



Recommendations for the 10th Mountain Division Hut Association's Carbon Reduction Plan

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Summary

This document represents a summary of observations and recommendations made by CLEER staff to support the 10th Mtn Division Hut Association in their Carbon Reduction Plan. It is the result of a thorough assessment of opportunities to reduce carbon through improvements to facilities, electrification of fleet vehicles, and utilization of renewable energy.

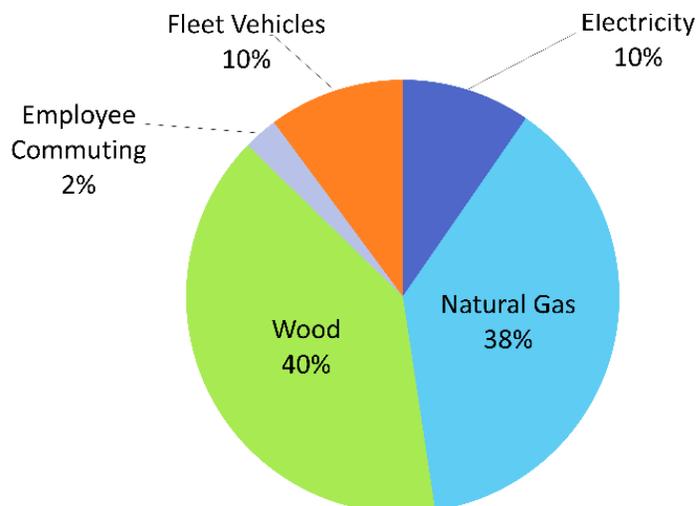
Recommendations for facilities include a fuel switch to move the Aspen employee housing building off fossil fuels and onto 100% renewably sourced electricity with Holy Cross Energy, on-site solar to move the Leadville Base of Operations to Net-Zero, and a proposal for improvements to the Benedict Building that would expand the impact of this project beyond the Hut Association by saving energy for all occupants of that building. For the huts, our recommendations include some ideas for engaging with the hut users on changing behavior to reduce the wood consumption.

Recommendations for renewables include on-site and off-site options for all the facilities that are on the grid. We are not recommending additional renewables for the huts at this time.

Recommendations for transportation include a phased transition to electric trucks and snowmobiles and the installation of necessary charging infrastructure to support these fleet vehicles and staff commuting to facilities.

Minor updates were made to the Inventory to include the actual carbon factors for the electric utilities and our team created this simple chart to visualize the emissions breakdown.

10th Mountain Division Emissions Breakdown (Metric tons CO₂e)



Summary of Observations and Recommendations

Facilities

Our team did walk-through assessments of all the facilities (excluding the huts) and produced a list of recommendations for each facility that is detailed below.

Aspen Employee Housing

This 3-unit residential building was built in the early 90's and is heated by an older gas boiler with baseboard distribution. Water heating is provided by a conventional gas water heater and older, uncontrolled bath fans are the only form of mechanical ventilation. Lighting is provided by a mix of bulb and fixture types with no controls on exterior lighting.

Recommendations:

- Assess opportunities to reduce energy loads through reduction of air leakage and improvement of insulation.
- Install minisplit heat pumps to provide heating and cooling to all dwelling units
- Improve ventilation
 1. Replace all bath fans with ENERGY STAR rated fans
 1. add programmable controls for whole house ventilation (if no ERV install)
 2. Consider the addition of a ductless ERV to the central living area of the two larger units for whole-house ventilation
- Replace existing water heater with an electric water heater
 - Alternately, consider a heat pump water heater placed in the garage to serve the building. This would lead to lower energy loads but could be complicated since plumbing is in place at the location of the existing water heater.
- Upgrade all lighting to Energy Star rated LED bulbs
- Add photo sensors to exterior lighting
- Consider Induction range tops for kitchens to reduce energy load
- Add energy storage with a battery supported by Holy Cross Energy's Power+ program

Benedict Building

The 10th Mtn Division Hut association has a small, partial ownership of this facility. The mixed-use building was constructed in the mid-1970s and has not had significant upgrades in many years. The recommendations here are intended for presentation to the building owner's association for their consideration to reduce fossil fuel and electrical usage in the building and save on utility costs. Any measures implemented on this building would not only contribute to the Hut Association's carbon goals but would allow this project to have a broader impact by reducing energy usage in the entire building while improving comfort for all building occupants.

