Ohio.

| | Natural Gas Usage (therms) | | Natural Gas Usage Cost (\$) | |
|-------|----------------------------|----------|-----------------------------|----------|
| | 2023 | Average | 2023 | Average |
| Jan | 481.1 | 481.1 | 346.13 | 346.13 |
| Feb | 314.2 | 314.2 | 226.1 | 226.1 |
| Mar | 232.9 | 232.9 | 167.63 | 167.63 |
| Apr | 153.27 | 153.27 | 110 | 110 |
| May | 65.23 | 65.23 | 47.17 | 47.17 |
| Jun | 14.1 | 14.1 | 10 | 10 |
| Jul | 10.33 | 10.33 | 7.23 | 7.23 |
| Aug | 10.33 | 10.33 | 7.23 | 7.23 |
| Sep | 10 | 10 | 7 | 7 |
| Oct | 51.33 | 51.33 | 37.23 | 37.23 |
| Nov | 217 | 217 | 156 | 156 |
| Dec | 352 | 352 | 253 | 253 |
| Total | 1,911.79 | 1,911.79 | 1,374.72 | 1,374.72 |

Table: Monthly Natural Gas Consumption

Natural Gas Consumption and Degree Days

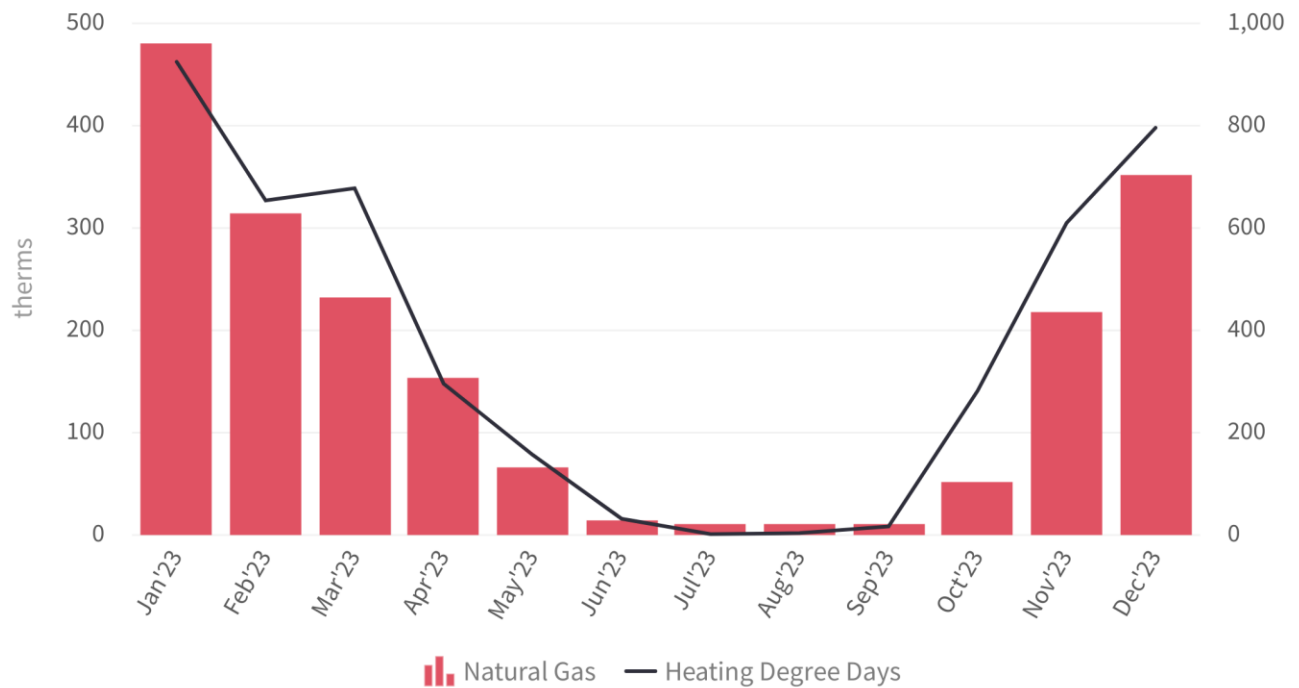


Figure: Monthly Natural Gas Consumption and Monthly Degree Days

UTILITY COSTS AND RATES

The energy cost savings calculations for the proposed ECMs are based on average annual electricity and natural gas costs for the period analyzed. For electricity and natural gas the blended rates will be used to determine the cost savings for ECM analysis.

