Energy Audit

City of Kent : Service Administrative Complex (SAC)

July 28, 2024

Table of Contents

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 : Service Administrative Complex (SAC) at 930 Overholt Rd., 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	166,741	11,078	36.5	183
Proposed	125,356	11,068	33.4	105
Reduction (%)	24.82%	0.09%	8.49%	42.62%
Proposed use w/ PV	6,556	11,068	24.5	69.5
Reduction (%) w/PV	96.1%	0.09%	35.8%	62%

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)
Add Solar Photovoltaic (PV) System to Building	216,000 (151,200 after Tax Incentive)	14,256	15.1	405,346	57.9	118,800	-
Lighting Upgrade T8/T5 Fluorescent to LED	27,000	4,407	6.1	125,289	17.89	36,720	-
Replace Natural Gas Packaged RTU (2001) Unit	13,000	567	>20	17,017	2.33	4,665	11

Total	256,000	19,230	13.3	547,652	78.12	160,185	11

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 : Service Administrative Complex (SAC) located at 930 Overholt Rd., Kent, OH. The auditor was Norm Stickney, who was accompanied onsite by 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 : Service Administrative Complex (SAC) is a mixed use facility operated by the Client and has a total floor area of approximately 45,939 sq.ft.. The building was built in 1992 and is a 1-story structure. The City of Kent's Service Administration Complex (SAC) is operated as an office space with indoor, light & heavy vehicle storage/parking.

BUILDING ENVELOPE

Application	Name	R-Value	Comments
Wall	Metal framing with masonry block cladding and some exterior wall areas covered with stucco over top of block.	R-6	Est. R-Value

Application	Name	R-Value	Comments
Roof	Flat, thermoset/thermoplastic, black colored covering over a metal sublayer	R-17	Est. R-Value – Roof is approximately 2-3 years old

Application	Name	R-Value	Comments
Window	Double paned, aluminum framed with thermal breaks	R-3	Est. R-Value

Tables: Construction

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

Name	Quantity	Location Name
UNIT HEATERS (GARAGE BAYS)	10	BAYS
GEN. MODINE / MEDIUM MODEL / NAT. GAS / VEHICLE STORAGE/PARKING	1	STORAGE

Name	Quantity	Location Name
MITSUBISHI / SPLIT SYSTEM HEAT PUMP / M# MSZ-GL09NA / BTU-IN 9000 / 2019	1	OFFICE
MITSUBISHI / SPLIT SYSTEM HEAT PUMP / M# MSZ-GL18NA / BTU-IN 18000 / 2019	2	SHOP
MITSUBISHI / SPLIT SYSTEM HEAT PUMP / M# MXZ-4C36NA / BTU-IN 36000 / 2019	1	SHOP
MITSUBISHI / SPLIT SYSTEM HEAT PUMP / M# MUZ-GL15NA / BTU-IN 15000 / 2018	2	OFFICE

CARRIER / PACKAGE RTU / 10 TON / BTU-IN 180K / M# 48TMD012 / 2006	2	OFFICE
CARRIER / PACKAGE RTU / 2.5 TON / BTU-IN 60K / M# 48ESA3006030 / 2012	1	OFFICE
CARRIER / PACKAGE RTU / 3 TON / BTU-IN 110K / M# 48FCEA04 / 2019	1	OFFICE
CARRIER / PACKAGE RTU / 10 TON / BTU-IN 224K / M# 48TCED12 / 2010	1	OFFICE
CARRIER / PACKAGE RTU / 4 TON / BTU-IN 115K / M# 48TFE005 / 2001	1	OFFICE

DOMESTIC HOT WATER

Name	Quantity	Location Name
KENMORE / ECONOMIZER 5 / ELECTRIC / 10 GALLON / M# 153.317131 / VEHICLE STORAGE	1	MER
CRAFTMASTER / ENVI-RO-TEMP SUPREME / ELECTRIC / 50 GALLON / M# E3Z50RD055CV / S# 0012103096 / ~2000	1	MER

LIGHTING

Name	Quantity	Location Name	Watts (W)
4 216W T5 4-lamp Standard Electronic High Output Fluorescent	70	BAYS	216
4 58.88W T8 2-lamp Standard Electronic Linear Fluorescent	120	OFFICE	58.88
4' 28/25W RW T8 2-Lamp, Elect Ballast	110	OFFICE	56
ELED3/1 - EXIT Light Emitting Diode, (1) 3W lamp, Single Sided	12		3

The majority of the general interior fixtures are fluorescent T8 and T5 fixtures that have not been upgraded. For the purpose of this report, the number of fixtures in the offices were estimated based on the available information. Overall, fixture counts for the facility were estimated.

Even though the existing interior fixtures have not been upgraded facility personnel control the lighting manually to reduce energy usage.