Recommendations:

- Contract with a qualified lighting supplier to complete a full upgrade of interior and exterior lighting.
- Update existing controls on exterior lighting and add occupancy sensors where appropriate indoors (bathrooms, kitchens, mechanical and storage rooms).
- Replace bath fans with Energy Star rated fans with occupancy sensors, fully programmable controls if needed for building ventilation.
- Hire a qualified contractor to reduce air leakage throughout the building.
- Consider replacement of windows in worst state of repair.
- Apply to Black Hills Energy for rebates on boiler pipe insulation.
- Install programmable thermostats throughout the building, these will be provided free of charge from Black Hills Energy.

Leadville Base of Operations

This modern, mixed-use building is a great example of efficient design. The radiant slab and indirect water heater are served by an electric boiler. A ductless ERV on a switch offers balanced ventilation and heat recovery when it is turned on.

Recommendations:

- Focus on moving this building to Net Zero by getting an estimate for a roof top solar array from a qualified solar installer.
- Change controls of the existing Panasonic ERV to run continuously with a toggle switch to control fan speed. In this configuration the ERV will run on a continuous low setting but can be boosted for more airflow when needed.
- Consider the addition of Panasonic ERVs to bedrooms, set to run continuously with optional boost via toggle switch. This could discourage opening of windows during the heating season.

Renewable Energy

There are a few different options for adding renewables to facilities, we've provided an overview. After looking at the facilities, the only one that might make sense for on-site solar is the Leadville Base of Operations.

Solar opportunities for Leadville facility

The average annual energy consumption at the Leadville facility is 41,830 kilowatt hours. To produce 100% of the energy consumption would require a solar PV system of 25 - 30 KW. Our team evaluated two options; net-metered rooftop and developing a community-scale solar array.

Net metered/ rooftop potential:

- Xcel Energy will allow for a Solar PV system sized up to 200% of the annual energy use.
- The PV system must be situated on the same parcel as the meter
- Systems over 25 kW are eligible for Xcel Energy's Solar Rewards program. The "medium program" (systems sized between 25 and 500 kW) provides an incentive payment of \$0.0375 for every kilowatt hour produced, for a period of 20 years.

There is the opportunity to mount a system on the roof of the building but as this is a high snowfall area it might be preferable to tilt up the array to encourage snow to slide off the panels. Trees to the south of the building would need to be removed to prevent shading. A structural engineer would be needed to assess the impacts of wind and snow loading on the building.

A second option would be to mount the PV array on the ground adjacent to the building, either on poles or on a ground mounted racking system. If mounted on the ground, there will be a better opportunity to have the PV modules higher off the ground in order to prevent snow from building up and covering the panels. Trees may need to be removed to create a suitably sized unshaded area.

Next steps for rooftop:

Engage the services of a solar contractor with experience working in mountainous, high snowfall areas, to assess the options and provide a cost estimate.

Community Scale Solar Development- on-site

We assessed the feasibility of an investment in a community scale solar project on the Leadville property and determined that Leadville is not likely to be a good location for such a project. New community scale projects that are interconnected to the Xcel utility grid are selected through a competitive community solar garden process as defined by Xcel Energy. To develop a solar farm on the Leadville parcel would be challenging. The process for getting selected by Xcel requires industry expertise and is outside of 10th Mtn's core business so partnering with a third-party developer would be key. However, a solar developer would most likely favor other potential sites over the Leadville site due to the higher costs to build at higher elevations in mountainous regions. To have a project selected by Xcel, it's necessary to propose the lowest cost project and the Leadville site would probably not be competitive since much of Xcel's territory is in lower elevations with lower cost for construction.