Electricity Average Blended Rate: \$0.12 /kWh

Natural Gas Average Blended Rate: \$0.7191 /therms

Energy Use Intensity

You are able to track building energy efficiency Key Performance Indicators (KPI) such as Energy Use Intensity (EUI). Facility managers can benchmark their facilities against similar types of building throughout the country using the EUI. The Site EUI is calculated by taking the facility's total annual energy usage normalized to kBtu and the square footage of the building. Source EUI considers losses in generation, storage, and distribution of the fuel type.

The table below shows key performance indicators for the facility, including the Energy Use Index EUI and the Energy Cost Index (ECI) based on the utility data provided.

| | Site EUI (kBtu/SqFt) | Total Cost Per Square Foot (\$/SqFt) |
|---------|----------------------|--------------------------------------|
| 2023 | 26.26 | 0.23 |
| Average | 26.26 | 0.23 |

Table: Normalized KPI

Energy End Use Breakdown

The table below outlines the energy end use breakdown of the City of Kent Vehicle Maintenance Facility into the end uses outlined by ASHRAE Standard 211/2018. This breakdown was estimated using data provided by the utilities, building operators/occupant interviews, and site visits.

End Use Breakdown by Fuel Type

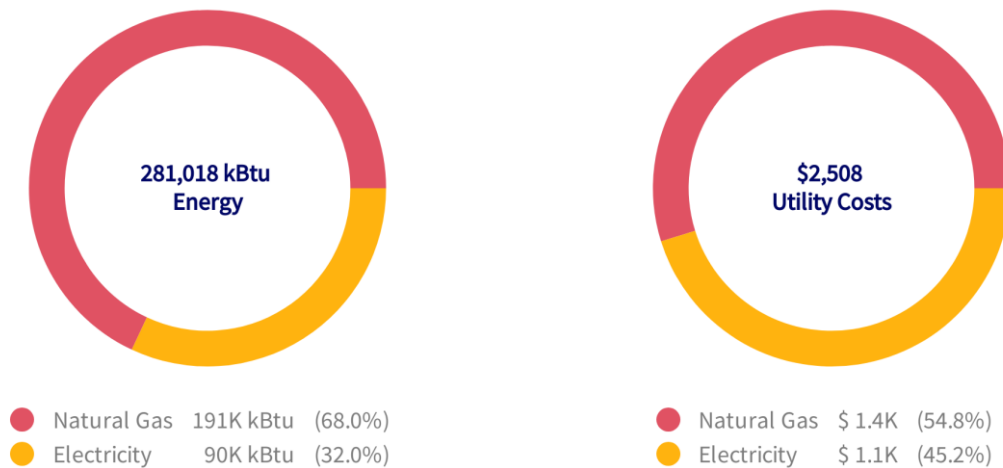


Figure: Energy & Cost End-Use Breakdown by Fuel Type

| End Use | Electric Usage (kWh) | Natural Gas Usage(therms) | Total Use (kBtu) | Percentages |
|--------------------|----------------------|---------------------------|------------------|-------------|
| Space Heating | 0 | 2,257* | 225,747 | 68.7% |
| Space Cooling | 116 | - | 394 | 0.1% |
| Air Distribution | 4,736 | - | 16,160 | 5% |
| SHW/DHW | 0 | 124 | 12,400 | 3.8% |
| Lighting | 15,368 | - | 52,435 | 16% |
| Plug Load | 6,218 | - | 21,215 | 6.4% |
| Total | 26,438 | 2,381 | 328,351 | 100% |
| Historical Billing | 26,330 | 1,910 | 280,838 | - |
| Actual | 100% | 125%* | 117% | - |

Table: Energy End-Use Breakdown

*Please note that the heating usage in the chart above for this building is estimated. This load is based on the gas usage metered for the building and an adjustment for other heating sources. The actual heating on this site is provided by both natural gas heating and waste oil heating. There is a waste oil furnace in use in the Main repair facility. This furnace uses waste oil from vehicle maintenance to provide heating. There is no metering available for the actual amount of waste oil burned. The gas heat usage in the chart is higher than actual usage in the chart because that oil usage has been estimated and the additional heating BTUs are shown in the heating usage.