CONTROLS

The HVAC system in the office area is controlled by thermostats and a zone control system in some areas. Access to the system was not available during the audit process. Facility personnel report the the building setpoints are setback during unoccupied periods. However, areas of the building do experience heating and cooling comfort issues.

The facility does control the heating system in the equipment bays to operate a lower temperature only. The equipment bays are heated by gas fired infrared heating units. The bays are not cooled. The heating in this bay areas is controlled by thermostat that is set to heat only at above approximately 50F. Personnel also manually control the system and it often does not run unless work is required in the bay area.

PLUG LOADS AND MISC LOADS

The report estimated the plug load and miscellaneous loads for the facility based usage for service facilities.

Energy Consumption Analysis

The historical energy usage at the City of Kent : Service Administrative Complex (SAC) was analyzed using utility data. This analysis of the building's energy use from January 2022 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)
2022	157,137.52	16,499.07	1,838,973.22	24,970.6	40.03	0.54
2023	145,141.47	15,239.93	1,288,903.7	20,398.39	28.06	0.44
Average	151,139.5	15,869.5	1,563,938.46	22,684.5	34.05	0.49

Table: Energy Usage

ELECTRICITY CONSUMPTION

Electricity at the City of Kent : Service Administrative Complex (SAC) is provided by FirstEnergy. The monthly electricity consumption from January 2022 to December 2023 is displayed in the Table and Figure below.

	Electric Usage (kWh)			Electric Usage Cost ($)		
	2022	2023	Average	2022	2023	Average
Jan	9,528.93	12,453.37	10,991.15	1,000.27	1,307.23	1,153.75
Feb	12,947.07	12,266.27	12,606.67	1,359.07	1,287.53	1,323.3
Mar	14,297.4	12,033.77	13,165.58	1,500.77	1,263.5	1,382.13
Apr	12,767.2	11,477.73	12,122.47	1,340.6	1,205.6	1,273.1
May	12,869.13	12,664.53	12,766.83	1,351.7	1,330.17	1,340.93
Jun	14,576.13	12,451.7	13,513.92	1,530.27	1,307.1	1,418.68
Jul	16,604.43	14,347.3	15,475.86	1,743.4	1,506.53	1,624.97
Aug	14,938.3	13,715.13	14,326.72	1,568.73	1,440	1,504.37
Sep	13,687.2	12,469.87	13,078.53	1,437	1,309.7	1,373.35
Oct	11,984.53	10,611.8	11,298.17	1,258.7	1,114.57	1,186.63
Nov	10,813.33	10,536	10,674.67	1,135.33	1,106	1,120.66
Dec	12,123.87	10,114	11,118.94	1,273.23	1,062	1,167.62
Total	157,137.52	145,141.47	151,139.51	16,499.07	15,239.93	15,869.49

