



Energy Audit

City of Kent: Police Department

July 6, 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: Police Department at 301 S. Depeyster 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	488,374	9,757	78.72	415
Proposed	426,559	9,757	72.44	385
Reduction (%)	12.66%	0%	7.98%	7.23%

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 Air Purifier to Evidence Room	4,000	-580	NA	-16,514	-2.36	-4,840	-
Add Solar Photovoltaic (PV) System to Building	103,200 or 72,240 after incentive	6,804	10.5	193,460	27.63	56,700	-
Variable Frequency Drives (VFD) - Pumps	2,000	1,195	1.7	33,966	4.85	9,955	-
Total	109,200	7,419	10.5	210,912	30.12	61,815	-

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: Police Department located at 301 S. Depeyster St., 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: Police Department is a Police Station operated by the Client and has a total floor area of approximately 33,561 sq.ft.. The building was built in 2018 and is a 2-story structure. The facility is primarily a Police Station. The City of Kent's Police Station serves as a 24-hour public safety facility. The building was designed with energy performance and operation as a priority.

BUILDING ENVELOPE

Application	Name	R-Value	Comments
Wall	Metal framing a combination of concrete & cement fiber board cladding.	R-8	Est. R-Value

Application	Name	R-Value	Comments
Roof	Flat, reflective/white, thermoset/thermoplastic cover over metal sublayer. Reflective roofing and thermoset design results superior thermal properties to reduce heat loss/gain.	R-25	Est. R-Value

Application	Name	R-Value	Comments
Window	Double paned with thermal breaks and slight tint.	R-4	Est. R-Value

Tables: Construction

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

Name	Quantity	Location Name
CARRIER AHUs	4	Various
LOCHINVAR (1) / CREST CONDENSING / NAT. GAS / M# FBN1001 / S# 1650104249795 / BTU-IN 1,000,000 : BTU-OUT 960K / 2016	1	Boiler Room
LOCHINVAR (2) / CREST CONDENSING / NAT. GAS / M# FBN1001 / S# 1650104249798 / BTU-IN 1,000,000 : BTU-OUT 960K / 2016	1	Boiler Room
CARRIER 30RAP AIR COOLED CHILLERS	3	Roof
ERV (associated w/ AHU4)	1	Roof

Name	Quantity	Location Name
CHW PUMP TACO 5HP	2	MER
HW PUMP TACO 3HP	2	MER
Chiller Pump 1.5 HP	3	MER
GEN. LG / SMART INVERTER Indoor Unit	4	
LG / SMART INVERTER / M# LSU090HSV4 Outdoor Unit	1	

DOMESTIC HOT WATER

Name	Quantity	Location Name
A.O. SMITH (1) / M# BTH-150A300 / S# 1722106329248 / NAT. GAS / 100 GALLON / ~2022	1	MER
A.O. SMITH (2) / M# BTH-150A300 / S# 1718106055336 / NAT. GAS / 100 GALLON / ~2022	1	MER

LIGHTING

Name	Quantity	Location Name	Watts (W)
30W	234	Various	30
30W	234	Various	30

LIGHTING AND LIGHTING CONTROL

The interior and exterior lighting fixtures are all energy efficient LED fixtures. For the purpose of this report, the number of fixtures were estimated based on estimated lighting power density(LPD) for the space. The fixture counts in the report are estimated to provide a baseline usage. Many areas in the facility have occupancy based lighting controls that reduce the lighting usage during lower occupied periods.

HVAC AND CONTROLS

The main HVAC system includes 4 VAV air handlers. The building also has a ERV to recovery energy from the exhaust of the section served by AHU4. The air handlers are provided chilled water by air cooled chillers and hot water by high efficiency condensing boilers.

The majority of the units are controlled by Alerton DDC controls. The DDC controls in the facility have been upgraded in the last 4 years to provide better response and maintainability. The HVAC controls are programmed to effectively optimize energy use throughout the building. The building is a 24x7 operation but areas that are less occupied have some automated controls including CO2 control and occupancy controls. Most areas that are not occupied 24x7 are setback or controlled by a form of occupancy control.