Community Scale Solar Subscription - off-site

There are options with both Xcel Energy and Holy Cross Energy to purchase renewable energy from projects located in other parts of the state.

*Xcel Energy Solar*Rewards Community Program:*

Xcel Energy works in partnership with third party solar developers to provide an option for customers to subscribe to community solar gardens. Subscribed customers receive a credit on their monthly electricity bill to compensate for the solar energy that their subscription provides to the utility grid.

Xcel Energy Renewable Connect:

Similar to the community program, customers can elect to purchase energy from off site solar and wind through the Renewable Connect program. However, customers will pay a premium for the energy and in return the Renewable Energy Credits (RECs) will be retired, allowing the customer to claim the carbon emission reductions against their organizational total.

Holy Cross Energy's PuRE Program:

The "Powered by 100% Renewable Energy (PuRE)" program provides Holy Cross members with the option to pay a small premium on their bill to have their energy use off-set with energy from renewable resources. Supply options include wind, solar, or hydro, or members can choose the PuRE power mix of all three. Similar to Xcel's Reconnect program, the Renewable Energy Credits are retired, allowing the customer to claim that they are using renew

10th Mountain Huts

These off-grid cabins are of varying ages and construction types. All have solar arrays for lighting, propane cooktops, and wood stoves. As noted in the inventory, the emissions from the wood burning stoves is the largest contributor to the overall emissions for the organization. Wood usage per hut may vary depending on the level of insulation, size of the wood stove, and state of repair. The CLEER team did not do an in-depth analysis of the huts at this time. This could be a strategy pursued in the future.

Recommendations:

- Some of the large wood stoves could be replaced with smaller where large stoves are not needed to melt snow for water. This would help reduce the amount of wood used for burning.
- Focus on reduction of wood burning through a combination of behavior modification strategies. Behavior modification strategies could include:
 1. Wood bin or box sized for wood needed for a 1 night stay with signage asking users to leave the box full and explaining that it is a tool to measure and reduce wood consumption.
 2. Signage posted near woodstove connecting the value of mountain landscapes to the impact of carbon produced from burning wood. Statements that talk about it as a social norm (everyone is doing it) can have a high impact.
 - Maybe something like, "10th Mountain Division hut users are working together to reduce our impact on the climate by reducing the amount of wood we burn while using the huts. We have figured out that this box should contain enough wood to keep the hut warm and toasty for one night."

Transportation

Trucks

10th Mountain Division's fleet vehicles are composed of 6 pickup trucks of the ¾ Ton and 1 Ton sizes. Currently, there are no like-for-like fully electric equivalents on the market and no known plans or timelines for when fully electric equivalent vehicles will become available. There are a few plug-in hybrid options in these vehicle classes on the market today, but the cost premium

relative to fuel savings ratio remains extremely high and adoption has remained low for the few specialized companies that manufacture such vehicles (e.g. [XL Fleets](#)).

However, all the automotive majors have released plans for launching electric ½ ton pickup trucks within the next couple of years, with the Ford F150 Lightning being a prime example. While these forthcoming electric trucks will be more similar in size dimensions to their ½ ton internal combustion counterparts, initial specifications from the manufacturers and conversations about 10th Mountain fleet needs suggest the organization could begin replacing the existing fleet with a fully-electric ½ ton equivalents without compromising performance and operations in terms of towing capacity or range requirements (e.g. [regular F150 vs all-electric F150 vs F250](#)) once they become available.

The all-electric F150 comes with a cost premium relative to a fossil-fueled vehicle, but the initial pricing offered by Ford suggests this premium will be very reasonable and could be offset by savings on fuel and operations and maintenance over the years. For example, 10th Mountain's total fuel costs for trucks in 2019 totaled \$10,926 with an average fleet fuel economy of 9.5 mpg. This would equate to \$0.32 per mile assuming an average gasoline price of \$3 per gallon going forward. Even with very conservative estimates for electricity and efficiency (\$0.14 per kWh and 1.5 miles / kWh), 10th Mountain could improve to an equivalent cost of \$0.09 per mile and dramatically reduce annual fuel costs by more than 50% in switching to electric trucks.