Table: Monthly Electrical Consumption

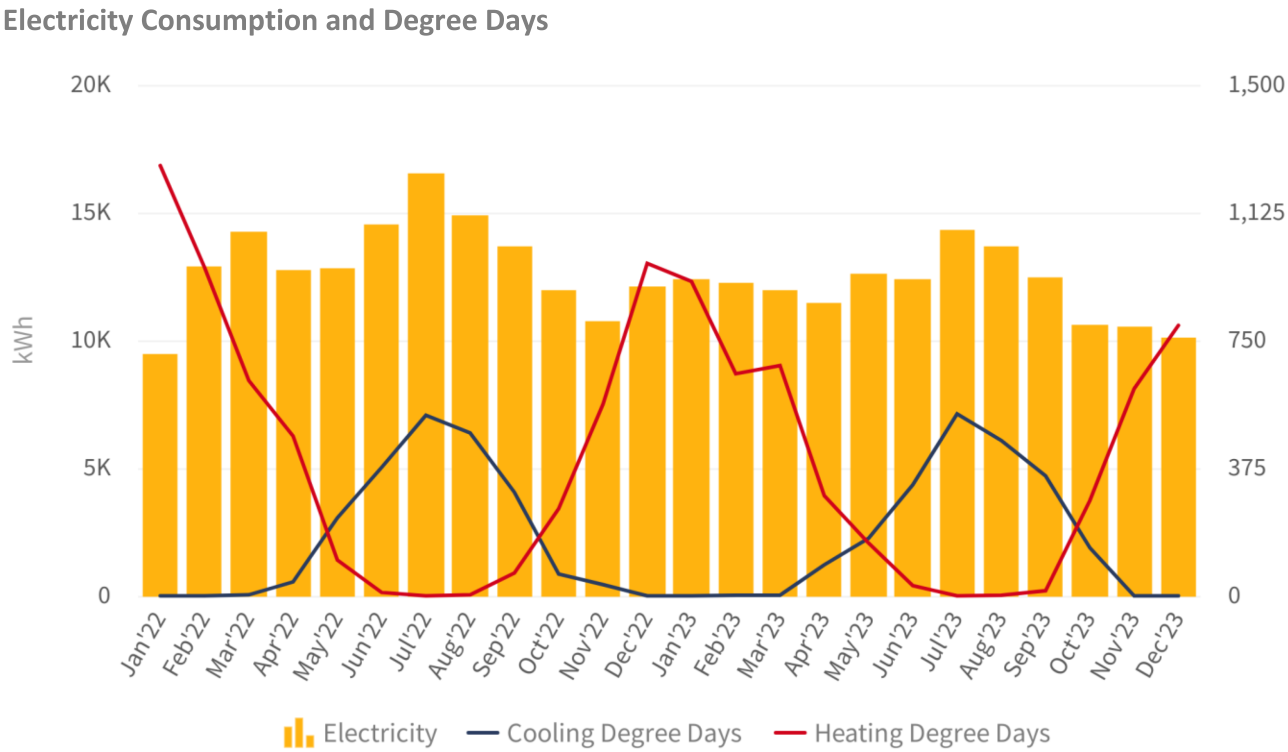


Figure: Average Monthly Electrical Consumption and Monthly Degree Days

NATURAL GAS CONSUMPTION

Natural Gas at the City of Kent : Service Administrative Complex (SAC) is provided by Dominion.

	Natural Gas Usage (therms)			Natural Gas Usage Cost ($)		
	2022	2023	Average	2022	2023	Average
Jan	2,010.8	2,033.1	2,021.95	1,307.53	1,321.97	1,314.75
Feb	2,641.87	1,513.2	2,077.53	1,717.47	983.83	1,350.65
Mar	2,731.23	1,484.5	2,107.86	1,775.3	964.53	1,369.91
Apr	1,943.4	407.27	1,175.34	1,263.3	265.13	764.21
May	705.43	132.73	419.08	458.47	86.8	272.63
Jun	187.4	54.2	120.8	121.73	35.1	78.42
Jul	160.7	51.47	106.08	104.63	32.97	68.8
Aug	148.97	47.8	98.38	97.17	31.13	64.15
Sep	125.8	46.97	86.38	82.4	30	56.2
Oct	187.73	60.57	124.15	122.67	39	80.84
Nov	597.67	508	552.84	388.83	330	359.41

Dec	1,587.2	1,597	1,592.1	1,032.03	1,038	1,035.01
Total	13,028.2	7,936.81	10,482.49	8,471.53	5,158.46	6,814.98