PLUG LOADS AND MISC LOADS

The report estimated the plug load and miscellaneous loads for the facility. The 2018 CBECS data for Public Order and Safety buildings was used as a reference. The plug loads are significant due to the nature of the operation and the 24 hour occupancy.

Energy Consumption Analysis

The historical energy usage at the City of Kent: Police Department 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.

Note that for the energy use breakdown, the gas usage for hot water reheat usage is combined with the domestic hot water and service hot water usage. The non heating gas usage is difficult to define individually because it is unrelated to HDD based analysis.

	Electric Usage (kWh)	Electric Total Cost (\$)	Total Energy Use (kBtu)	Total Cost (\$)	Site EUI (kBtu/SqFt)	Total Cost Per Square Foot (\$/SqFt)
2022	477,855.12	39,662.34	2,605,101.67	46,094.28	77.62	1.37
2023	476,929.89	39,585.66	2,661,923.78	46,412.72	79.32	1.38
Average	477,392.51	39,624	2,633,512.72	46,253.5	78.47	1.38

Table: Energy Usage

ELECTRICITY CONSUMPTION

Electricity at the City of Kent: Police Department 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	24,801.33	35,710.57	30,255.95	2,058.47	2,963.97	2,511.22
Feb	28,247.33	29,391.97	28,819.65	2,344.53	2,439.7	2,392.11
Mar	30,772.53	32,692.67	31,732.6	2,554.3	2,713.67	2,633.99
Apr	30,595.6	34,841.6	32,718.6	2,539.8	2,891.53	2,715.66
May	31,540.8	37,019.07	34,279.93	2,618.3	3,072.8	2,845.55
Jun	41,635.07	41,264	41,449.54	3,455.87	3,424.6	3,440.23
Jul	55,161	52,290	53,725.5	4,578.27	4,340.2	4,459.24
Aug	57,258.33	49,958.77	53,608.55	4,752.67	4,147.03	4,449.85

Sep	59,106.6	56,120.37	57,613.49	4,905.6	4,658.13	4,781.86
Oct	47,326.23	43,555.87	45,441.05	3,928.03	3,615.03	3,771.53
Nov	37,405.5	31,781	34,593.25	3,104.5	2,638	2,871.25
Dec	34,004.8	32,304	33,154.4	2,822	2,681	2,751.5
Total	477,855.12	476,929.89	477,392.51	39,662.34	39,585.66	39,623.99

