HOLY CROSS ENERGY

2021 EV Update

About Holy Cross Energy

Founded in 1939, Holy Cross Energy (HCE) is a not-for-profit rural electric cooperative that provides safe, reliable, affordable, and sustainable energy and services that improve the quality of life for more than 43,000 members and their communities in Western Colorado. With a vision to lead the responsible transition to a clean energy future, HCE committed to providing 100% carbon-free electricity to its members by 2030.

As part of its beneficial electrification strategy, the transportation sector was identified by HCE as an opportunity for growth. In 2018, HCE launched its first programs to educate and inform members on the benefits of electric vehicles (EVs). Currently, the HCE service territory boasts the 4th highest concentration of EVs in the state of Colorado.

Executive Summary

BACKGROUND

Over the past decade, EVs have slowly increased their market share. All leading vehicle manufacturers have plans to introduce EVs and many are developing highly anticipated light and medium duty vehicles. Infrastructure planning for heavy duty/semi-truck EVs has already begun. Being an early adopter of an EV strategy, HCE has already seen numerous economic and environmental benefits to accompany load growth.

Vehicle efficiency standards have been a subject of governmental debate at the national level and has produced a polarization and uncertainty in the electrification of the transportation sector. However, as the grid becomes more flexible and reliant on renewable energy, the long-term global movement towards beneficial electrification has accelerated.

HCE introduced its Electrification of Transportation Plan in April 2018. The plan was aimed at meeting a broad range of member needs, from ensuring cost-effective home and workplace charging and reducing range anxiety through a local network of fast chargers, to meeting the mass transit needs of members and local communities and ensuring a thoughtful HCE fleet electrification strategy.

Each program is uniquely tailored to specific needs and charging considerations. HCE's focus is on four segments:

1 Charge at Home. Charge at Work.

Assists with the upfront cost of installing Electric Vehicle Service Equipment (EVSE) such as chargers at homes and workplaces. HCE offers free or discounted chargers combined with service agreements to cover the installation costs, which can be repaid on members' electric bills. This program also provides free home chargers to members willing to allow HCE to optimize their charging patterns utilizing HCE's Distribution Flexibility Tariff.

2 Community Charging

Supports community partners in developing a public EV fast-charging network by covering electrical upgrade costs, utilizing state grants, and providing a simple site approval process.

3 Transit

HCE partners with local transit authorities and school districts by providing engineering analysis and a Time-of-Day (TOD) rate with no demand charge. This segment has shown the largest reduction in Green House Gas (GHG) emissions and will double its abatement by 2022.

4 HCE Fleet and Utilities

Focuses internally on beneficial electrification options for all parts of HCE's operations. Since the program began, and now with EV charging coupled to onsite solar generation, the HCE EV fleet has driven 67,000 miles, saved 17 metric tons of CO2 emissions and thousands of dollars in fuel and maintenance costs.

State of the Market

EV sales in Colorado have seen steady growth since 2012, placing it on pace with the Colorado Energy Office's ZEV+ scenario of 12% of the total population owning EVs by 2030. Inside HCE's service territory, there has been a similar growth rate. The greatest number of EVs on the road in HCE's service territory are in Eagle County, followed closely by Garfield County and Pitkin County.

Battery technology has improved tremendously, with a wide variety of EV options getting more than 200 miles per charge. As EV range increases there will be EVs suitable for more applications of vehicles, such as medium and heavy-duty trucks and buses, leading to greater use of electricity for all segments of the transportation sector. New long-range models are available to extend the range to nearly 400 miles, with future models being able to travel 600 miles on one charge. As battery technology evolves, vehicles will be able to accept faster charging times. New models like the Tesla Model Y and Porsche Taycan can accept an estimated "extreme" fast charge of 40 to 60 miles in just four minutes.