Table: Monthly Natural Gas Consumption

Natural Gas Consumption and Degree Days

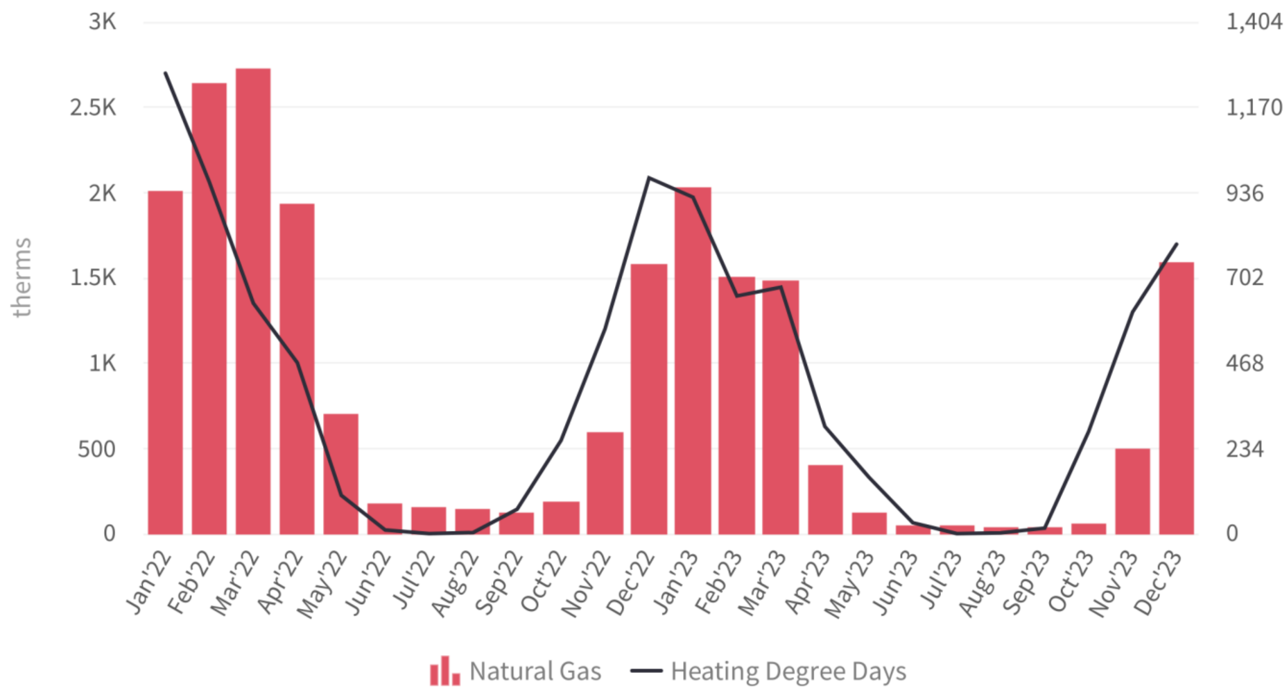


Figure: Monthly Natural Gas Consumption and Monthly Degree Days

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: $0.6501 /therms

Energy Use Intensity

You are able 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)
2022	40.03	0.54
2023	28.06	0.44
Average	34.05	0.49

Table: Normalized KPI

Energy End Use Breakdown

The table below outlines the energy end use breakdown of the City of Kent : Service Administrative Complex (SAC) 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

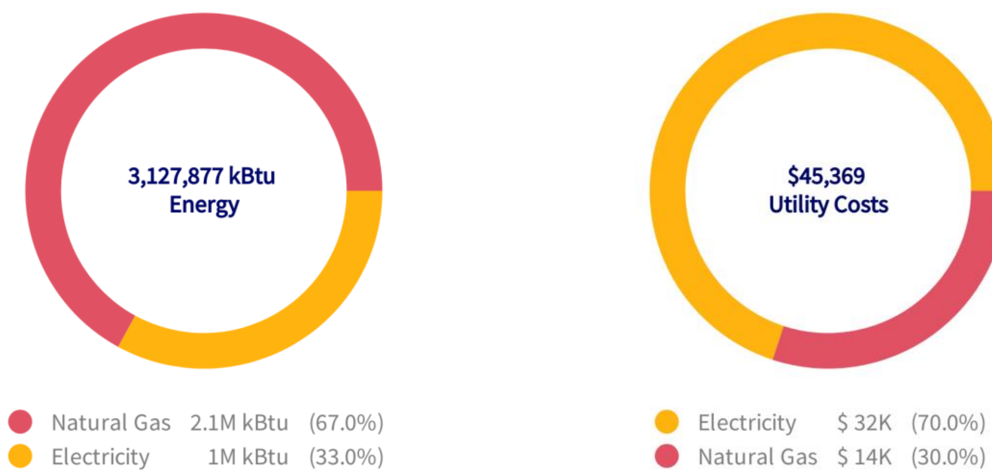


Figure: Energy & Cost End-Use Breakdown by Fuel Type

End Use	Electric Usage (kWh)	Natural Gas Usage(therms)	Total Use (kBtu)	Percentages
Space Heating	21,861	9,805	1,055,088	62.9%
Space Cooling	25,434	-	86,779	5.2%
Air Distribution	28,876	-	98,526	6%
SHW/DHW	0	1,273	127,300	7.6%
Lighting	66,174	-	225,787	13.4%
Plug Load	24,396	-	83,239	4.9%
Total	166,741	11,078	1,676,719	100%
Historical Billing	151,141	10,482	1,563,893	-
Actual	110%	106%	107%	-