Table: Monthly Electrical Consumption

Electricity Consumption and Degree Days

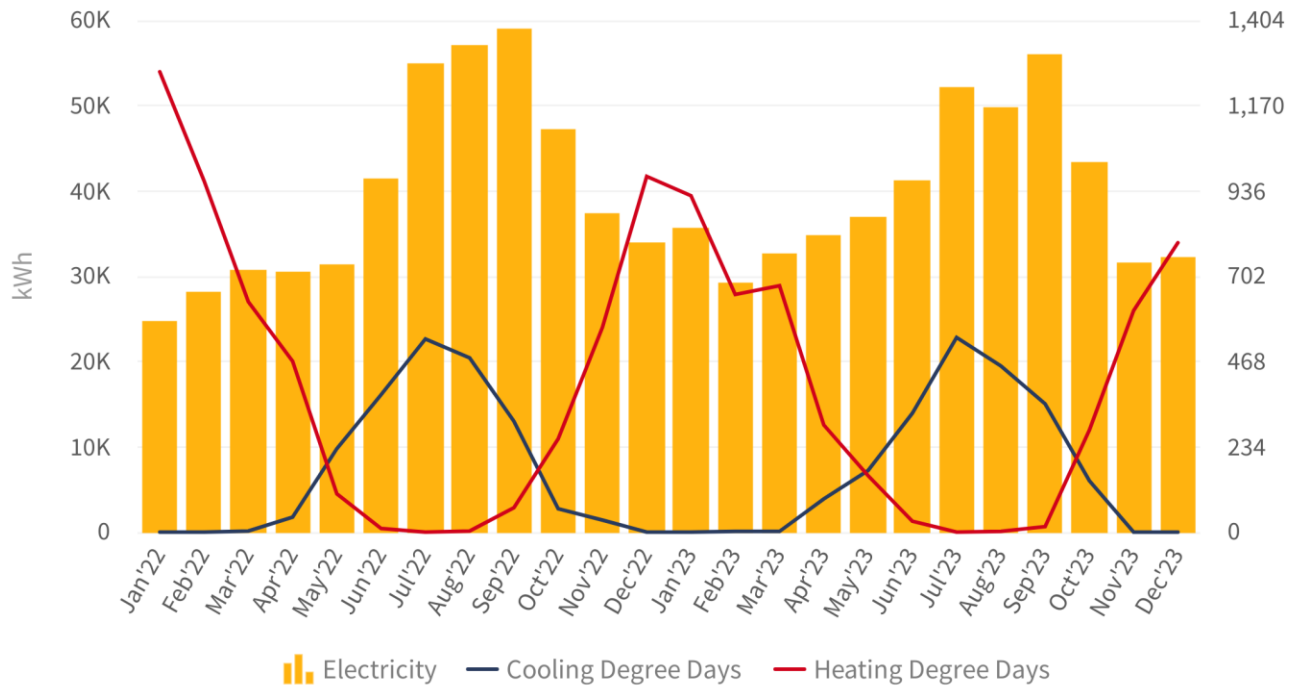


Figure: Average Monthly Electrical Consumption and Monthly Degree Days

NATURAL GAS CONSUMPTION

Natural Gas at the City of Kent: Police Department is provided by Dominion.

	Natural Gas Usage (therms)			Natural Gas Usage Cost (\$)		
	2022	2023	Average	2022	2023	Average
Jan	1,033.27	1,573	1,303.13	682	1,038.47	860.24
Feb	1,441.73	1,234.57	1,338.15	951.33	815.1	883.22
Mar	1,191	1,248.9	1,219.95	786.37	823.7	805.04
Apr	844.1	832.33	838.22	557.3	549.4	553.35
May	540.1	741.7	640.9	356.27	489.6	422.94

Jun	475.47	493.9	484.69	313.73	325.8	319.76
Jul	532	473.53	502.76	350.97	311.93	331.45
Aug	542.93	525.4	534.16	358.43	346.8	352.62
Sep	609.4	621.23	615.32	402.4	409.53	405.96
Oct	619.33	681.83	650.58	408.2	449.73	428.97
Nov	669.5	820	744.75	441.67	541	491.34
Dec	1,247.77	1,100	1,173.88	823.27	726	774.63
Total	9,746.6	10,346.39	10,046.49	6,431.94	6,827.06	6,629.52

