9/29/2023

Winter Park Police Training Center

ASHRAE Level II Energy Audit

15 lightyears
Energy Testing | Solar Power | Green Certification

TLC ENGINEERING SOLUTIONS

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Executive Summary

TLC Engineering Solutions (TLC) and 15 Lightyears performed an ASHRAE Level 2 facility energy audit of the Winter Park Police Training Firing Range as a part of a contract with the City of Winter Park.

This report is related to the energy-consuming systems only and is intended to fulfill the requirements of an ASHRAE Level 2 Energy Audit, per the guidelines set forth by the ASHRAE document "Procedures for Commercial Building Energy Audits." The purpose was to observe existing conditions and gather information that would enable TLC to render an opinion concerning conditions or deficiencies that could affect efficient use of this facility, and to identify potential areas for improvement. Neither the field visits nor this report is intended to uncover hidden defects or the presence of hazardous materials.

TLC reviewed the current utility bills from January 2021 through December 2022, subsequent project documentation, and visited the site in January 2023 to review the mechanical and electrical equipment, the HVAC and lighting controls systems, and observe each space type and its general energy use intensity. In the course of its work, TLC obtained extensive photo documentation of the conditions of the facility. Several of the photographs are included in Appendix B of this report, and the reader is encouraged to thoroughly review the photographs and descriptions, as they are intended to support and supplement the observations described herein.

After the time on site, TLC developed energy saving spreadsheets to assist with the analysis of recommended Energy Conservation Measures (ECMs) and Facility Improvement Measures (FIMs). The combination of all the walkthrough and post-walkthrough activities led to the development of the ECM and FIM list. A complete description and analysis of each ECM, as well as a table summarizing estimated cost and savings of each measure, can be found later in this report in the Energy Saving Opportunities section.

Project Information & Contacts

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General Facility Description

The Police Training Firing Range is a one-story civic building of approximately 10,929 square feet, which includes a support facility, firing range, and outdoor training ground. An aerial view of the Police Training Firing Range is shown below.

Figure 1: Aerial View of the Police Training Firing Range

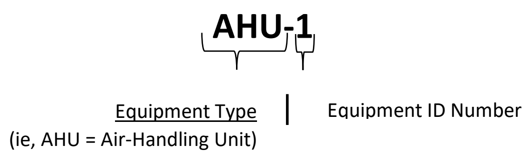
The interior of the building hosts the firing range, restrooms, storage, and other support spaces for police training. Outside the building, there is a training obstacle course and a covered garage/storage space.

Mechanical Systems

The Police Training Firing Range features mechanical systems designed to support the use of the building as a training facility. Conditioning and ventilation for the building is provided via packaged rooftop DX air handling units and exhaust fans. Mechanical system information came from a combination of resources, including information gathered during TLC's audit walk-through of the building and construction drawing review. The below breakdown of the mechanical systems and areas they serve is TLC's best attempt to consolidate all avenues of information into one master list.

Equipment Naming Convention

The general naming convention used on the mechanical drawings is shown below. Please note, this convention applies to most of the equipment, but not all equipment.



Air Handling Units

The air conditioning for the majority of the building is provided by three (3) rooftop DX air conditioning units. Information available from the unit labels was limited, as model and serial numbers were mostly worn and unreadable.

VAV Terminal Units

Variable Air Volume (VAV) boxes are duct devices that modulate flow to different thermal zones based on changing loads. The VAVs are part of the ductwork distribution from the AHUs and serve the various spaces and training areas throughout the building.

Exhaust Fans

Exhaust fans were observed on the rooftop, providing general exhaust for restrooms located within the building. Additionally, the firing range is provided with exhaust via a dedicated fan, which includes filtration prior to the airstream exiting the building to the atmosphere.

Building Controls

The building is not currently controlled by a centralized Building Automation System (BAS). All equipment within the building operates as a standalone system. Instead, the rooftop units have been outfitted with Ecobee smart thermostats. The thermostats provide remote monitoring and setpoint change capability to the Winter Park Facilities personnel, as well as limited energy analysis such as runtime trending.