Table: Energy End-Use Breakdown

Electricity & Natural Gas End-Use Breakdown

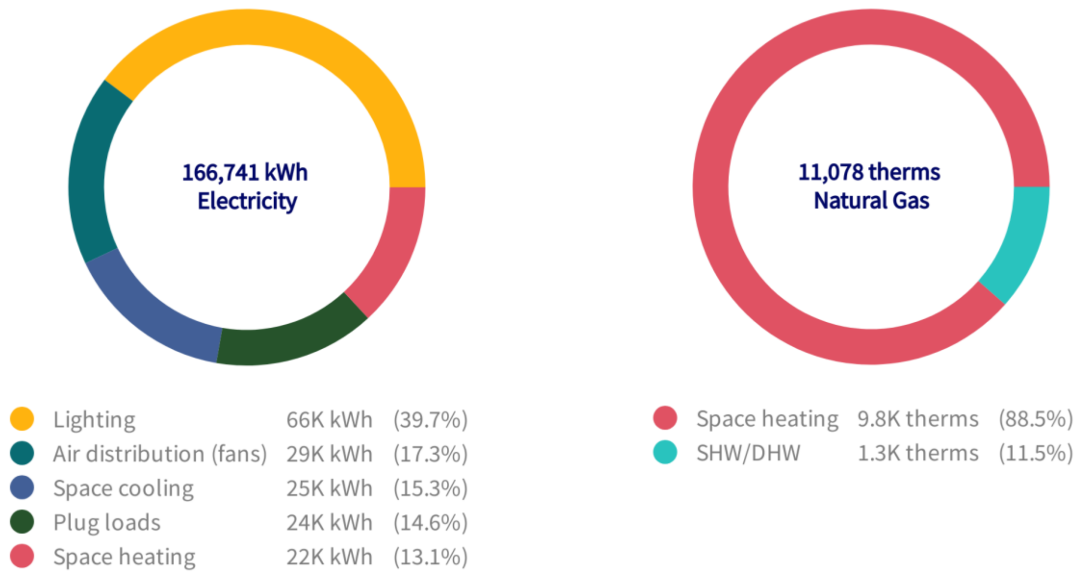
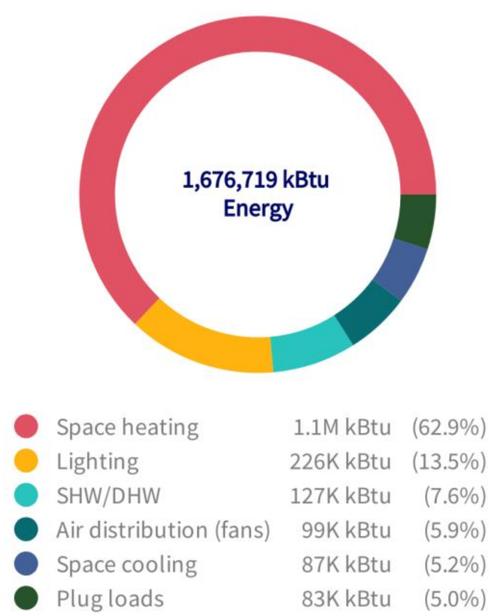


Figure: Electricity End-Use Breakdown and Natural Gas End-Use Breakdown

End Use Breakdown by End Use



Summary of Energy Savings

If all ECMs are implemented, the facility can expect to reduce electricity consumption by 25% and natural gas consumption by .1%. This would produce an annual operational savings on the order of 160,185 kWh and 11 therms for a combined $19,230 of utility and O&M expenditure reduction. The full implementation cost of these projects is estimated at $256,000, yielding a simple payback of 13.3 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	21,861	-	9,805	10	1,055,088	1,054,088	0.1%
Space Cooling	25,434	4,664	-	-	86,779	70,862	18.3%
Air Distribution	28,876	0	-	-	98,526	98,526	0%
SHW/DHW	0	0	1,273	0	127,300	127,300	0%
Lighting	66,174	36,720	-	-	225,787	100,498	55.5%
Plug Load	24,396	0	-	-	83,239	83,239	0%
Solar PV	0	118,800	0	0	0	-405,346	
Total without Solar PV	166,741	41,385	11,078	10	1,676,719	1,534,513	8.5%