Electricity & Natural Gas End-Use Breakdown

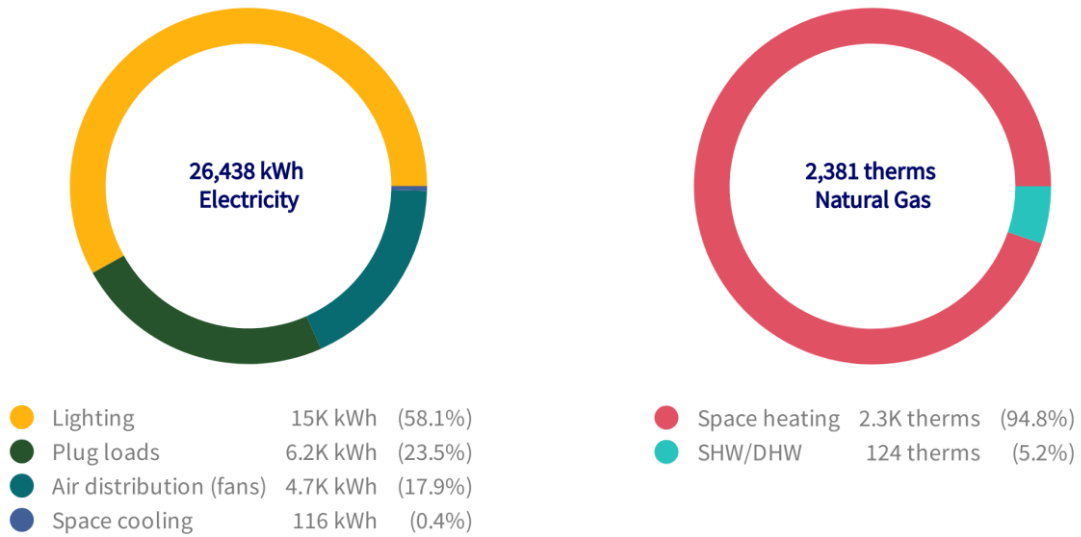


Figure: Electricity End-Use Breakdown and Natural Gas End-Use Breakdown

End Use Breakdown by End Use

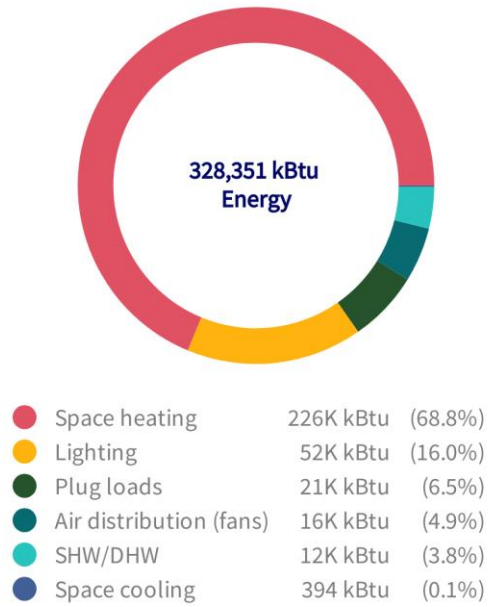


Figure: Total Energy End-Use Breakdown

Summary of Energy Savings

If all ECMs are implemented, the facility can expect to reduce electricity consumption by 13% and natural gas consumption by 47%. This would produce an annual operational savings on the order of 3,532 kWh and 1,126 therms for a combined \$931 of utility and O&M expenditure reduction. The full implementation cost of these projects is estimated at \$11,900, yielding a simple payback of 12.8 yrs. The following table depicts expected savings figures for this facility:

ENERGY SAVINGS BY END USE

| End Use | Electricity (kWh) | Electricity Savings (kWh) | Natural Gas (therms) | Natural Gas Savings (therms) | Total Existing Energy Consumption (kBtu) | Total Proposed Energy Consumption (kBtu) | % Reduction |
|------------------|-------------------|---------------------------|----------------------|------------------------------|--|--|--------------|
| Space Heating | 0 | - | 2,257 | 1,126 | 225,747 | 113,147 | 49.9% |
| Space Cooling | 116 | 0 | - | - | 394 | 394 | 0% |
| Air Distribution | 4,736 | 0 | - | - | 16,160 | 16,160 | 0% |
| SHW/DHW | 0 | 0 | 124 | 0 | 12,400 | 12,400 | 0% |
| Lighting | 15,368 | 3,532 | - | - | 52,435 | 40,384 | 23% |
| Plug Load | 6,218 | 0 | - | - | 21,215 | 21,215 | 0% |
| Total | 26,438 | 3,532 | 2,381 | 1,126 | 328,351 | 234,061 | 28.7% |