Table: Monthly Natural Gas Consumption

Natural Gas Consumption and Degree Days

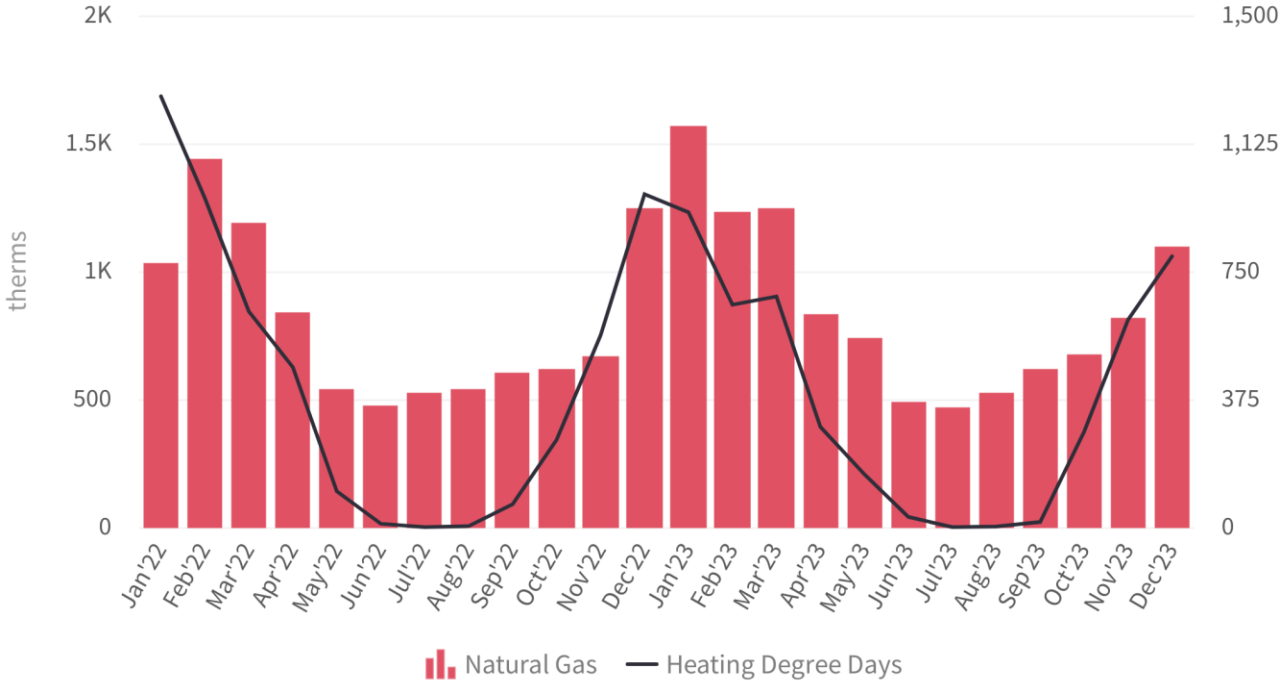


Figure: Monthly Natural Gas Consumption and Monthly Degree Days

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: \$0.083 /kWh

Natural Gas Average Blended Rate: \$0.6599 /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)
2022	77.62	1.37
2023	79.32	1.38
Average	78.47	1.38

Table: Normalized KPI

Energy End Use Breakdown

The table below outlines the energy end use breakdown of the City of Kent: Police Department 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

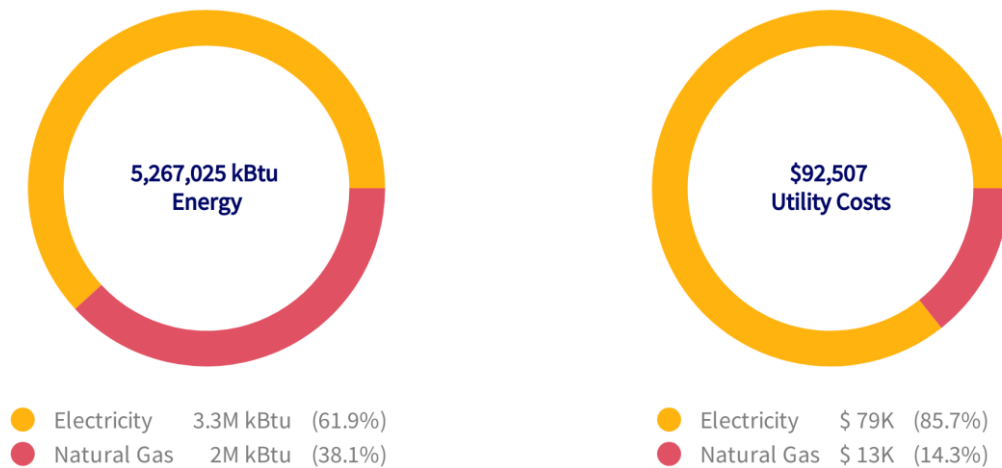


Figure: Energy & Cost End-Use Breakdown by Fuel Type

End Use	Electric Usage (kWh)	Natural Gas Usage(therms)	Total Use (kBtu)	Percentages
Space Heating	0	3,724	372,362	14.2%
Space Cooling	88,736	-	302,767	11.5%
Air Distribution	127,018	-	433,384	16%
HW Reheat/SHW/DHW	0	6,033	603,320	22.9%
Lighting	82,555	-	281,678	10.7%
Plug Load	132,000	-	450,384	17.1%
Water Distribution	58,065	-	198,118	7.6%
Total	488,374	9,757	2,642,013	100%
Historical Billing	477,394	10,047	2,633,568	-
Actual	102%	97%	100%	-