Table: Energy Savings Breakdown by Usage

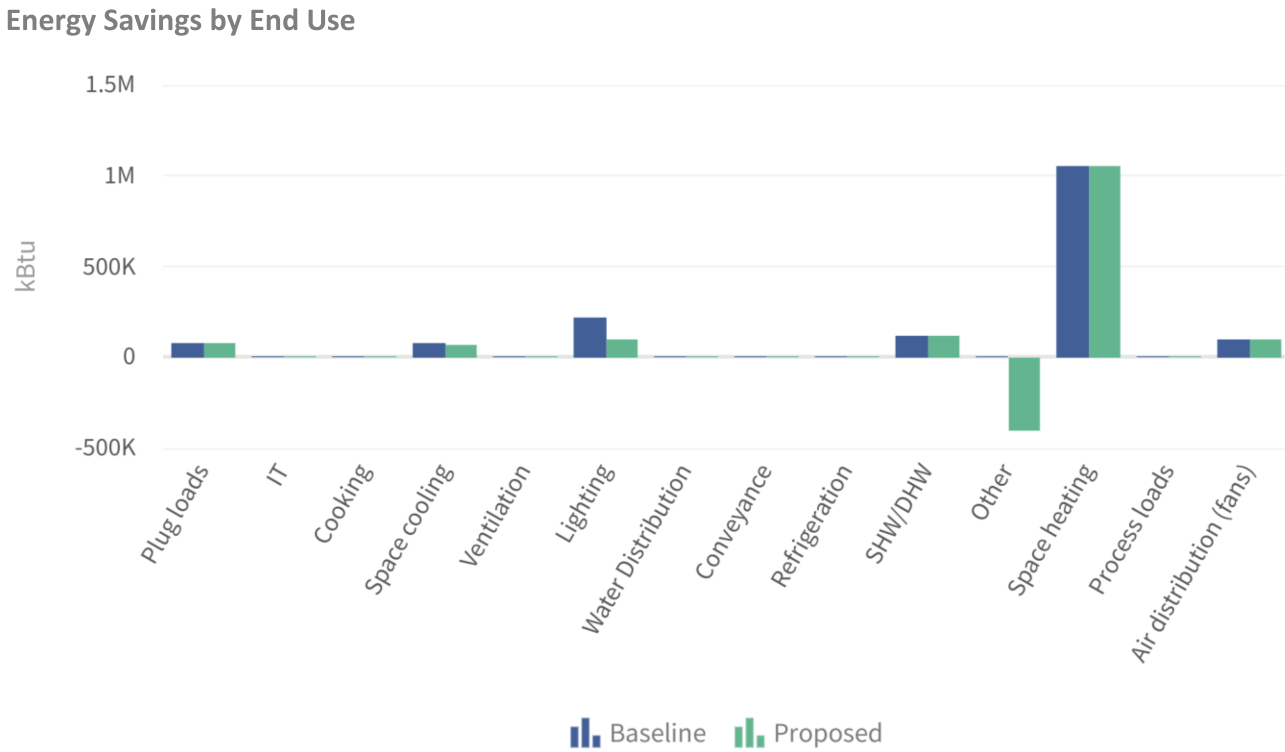


Figure: Energy Saving End-Use by Usage

Key Performance Indicators

Energy	Electricity (kWh)	Natural Gas (therms)	Site EUI	Total GHG Emissions (mtCO2e)
Baseline	166,741	11,078	36.5	183
Proposed	125,356	11,068	33.4	105
Reduction (%)	24.82%	0.09%	8.49%	42.62%