Lighting Systems

Interior lighting throughout the facility is predominantly provided via LED light fixtures. These are controlled manually via wall switch.

Domestic Water Fixture (Plumbing) Systems

The building is served by one (1) electric tank-style water heater. The water heater has a capacity of 30-gallons.

Building Envelope

The building envelope consists primarily of CMU wall construction, with a flat, built-up roof system. During the auditing observation visit, no visible issues were noted with the building envelope with respect to the audit scope. However, the City has indicated that during summer months, the temperature indoors is often elevated and investigation into the building insulation may be performed in the future.

Key Operating Parameters

There are no published operating hours for the Firing Range facility. The HVAC systems are scheduled to maintain a space temperature setpoint of 69F from the hours of 6:30 AM to 11:30 PM.

Site Visit

The site was audited by TLC engineers and 15 Lightyears personnel in January 2023. A full evaluation of existing energy consuming systems, compliant with ASHRAE Standard 211-2019 was performed. During the audit, TLC personnel were escorted by the City of Winter Park sustainability manager, Leif Bouffard. He, as well as any facility staff that were available for comment, were questioned on system operation, condition, and maintenance of the building systems.

Utility Analysis

Historical Utility Data

The building is currently provided with electricity and water utilities by the City of Winter Park. Electrical utility consumption values were provided for the months of January 2021 through June 2023. The monthly consumption profile follows a regular pattern of training periods for the Winter Park police throughout the year. No specific costs or utility bills were provided, but a blended rate for kWh savings was determined based on the published rates for consumption and demand. Calculation of the blended utility rate takes into account the non-fixed costs associated with electrical utilities use by the facility, including fuel charges, per-kWh cost, demand charges, etc. Table 3 details the components of the blended rate calculation.

Table 1: Annual Baseline Energy Consumption

Utility	Total
Annual Electrical Consumption (kWh)	69,744
Annual Electrical Cost	-

The following graph and table show the total consumption and demand per monthly billing period for electricity.