Table: Energy End-Use Breakdown

Electricity & Natural Gas End-Use Breakdown

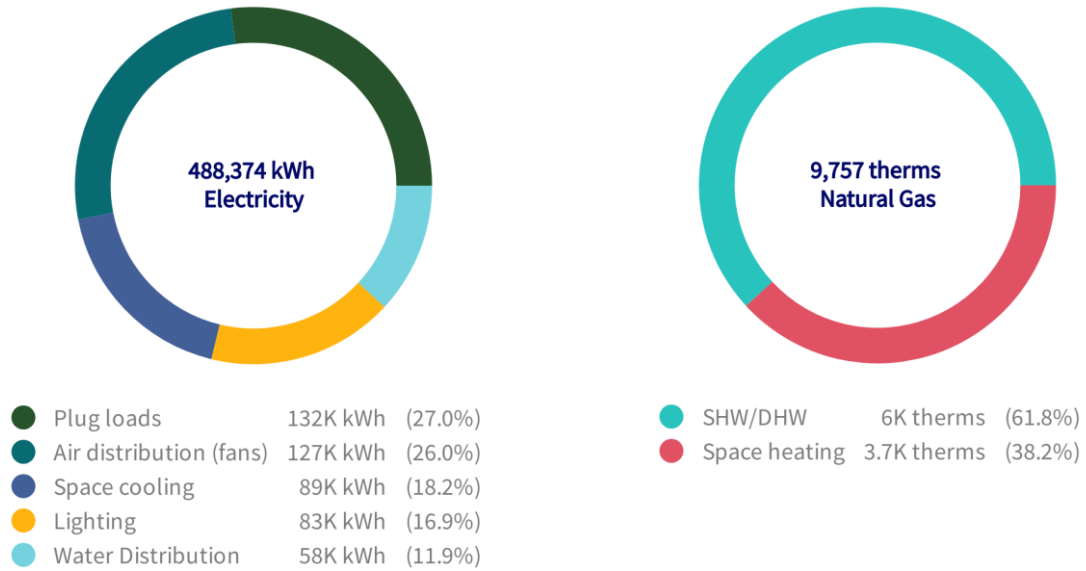
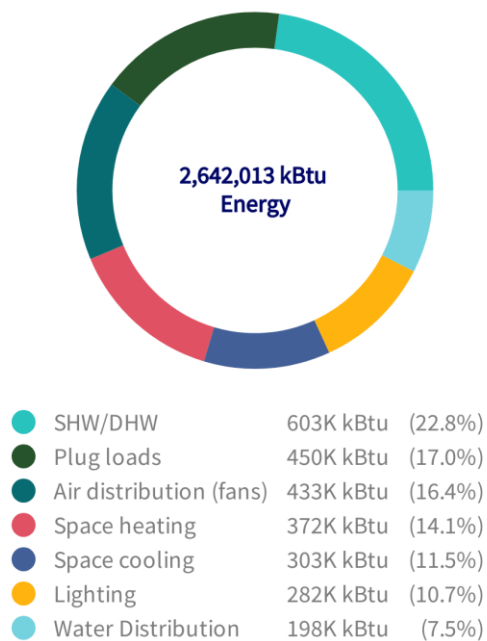


Figure: Electricity End-Use Breakdown and Natural Gas End-Use Breakdown

End Use Breakdown by End Use



Summary of Energy Savings

If all ECMs are implemented, the facility can expect to reduce electricity consumption 13%. This would produce an annual operational savings on the order of 61,815 kWh for \$7,419 of utility and O&M expenditure reduction. The full implementation cost of these projects is estimated at \$109,200, yielding a simple payback of 10.5 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	-	3,724	0	372,362	372,362	0%
Space Cooling	88,736	9,954	-	-	302,767	268,801	11.2%
Air Distribution	127,018	-4,840	-	-	433,384	449,898	-3.8%
HW Reheat/SHW/DHW	0	0	6,033	0	603,320	603,320	0%
Lighting	82,555	0	-	-	281,678	281,678	0%
Plug Load (Savings attributed to PV installation)	132,000	56,700	-	-	450,384	256,924	43%
Water Distribution	58,065	0	-	-	198,118	198,118	0%
Total	488,374	61,815	9,757	0	2,642,013	2,431,100	8%