Table: KPI

Site Energy Use Intensity

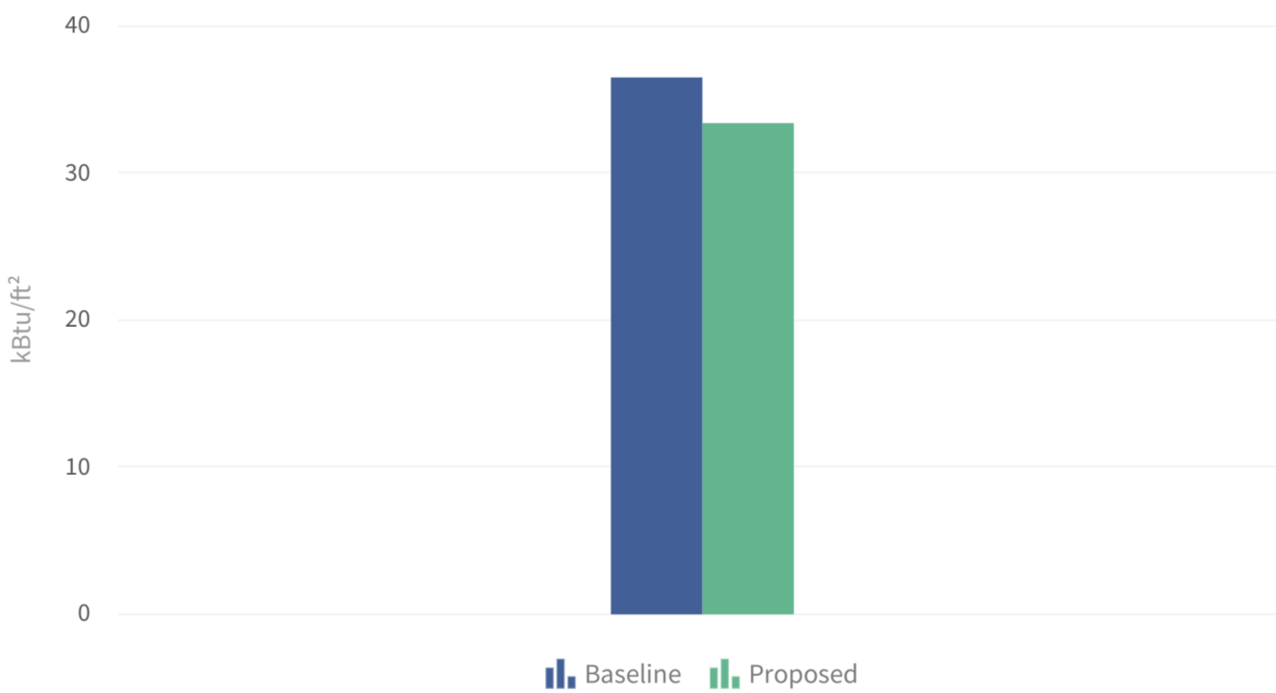


Figure: Site EUI Reduction

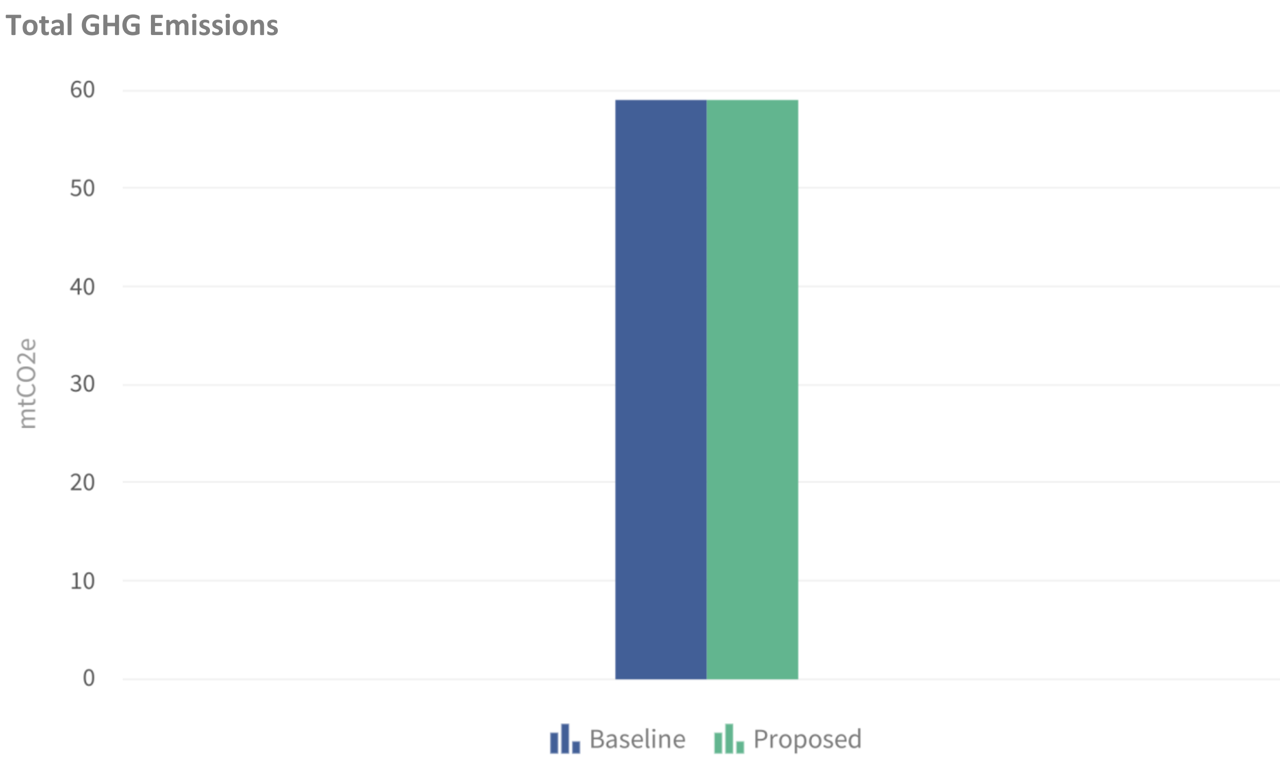


Figure: GHG Reduction

Energy Conservation Measures (ECMs)

Add Solar Photovoltaic (PV) System to Building

The building's garage bay roof would be a good candidate for a grid-tied solar PV system. Estimated square footage of the building's usable roof is 12000 square feet. With a typical coverage ratio of 90% and power output of 20 watts per square foot, a 108 kW system is achievable. A 108 kW system will produce around 18,800 kWh per year. PV systems are eligible for accelerated depreciation and a 30% Federal tax credit.

Name	Energy Savings (kBtu)	Electric Savings (kWh)	Natural Gas Savings (therms)	Estimated GHG Savings (mtCO2e)	Effective Useful Life (years)
Add Solar Photovoltaic (PV) System to Building	405,346	118,800	-	57.9	-

Total Measure Cost ($)	216,000	Simple Payback (yrs)	10.6
Estimated Incentive ($)	64,800	ROI (%)	9.4
Annual Cost Savings ($)	14,256	NPV ($)	-23,715

Replace Natural Gas Packaged RTU (2001) Unit

Replace a packaged heat pump with a higher efficiency unit in order to save energy. This project uses degree days to estimate energy consumption of the existing and replacement units.

Name	Energy Savings (kBtu)	Electric Savings (kWh)	Natural Gas Savings (therms)	Estimated GHG Savings (mtCO2e)	Effective Useful Life (years)
Replace Natural Gas Packaged RTU (2001) Unit	17,017	4,665	11	2.33	-

Total Measure Cost ($)	13,000	ROI (%)	4.4
Annual Cost Savings ($)	567	NPV ($)	-7,934
Simple Payback (yrs)	> 20 years		

Lighting Upgrade T8/T5 Fluorescent to LED

The majority of the general interior fixtures are fluorescent T8 fixtures that have not been upgraded. For the purpose of this report, the number of fixtures were estimated based on the available information. The fixture counts for the facility were estimated.