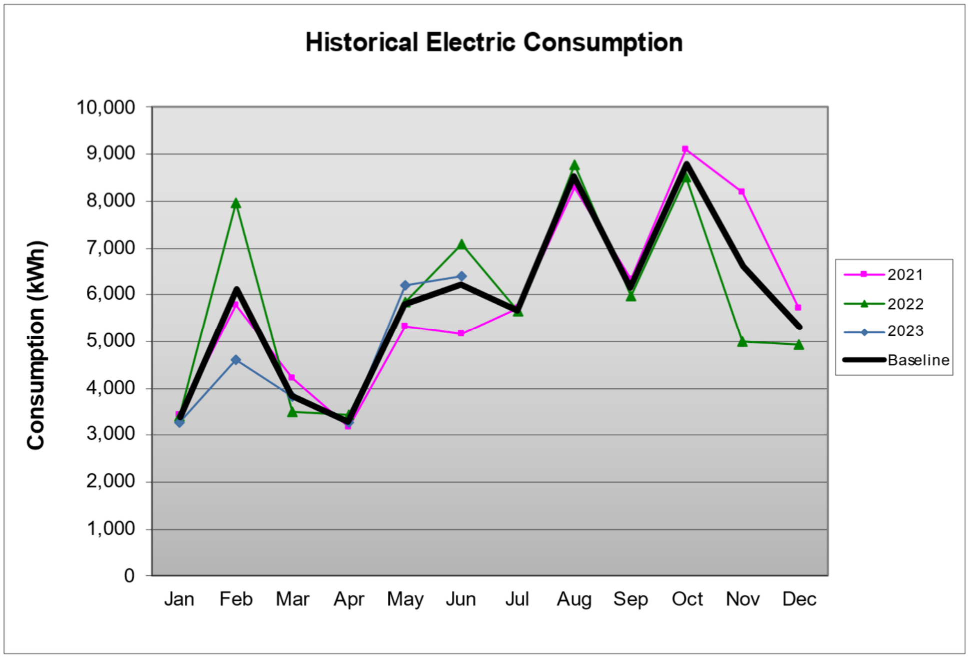


Figure 2: Police Training Firing Range Electric Consumption

Table 2: Police Training Firing Range Electricity Consumption Data

Date	Consumption (kWh)	Demand (kW)
Jan-21	3,450	134.78
Feb-21	5,796	161.00
Mar-21	4,232	135.24
Apr-21	3,174	140.76
May-21	5,336	143.52
Jun-21	5,152	147.66
Jul-21	5,704	152.26
Aug-21	8,280	77.74
Sep-21	6,348	76.36
Oct-21	9,108	77.28
Nov-21	8,188	76.36
Dec-21	5,704	92.46
Jan-22	3,404	70.38
Feb-22	7,958	95.22
Mar-22	3,496	66.24
Apr-22	3,450	75.44
May-22	5,842	76.36
Jun-22	7,084	75.44
Jul-22	5,658	75.90
Aug-22	8,786	77.79
Sep-22	5,980	77.79
Oct-22	8,510	79.07
Nov-22	5,014	92.92
Dec-22	4,922	93.29

Date	Consumption (kWh)	Demand (kW)
Jan-23	3,266	93.29
Feb-23	4,600	93.29
Mar-23	3,818	93.29
Apr-23	3,266	93.29
May-23	6,210	93.29
Jun-23	6,394	93.29

Benchmarking

TLC compared energy consumption for the Firing Range using common benchmarks to gauge how the site compares to similar ones both regionally and nationally, principally through the use of Energy Star Portfolio Manager. The building's Energy Use Intensity (EUI), which is used by energy engineers to determine overall energy consumption to a common unit of measure, was compared to other similar buildings throughout the United States. The Energy Use Intensity measures annual consumption of electricity per square foot, in kBTU/sf/year.

These benchmark tools were developed by the Department of Energy and are based on feedback from building operators all over the country. Using the utility billing information and observing the system operation allows the energy profiles to be broken down to greater detail. The facility was modeled in Portfolio Manager as a public safety (fire/police) building.

The historical energy consumption was entered into Portfolio Manager. Based on most recent 24-months of utility data, the chart below compares the WPPD Firing Range to the average energy use intensity (EUI) of similar buildings in Energy Star's database.