Table: Energy Savings Breakdown by Usage

Energy Savings by End Use

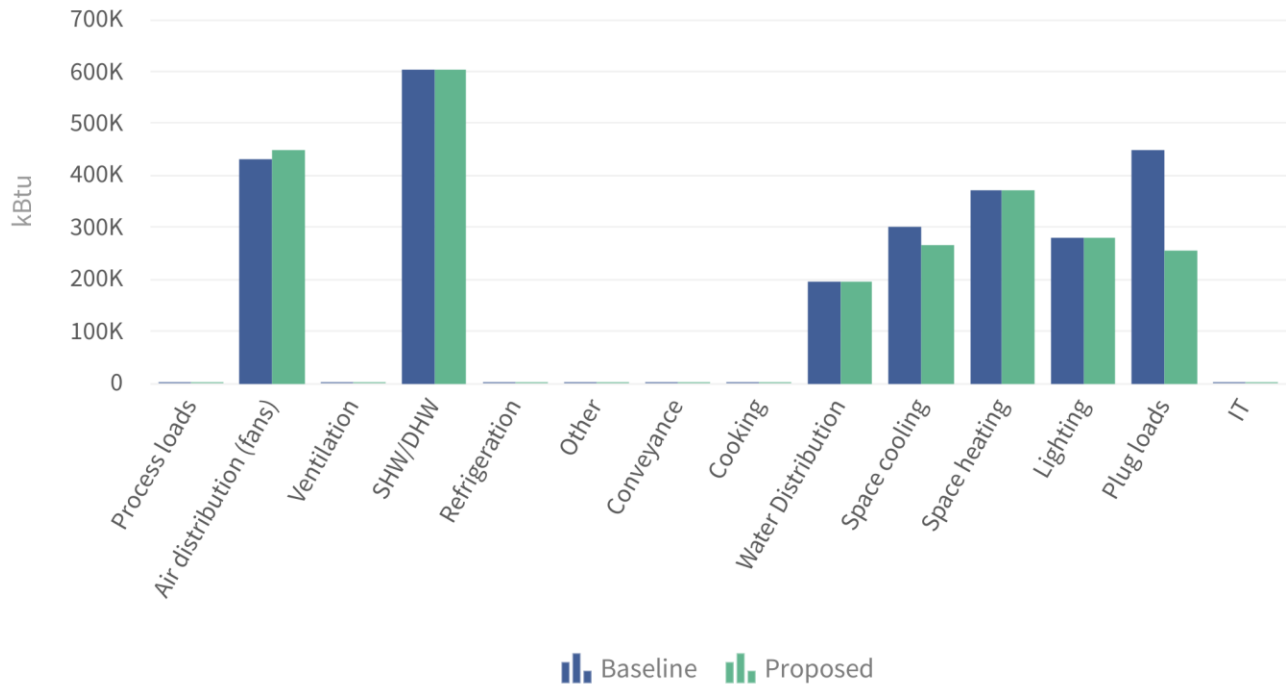


Figure: Energy Saving End-Use by Usage

Key Performance Indicators

Energy	Electricity (kWh)	Natural Gas (therms)	Site EUI	Total GHG Emissions (mtCO2e)
Baseline	488,374	9,757	78.72	415
Proposed	426,559	9,757	72.44	385
Reduction (%)	12.66%	0%	7.98%	7.23%