Even though the existing interior fixtures have not been upgraded, the facility does an excellent job of controlling the lighting to reduce energy usage. A number of areas in the facility use occupancy sensors to reduce lighting usage very effectively. Many areas of the facility have limited hours use for the lighting due to occupancy. The truck bay lighting system is T12 fluorescent. These fixtures are not used most of the day. The bay areas have sufficient daylight from the glass doors and the lighting is manually used as needed. It is estimated that these fixtures are used 3 hours a day on the average.

Name	Energy Savings (kBtu)	Electric Savings (kWh)	Natural Gas Savings (therms)	Estimated GHG Savings (mtCO2e)	Effective Useful Life (years)
Lighting Upgrade T8/T5 Fluorescent to LED	125,289	36,720	0	17.89	0

Total Measure Cost ($)	27,000	Simple Payback (yrs)	6.1
Estimated Incentive ($)	0	ROI (%)	53.8
Annual Cost Savings ($)	4,407	NPV ($)	12,403

Other Potential Building Upgrades

The there are other potential opportunities that could help improve the building energy use profile. These additional measures would require additional investigation and engineering to quantify the potential improvements. These potential improvements are beyond the scope and details available for this audit report, but it may be valuable to further explore these opportunities.

HVAC System Upgrades

The best long term course of action for the HVAC system may be to replace the rooftop HVAC system with a new multizone VRF system. This would be a large capital investment and require significant engineering to design. This upgrade can have potential energy reduction and sustainability impact. Conversion to the VRF heat pump systems would reduce the natural gas usage. The system also has the ability to heat and cool a building at the same time, providing the opportunity to rectify the zone heating cooling comfort issues in the building.

VRF is well suited to retrofit applications in older buildings because it may be added onto or replace existing equipment in limited space. This facility currently has a number of mini-split heat pump systems in use already. HVAC Systems using variable refrigerant flow (VRF) technology allows 40 to 50 percent efficiency improvement over standard ASHRAE 90.1 standard RTU units. Basically, VRFs use the refrigerant as the cooling- and heat-transfer medium. The refrigerant is conditioned by an outdoor condensing unit and then circulated within the building to multiple indoor fan-coil units. The system can also provide the ability to address the

VRF system are larger capital investments than the existing systems and the many fan coils required may introduce maintenance costs that may not have previously existed.

HVAC Zoned Controls and Controls Upgrade on Existing HVAC

The existing thermostat controls in the facility are for the most part programmed to setback the temperature in the spaces during low occupied hours. This control is reducing energy usage. It may be advantageous to replace or re-commission the zone controls of HVAC spaces in the facility.

Currently, the facility personnel report comfort issues. The main RTU units do have controls that serve multiple zones independently from the same unit. These zone controls were not accessible during the audit. Information about the control systems or drawings were not made available. The existing controls may be able to be recommissioned to better meet the heating and cooling requirements in each space. Additional investigation is required to determine the viability of the existing controls.

Potential Building Envelope Improvement

Coating the exterior metal roof surfaces with a highly reflective paint (this is sometimes referred to as a “cool roof”). White reflective coatings used for cool roof applications contain transparent polymeric materials, such as acrylic, and a white pigment, such as titanium dioxide (rutile), to make them opaque and reflective. These coatings typically reflect 70% to 80% of the sun’s energy. Thus, the pigments help protect the polymer material and the substrate underneath from UV damage. As long as the coating is white or light-colored, the roof will have high reflectance and emittance levels. Cool roofs also help reduce energy use during peak demand times during summer electrical usage is highest. Cool roofs can help reduce the demand charge that a facility pays all year on the basis of its greatest energy use.

The PV Solar measure currently is estimated based on the existing conditions. However, adding a cool roof coating with reflective materials can help make a potential solar system more effective and produce more power. It is estimated that a cool roof reduces the ambient temperature of the roof covering by 10 degrees and in so doing may increase the generating performance of the PV panels by 10-13 percent.

Appendix

Lighting Table

Name	Quantity	Location Name	Watts (W)	Control type
4 216W T5 4-lamp Standard Electronic High Output Fluorescent	70	Shop	216	-
4 58.88W T8 2-lamp Standard Electronic Linear Fluorescent	120	Office	58.88	-
4' 28/25W RW T8 2-Lamp, Elect Ballast	110	Office	56	-
ELED3/1 - EXIT Light Emitting Diode, (1) 3W lamp, Single Sided	12	Various	3	-

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
CBECS	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		