Table: Energy Savings Breakdown by Usage

Energy Savings by End Use

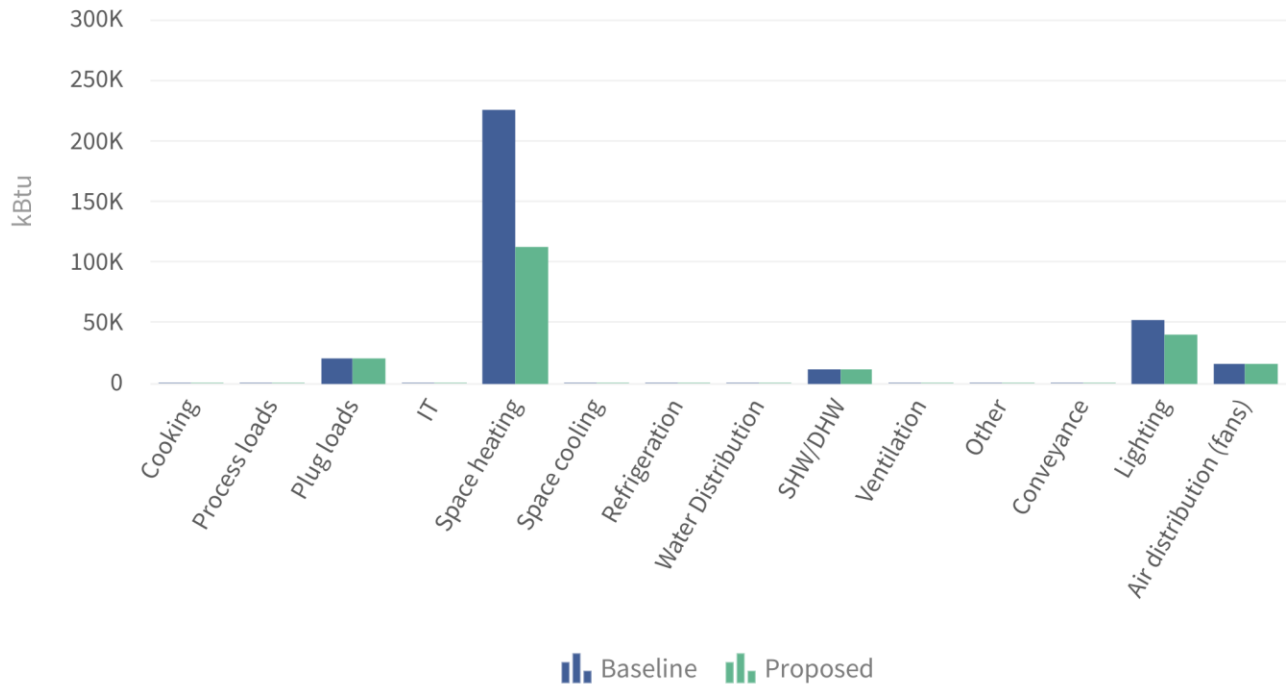


Figure: Energy Saving End-Use by Usage

Key Performance Indicators

| Energy | Electricity (kWh) | Natural Gas (therms) | Site EUI | Total GHG Emissions (mtCO2e) |
|---------------|-------------------|----------------------|----------|------------------------------|
| Baseline | 26,438 | 2,381 | 33.52 | 39 |
| Proposed | 22,906 | 1,255 | 21.87 | 32 |
| Reduction (%) | 13.35% | 47.29% | 34.76% | 17.95% |