Table: KPI

Site Energy Use Intensity

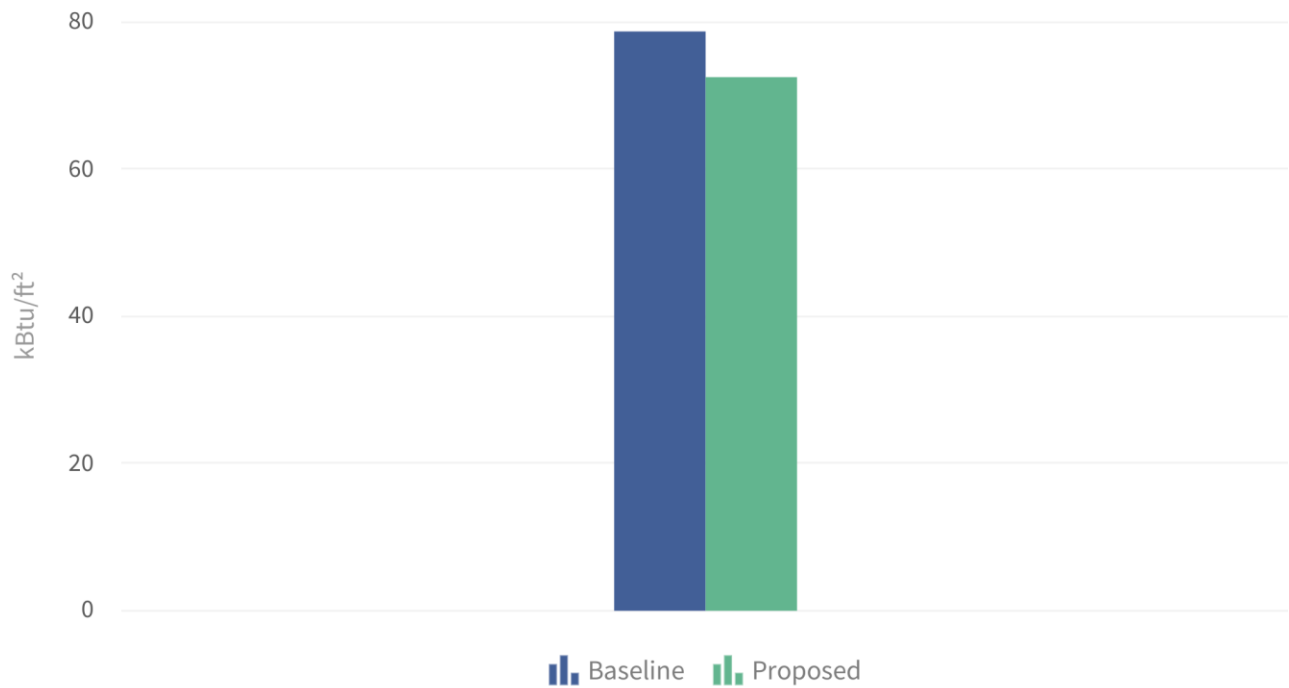


Figure: Site EUI Reduction

Total GHG Emissions

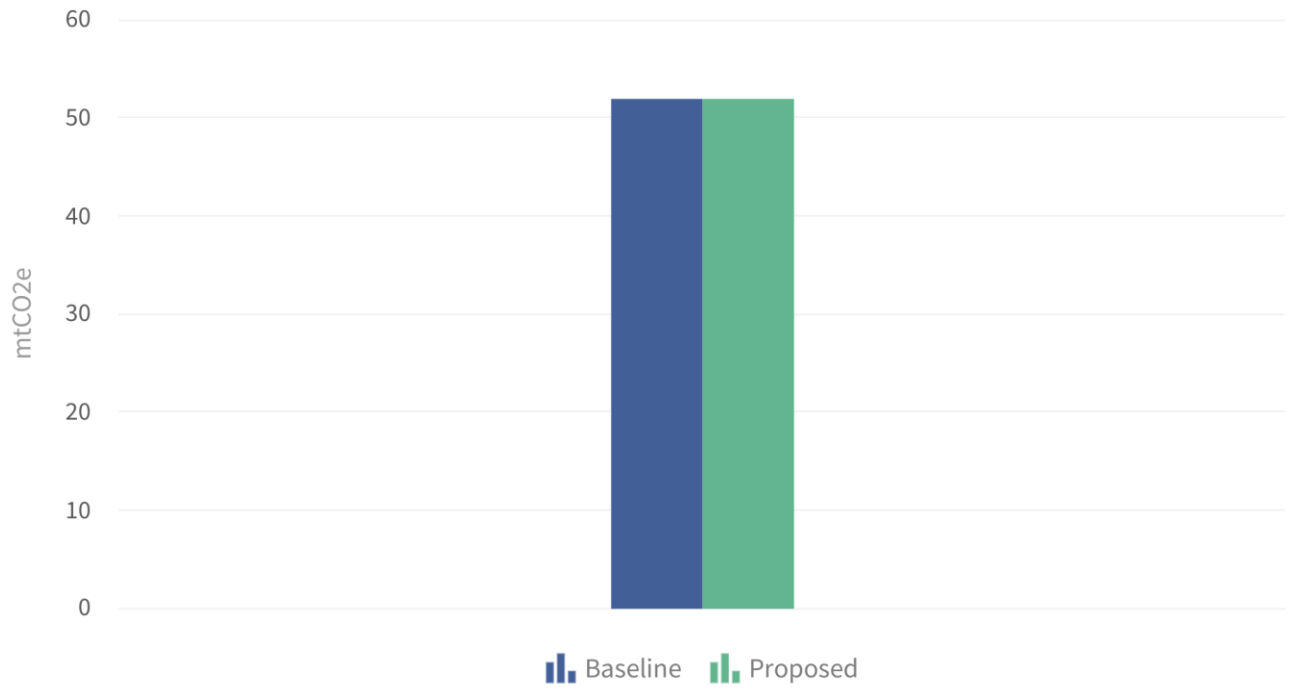


Figure: GHG Reduction

Energy Conservation Measures (ECMs)

Variable Frequency Drives (VFD) - Pump

Re-establish the variable frequency drive control on hot water pumping. Application covered in this section are heating hot water pumps. Currently the 3 HP hot water pump is operating at 60 HZ (100 percent speed) continuously. This pump provides HW to serve the HVAC system and HW reheat. There is a VFD to control the variable HW pumping but the system is not varying the speed. A component of the HW system had to be replaced for maintenance, and it is possible that the system is overridden. Also, the differential pressure setpoint may be programmed and the system may not reach the setpoint. Re-instituting the use of the VFD control of the HW pumping will result in energy savings.

Name	Energy Savings (kBtu)	Electric Savings (kWh)	Natural Gas Savings (therms)	Estimated GHG Savings (mtCO2e)	Effective Useful Life (years)
Variable Frequency Drives (VFD) Pumps	33,966	9,955	-	4.85	-

Total Measure Cost (\$)	2,000	ROI (%)	59.8
Annual Cost Savings (\$)	1,195	NPV (\$)	8,682
Simple Payback (yrs)	1.7		

Add Solar Photovoltaic (PV) System to Building

The building's roof would be a good candidate for a grid-tied solar PV system. Estimated square footage of the building's usable roof is 5000 square feet. With a typical coverage ratio of 90% and power output of 20 watts per square foot, a 51 kW system is achievable. A 51 kW system will produce around 56,700 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	193,460	56,700	-	27.63	-

Total Measure Cost (\$)	103,200	Simple Payback (yrs)	10.6
Estimated Incentive (\$)	30,960	ROI (%)	9.4