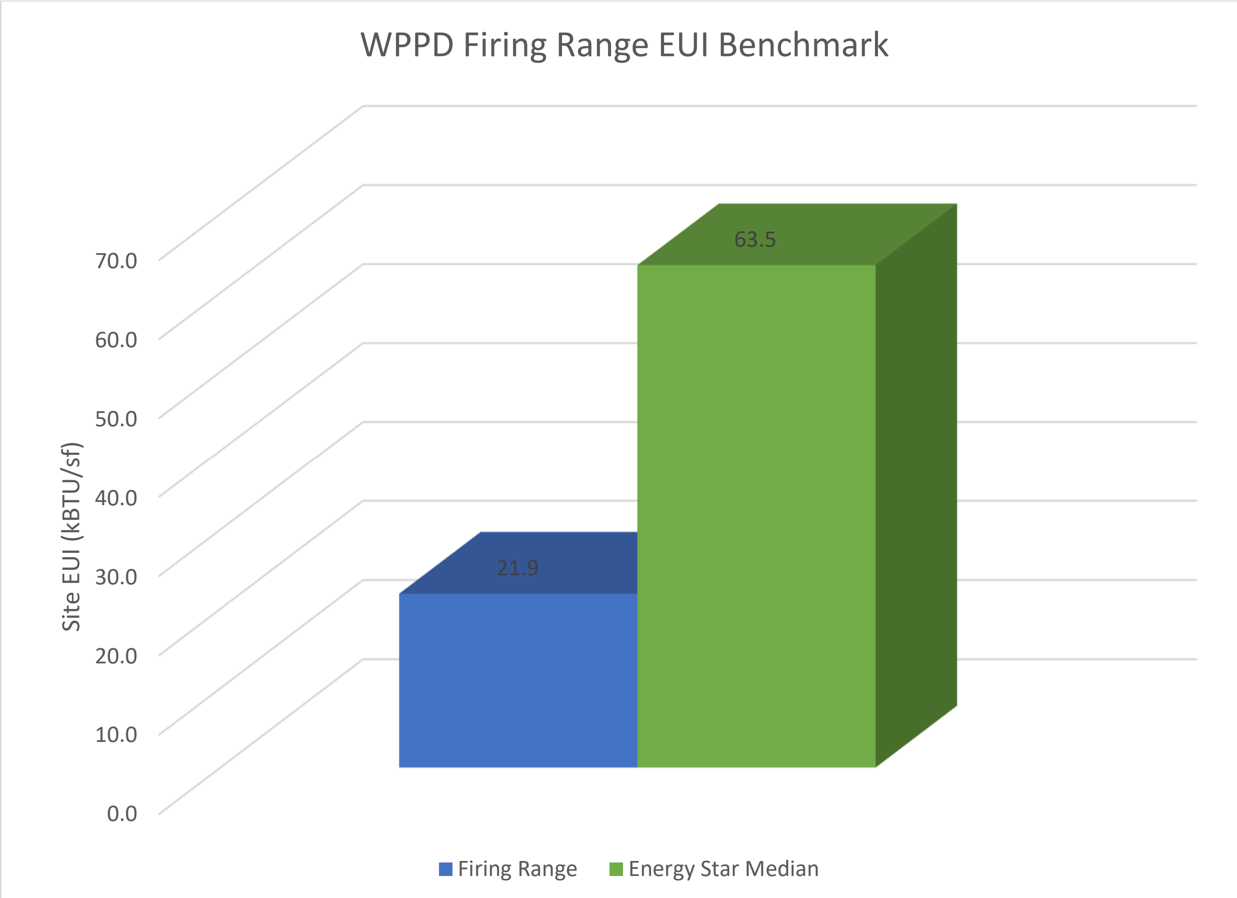


Figure 3: Firing Range Energy Performance Comparison

Based on most recent 24 months of utility data, a comparison can be drawn between the WPPD Firing Range and the average energy use intensity (EUI) of similar buildings throughout the United States. The median EUI for a public safety building in the United States is 63.5 kBTU/sf, and the calculated EUI of the Firing Range is 21.9 kBTU/sf. It is worth noting that the median value reported by Energy Star is dependent on the annual responses from building surveys, and that the baseline for comparison is to a police station as opposed to a standalone firing range. The energy conservation measures detailed in this report will serve to decrease the EUI of the facility building through efficiency increases.

Utility Rate Analysis

The building is provided with electricity by the City of Winter Park (CoWP), following their Rate Schedule GSD-1, General Service – Demand. The utility rate charges shown below were used to calculate the costs associated with the provided consumption and demand. Energy savings calculated for this building have been assigned a blended rate of $0.1907/kWh, which is the calculated blended rate not including fixed customer charges.

Table 3: Utility Rate Schedule

Description	Charge
Demand Charge	$5.05 per kW of billing demand
Energy Charge	$0.04216 per kWh

Fuel Cost Recovery Factor	$0.02281 per kWh
Gross Receipts Tax	2.5641%
Franchise Fee	6.00%
Electric Utility Tax	10.00%
EL State Sales Tax (Commercial Only)	7.45% (First $5,000)
EL State Sales Tax (Commercial Only)	6.95% (Over $5,000)

Average Rates

As noted above, a blended cost per kWh has been calculated from the rate schedule. Savings for this building have been calculated using the blended rate. The following table details the average rate over the period of analysis.

Table 4: Average Utility Rate

Utility	Average
Electricity	$0.1907/kWh

Energy Saving Opportunities

The operation and condition of equipment at the Police Training Firing Range building was observed to offer a few different avenues for improvement. This is to be expected given the age of the equipment itself and how long it has been in service. Improvements can be made by replacing the aging equipment as well as optimizing the control sequences and settings. The following table summarizes the recommended ECMs for this facility that should be considered for future projects. In addition, the table distinguishes between measures specifically intended to save energy (ECMs) and facility improvement measures (FIM) that benefit the overall operation of the facility but may not provide significant energy savings.