Table: KPI

Site Energy Use Intensity

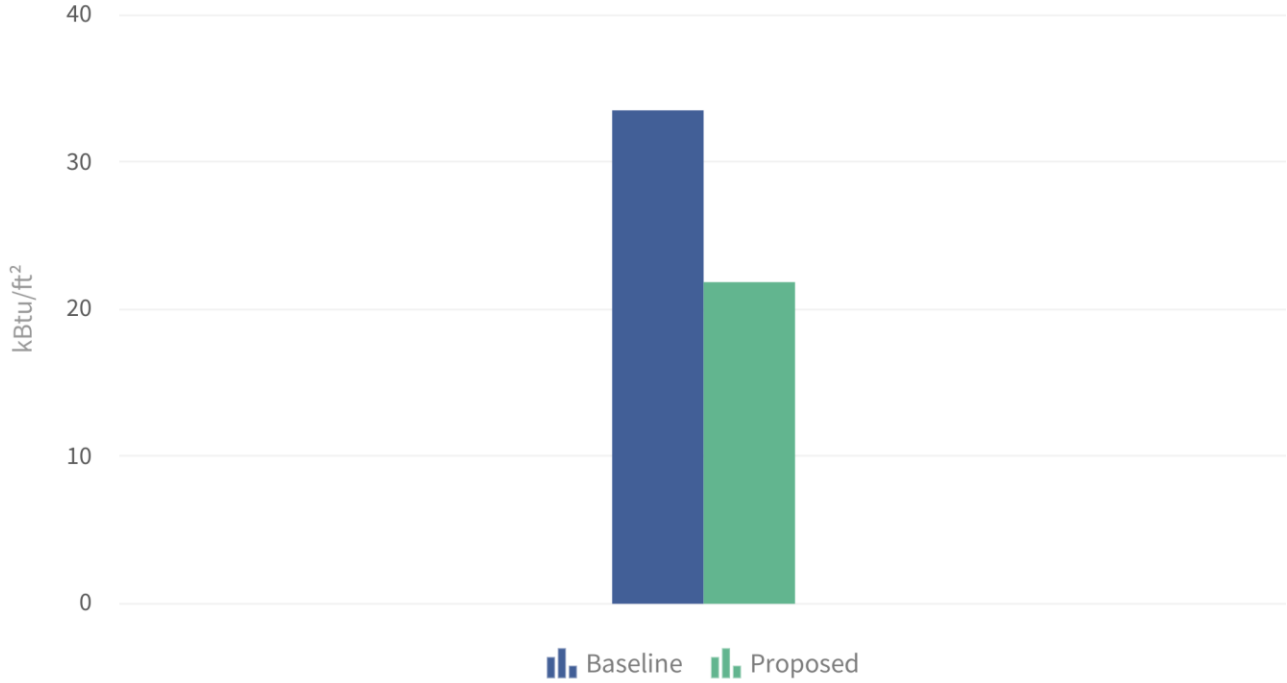


Figure: Site EUI Reduction

Total GHG Emissions

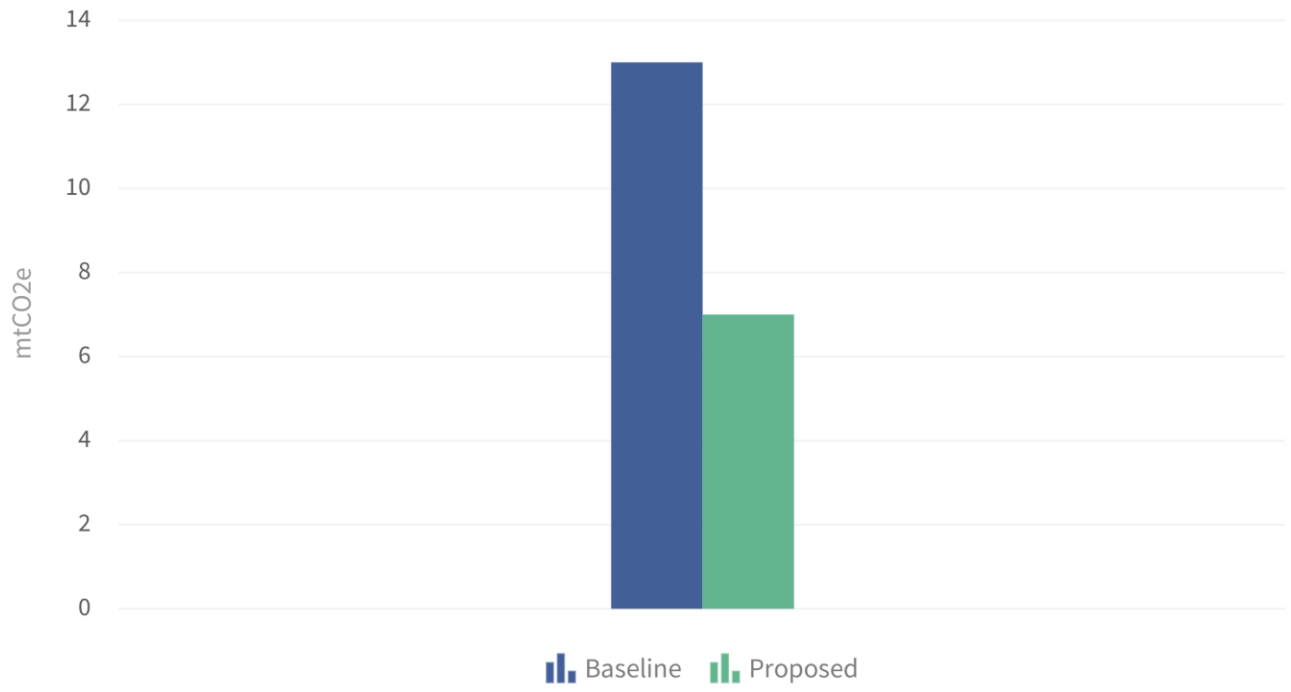


Figure: GHG Reduction

Energy Conservation Measures (ECMs)