Annual Cost Savings (\$)	6,804	NPV (\$)	-11,394

Add Air Purifier to Evidence Room

Facility personnel report that evidence room has ventilation issues that result in odors in the room.

Air Purifiers are often used for evidence rooms not only for the safety of the employees but also to preserve the evidence from decaying rapidly. Especially drugs like marijuana and mushrooms tend to mold quickly causing excessive off-gassing and loss of inventory. By using an air purifier in the evidence room or property storage room, the purifiers reduce odors and other harmful contaminants emitted from narcotics, marijuana, mold etc. protecting the health of the employees and creating a safer work environment. The addition of the air purifier is a net negative energy savings because the purifier system uses electric power.

It is also recommended that the existing HVAC system and controls should be verified to be being operated as designed. Appropriate/recommended air changes per hours should be maintained. The HVAC filter systems should be maintained regularly. The HVAC and exhaust evidence rooms were should be used to keep the space under negative pressure to prevent odors from escaping to other areas. It may also be advantageous to install CO2 sensors to maintain appropriate outside air supply. Dehumidification or humidity control may also help to reduce the odors in the room.

Name	Energy Savings (kBtu)	Electric Savings (kWh)	Natural Gas Savings (therms)	Estimated GHG Savings (mtCO2e)	Effective Useful Life (years)
Add Air Purifier to Evidence Room	-16,514	-4,840	-	-2.36	-

Total Measure Cost (\$)	4,000	NPV (\$)	-9,193
Annual Cost Savings (\$)	-580		

Appendix

Lighting Table

Name	Quantity	Location Name	Watts (W)	Control type
30W LED	234	Various	30	Automated
30W LED	234	Various	30	Automated

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		