Table 5: ECM/FIM Summary

Energy Savings Measure	FIM/ECM	ECM Category	Annual kWh Savings	Annual $ Savings	Cost $	Payback (years)
HVAC Controls Optimization	ECM	Low Cost	2,444	$466	$1,840	3.9
MAU and EF CV to VAV	ECM	Moderate Cost	71,194	$13,577	$22,277	1.6
RTU Motor Replacement	FIM	Capital Improvement	--	--	$14,000	--
Duct Modifications	FIM	Capital Improvement	--	--	$2,000	--
Totals			**74,238**	**$14,043**	**$24,117**	**1.7**

*ROI calculations exclude capital improvement items, as they are intended more for facility improvement than for energy savings.

The cost and paybacks shown in the table above are estimates based on the information gathered during the auditing process. TLC utilized RSMeans 2023, as well as engineering best practices, to estimate the cost of these suggested measures. Final pricing will vary based on contractors' estimation and final equipment selections. Final payback periods are also dependent on contractor pricing and the facility's negotiated utility price.

HVAC Controls Optimization

General Description

The scope for this ECM involves optimizing the building HVAC controls through one or multiple controls strategies. For this project, the controls strategy recommended would be occupancy scheduling with setback temperatures.

Consistent occupied and unoccupied temperature settings will be implemented based on the building type and their needs. Occupied schedules for the HVAC controls will be set up to dictate the hours when the building is considered occupied versus unoccupied. Whenever a building enters unoccupied mode, the building HVAC controls will utilize the unoccupied settings in lieu of the occupied settings.

Site Specifics

While the building is occupied between the hours of 6am-11pm, it should be optimized with controls based on this schedule. HVAC controls will be given setback temperature settings to use during unoccupied conditions. Operating portions of the building at setback temperatures will result in energy savings due to the HVAC systems not having to work as hard to condition the building when unoccupied.

MAU and Exhaust CV to VFD

General Description

This measure proposes to convert the existing constant volume make-up air and exhaust fans to operate at variable frequencies. Existing constant volume (CV) fans provide constant airflow to and from the space 24 hours a day. The ventilation in the space is controlled by introducing outside air and removing exhaust air. VFD systems allow the fan speed to be reduced for part load conditions, only providing the amount of air that is needed to meet the ventilation requirements. The modulating airflow allows for tighter control when ventilation is not required.

The fan motors will be provided with a variable frequency drive (VFD) to vary the fan speed/airflow based on the building's occupied schedule. Varying fan speed can greatly reduce the fan energy and make the system more efficient without sacrificing ventilation requirements when the building is occupied. When applying this strategy, consideration will be taken to maintain high enough airflow to keep sufficient ventilation in all spaces, and enough air velocity to maintain proper throw from diffusers. It is recommended that any retrofits affecting the design/operation of the building's systems be designed by a licensed engineer and carried out by a mechanical contractor.

Site Specifics

The existing make-up air and exhaust fans will be converted to operate at higher speeds when the building is occupied, and ventilation is required. During the audit, it was noted that the system is always running.

Facility Improvement Measures

TLC identified additional Facility Improvement Measures (FIM) that do not provide energy savings but should be addressed. By implementing the recommended FIM, the facility will experience improved equipment reliability, increased thermal comfort for occupants, and be able to operate as originally designed. While it is possible that these measures may decrease energy consumption, this has not been quantified as their purpose is focused on performance and reliability.

Premium Efficiency Motors

The supply air fans for the building's RTUs appear to use the original 30HP motors aged around 20 years old. As they are reaching the extent of their predicted lifespan, it is worth considering replacing them with high efficiency NEMA premium rated motors to increase the reliability and longevity of the HVAC systems.

Ductwork Modifications

It was noted during the walkthrough that an exhaust air outlet requires modification in order to prevent the intrusion of rainwater into the existing ductwork. This measure should not only cease the intrusion of water into the space, but also stop any degradation of the exhaust air ductwork.