Replacing one or two trucks first could be a good way to evaluate them and demonstrate 10th Mountain's commitment to reducing carbon emissions.

Snowmobiles

While all-electric snowmobile adoption remains in its early infancy, there are promising developments from incumbent manufacturers like [Polaris](#) and upstarts such as [Taiga Motors](#). CLEER recently hosted an electric snowmobile (and snowgroomer) webinar, here's the link to watch it: <http://cocleandiesel.org/events/>

The relatively low vehicle miles traveled on a daily basis for 10th Mountain's snowmobiles (estimated at 30 miles per day maximum) suggest that the new electric options could meet the fleet needs, even considering the elevation profile. While electric snowmobiles should be evaluated, electrifying trucks should be prioritized where feasible given the substantially larger fuel consumption profile and emissions footprint of these vehicles.

Charging Infrastructure

Adding EV Charging Infrastructure to 10th Mountain's facilities in Leadville and Aspen will be essential as 10th Mountain electrifies its fleet trucks and snowmobiles and staff adopt EVs for commuting purposes. The maximum daily VMT for both trucks and snowmobiles (estimated at 100 miles for trucks and 30 miles for snowmobiles) means that 10th Mountain could likely support the travel needs with Level II AC charging overnight and that expensive, high-voltage DC fast-charging will not be required.

This Level II charging infrastructure will be essential for fleet electrification, but the additional load from charging will likely trigger a commercial rate change with Xcel at the Leadville Base of Operations Facilities. Assuming a coincidental charging session with the observed 17 kW peak demand, 10th Mountain would only be able to add a 30 amp / 240 V Level Charging Station to stay under the 25kW threshold to avoid a rate change (24.2 kW = 17 kW+ 7.2kW (30amp x 240 V)). 30amp chargers are common in the market today, but the industry is moving to higher and higher amperages, especially in anticipation of larger batteries for trucks and SUVs. For example, the all-electric F150, has a minimum battery size of 115 kW. On a 30-amp charger, this would take around 16 hours to charge from 0 to 100%. 10th Mountain should consult with Xcel staff to understand the implications of changing electric rates triggered by adding Level II charging to Leadville and evaluate how Xcel's new EV programs might help with the financial and technical barriers to adding EV charging stations.

Holy Cross Energy confirmed there is sufficient electric capacity to add the multiple Level II Charging Stations needed to support fleet electrification and staff charging personal commuter vehicles at the Aspen Employee Housing

Recommendations:

- Identify near-term fleet trucks suitable for retirement and timeline & budget for replacement with all-electric options
 1. The 2006 Chevy & 2008 appear the best candidates given their engine model years and utilization.
 2. Evaluate Ford Electric F150 and other options as manufacturing specifications emerge and come to market.
 3. Late 2022 is the earliest possible time 10th Mountain could take delivery of an all-electric option, with 2023 a more likely timeframe given current supply-chain issues.
- All-electric snowmobiles
 1. Establish contact with Taiga Motors (CLEER willing to make the introduction) to received quotes and compare specs
 2. Create timeline and budget to place first deposit on an electric snowmobile (s)
- Charging Infrastructure
 1. Reach out to [Xcel EVSE Program](#) for Leadville Base of Operations to assess best options to add EVSE, avoid expensive rate changes, and electrify fleet operations in Leadville.
 2. Create timeline & budget for adding EV Charging to Aspen & Leadville facilities.
 - Prioritize the Aspen Employee Housing given the higher VMT of Aspen operations and the ability to maximize charger utilization for workplace charging for staff commuter vehicles.
 3. Apply for [Charge Ahead Colorado](#) grants to help offset costs of installing EV Charging Infrastructure

- 3 Charge Ahead Grant Cycles Annually
 - January / February
 - May / June
 - September / October
- CLEER can offer pro-bono coaching and grant-writing assistance here.