Equipment Storage Roof Repair and Insulation Upgrade

The equipment storage building sustained water damage that resulted in a large portion of the ceiling having to be removed thus breaking the thermal boundary between the conditioned space below and the unconditioned attic area.

The repair of the open ceiling section(s) (after the source of the moisture intrusion has been sealed) should be done by:

- 1.) Closure of the hole and air-sealing of the joints between the new and existing ceiling board
- 2.) Reapply insulation to match the existing insulation level which appeared to be batts of R-13 fiberglass
- 3.) Being that insulation work is already being done to this new section, it's recommended to take advantage of the situation and apply a level of "blown-in cellulose" insulation on top of the existing batt insulation aiming for an overall R-30 level of thermal resistance.

| Name | Energy Savings (kBtu) | Electric Savings (kWh) | Natural Gas Savings (therms) | Estimated GHG Savings (mtCO2e) | Effective Useful Life (years) |
|--|-----------------------|------------------------|------------------------------|--------------------------------|-------------------------------|
| Equipment Storage Roof Repair and Insulation Upgrade | 112,600 | - | 1,126 | 5.97 | - |

| | | | |
|--------------------------|-------|----------|--------|
| Total Measure Cost (\$) | 8,500 | ROI (%) | 6 |
| Annual Cost Savings (\$) | 507 | NPV (\$) | -3,968 |
| Simple Payback (yrs) | 16.8 | | |

Lighting Upgrade

Upgrade the fluorescent T8 fixtures to LED fixtures.

| Name | Energy Savings (kBtu) | Electric Savings (kWh) | Natural Gas Savings (therms) | Estimated GHG Savings (mtCO2e) | Effective Useful Life (years) |
|------------------|-----------------------|------------------------|------------------------------|--------------------------------|-------------------------------|
| Lighting Upgrade | 12,051 | 3,532 | 0 | 1.72 | 0 |

| | | | |
|--------------------------|-------|----------------------|------|
| Total Measure Cost (\$) | 3,400 | Simple Payback (yrs) | 8 |
| Estimated Incentive (\$) | 0 | ROI (%) | 12.5 |
| Annual Cost Savings (\$) | 424 | NPV (\$) | 390 |

Appendix

Lighting Table

| Name | Quantity | Location Name | Watts (W) | Control type |
|---------------------------------|----------|---------------|-----------|--------------|
| 100W LED | 32 | - | 100 | Main |
| 2x4' 32W T8 Lamp, Elect Ballast | 38 | - | 58.88 | Storage |
| 150 WATT LED | 7 | - | 150 | Exterior |

Definitions

| | | | |
|--------------|--|--------------|-------------------------------------|
| AHU | Air Handling Unit | OAT | outside air temperature |
| Btu | British thermal unit | EUI | Energy Use Intensity |
| Btu/h | British thermal unit per hour | ECI | Energy Cost Index |
| CDD | Cooling Degree Days | W | watt |
| DD | Degree Days | MMBtu | One million Btu |
| HDD | Heating Degree Days | kW | kilowatt |
| cfm | cubic feet per minute | kWh | kilowatt-hour |
| CBES | Commercial Buildings Energy Consumption Survey | KPI | key performance indicator |
| DHW | domestic hot water | CO2e | carbon dioxide equivalent |
| ECM | energy conservation measure | MBH | 1,000 British thermal unit per hour |
| gal | gallon | VFD | Variable Frequency drive |
| GHG | greenhouse gas | | |
| gpm | gallons per minute | | |
| FY | fiscal year | | |
| hp | motor horsepower | | |
| AC | air conditioner | | |
| HV | heating and ventilation | | |
| kBtu | 1,000 Btu | | |
| COP | coefficient of performance | | |
| EER | energy efficiency ratio | | |
| HW | hot water | | |
| FY | fiscal year | | |
| SF | square feet | | |