Calculation Methodology – Spreadsheet System Models

Savings for this report were evaluated using spreadsheet building models for the lighting and HVAC systems. The methodologies used for each measure are described separately in this section. Industry Standard methods of evaluation were used and are detailed in this section. Additionally, assumptions made to calculate the energy savings are detailed.

CV to VFD

Savings for this measure have been based on a reduction in the power consumed by the exhaust fan. The following table shows the major inputs used in the calculation of savings for this measure.

Table 6: CV to VFD Major Inputs

Input Name	Bldg./Area Affected	Input Value	Basis of Input
Fan Motor HP	Exhaust Fan	30.0	As-built drawings
Annual Operating Hours	Exhaust Fan	4,420	Building schedule
Existing Fan Power Ratio	Exhaust Fan	1.00	No reduction, fan always at 100% power
Proposed Fan Power Ratio	Exhaust Fan	0.28	Estimated average condition of 60% flow

Calculations:

Savings for this measure were based on calculating the annual fan energy with the existing and proposed fan power ratios. The fan's annual energy consumption in kWh was calculated with the following formula.

$$Energy\ Consumption = Fan\ HP \times 0.7457 \times Hours \times Fan\ Power\ Ratio$$

HVAC Controls Optimization

Savings for this measure have been based on a reduction in cooling energy due to setting back unoccupied hours of the building operation. The following table shows the major inputs used in the calculation of savings for this measure.

Table 7: Controls Optimization Major Inputs

Input Name	Bldg./Area Affected	Input Value	Basis of Input
% Cooling Energy Reduction	Entire building	8%	Engineering judgment

Calculations:

Savings for this measure were based on calculating the annual cooling energy and saving a percentage of it. The existing annual cooling energy was calculated from the electric utility baseline as the sum of all the electrical consumption for each month exceeding the lowest month's consumption. The following formula was used to calculate existing annual cooling energy.

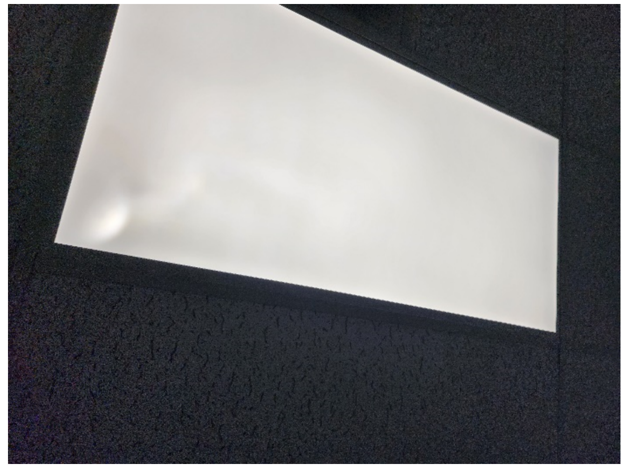
$$Existing\ Cooling\ kWh = Annual\ Total\ kWh - (12 \times Baseload\ Month\ kWh)$$

Appendix A – Mechanical Equipment

The following table shows a listing of all recorded major equipment in the building.

Building	Type	Equip	Location Served	Tag	Qty	Capacity	Units	Make	Model	Serial Number	Year
Police Training	EWH	Electric Water Heater			1			Lochinvar	ESX030		
Police Training	EF	Exhaust Fan			1						
Police Training	EF	Exhaust Fan			1						
Police Training	RTU	Packaged Rooftop Unit			1			Trane		192313296L	2019
Police Training	RTU	Packaged Rooftop Unit			1			Trane			
Police Training	RTU	Rooftop Air Conditioner			1						
Police Training	RTU	Rooftop Air Conditioner			1						

Appendix B – Site Walkthrough Photos

 C-1: Entrance to Building	 C-2: Interior Lighting
 C-3: Electric Water Heater	 C-4: Shower

C-5: Exhaust Fan (Photo 1)

C-6: RTUs

C-7: Exhaust Fan (Photo 2)

C-8: VAV-2 Controls

C-9: VAV-1 Controls

C-10: A/C-3 Thermostat and VAV-4 Controls

C-11: Firing Range

C-12: A/C 2 Thermostat

 C-13: Interior Lighting	