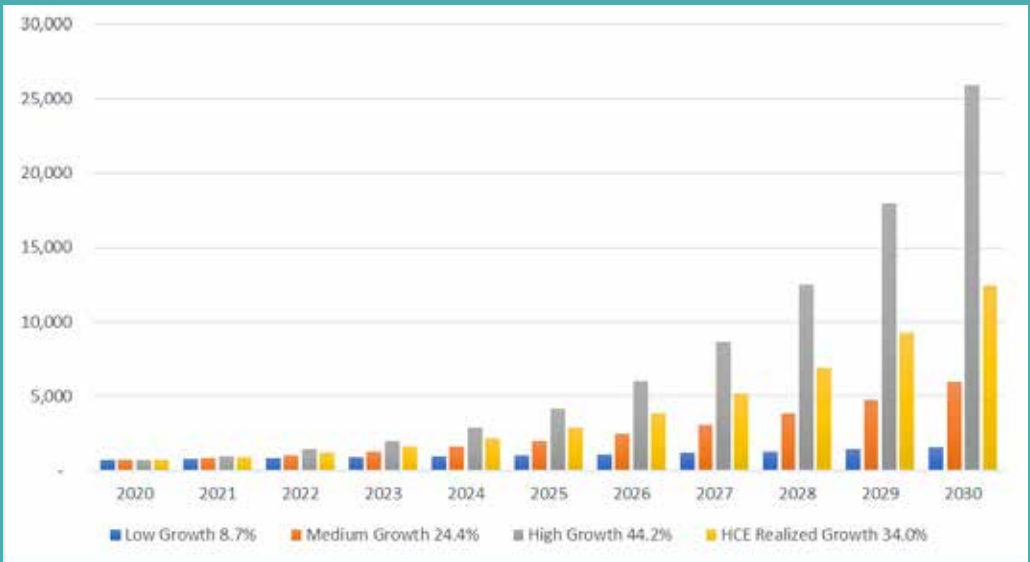
HCE's resource plan includes a projection of electrification for future load growth.

HCE evaluated multiple scenarios specifically around electric vehicle adoption growth rates.

First, HCE forecasted the expected load from transit authorities operating within HCE's territory. There are currently twelve electric buses operating in HCE's territory with plans to bring more to the Eagle/Vail and Aspen areas. HCE anticipates transit contributing to an increased energy need of about 8GWH/year by 2030.

For personal and light duty electric vehicles, HCE utilized the 2018 Colorado Energy Office (CEO) EV growth report for scenario analysis. HCE started with service-territory data showing current EV registrations and projected that into the future utilizing the CEO growth rate assumptions. HCE also analyzed the last three years of EV registration data and ran a scenario assuming HCE's realized growth rate continues.

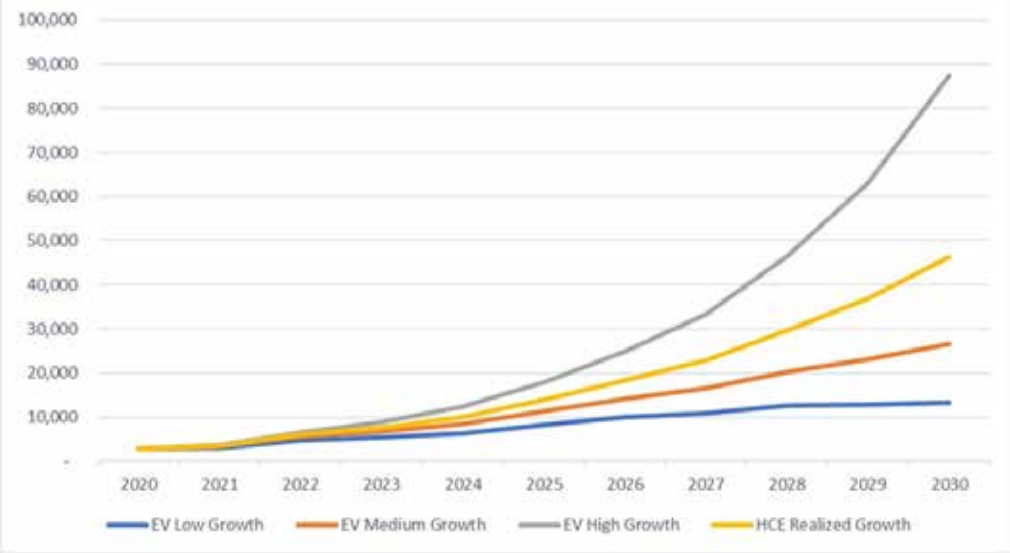
GRAPH 1 **# EVs, YOY Growth Scenarios**



Graph 1 – Number of Electric Vehicles, Year-over-year Growth Scenarios

The EV registration projections (Graph 1) were converted into MWh load growth expectation (Graph 2) by estimating the average commute distances/days in our service territory (~10,000 miles/year) and average efficiency from the top EV models (29.4kWh/100 miles).

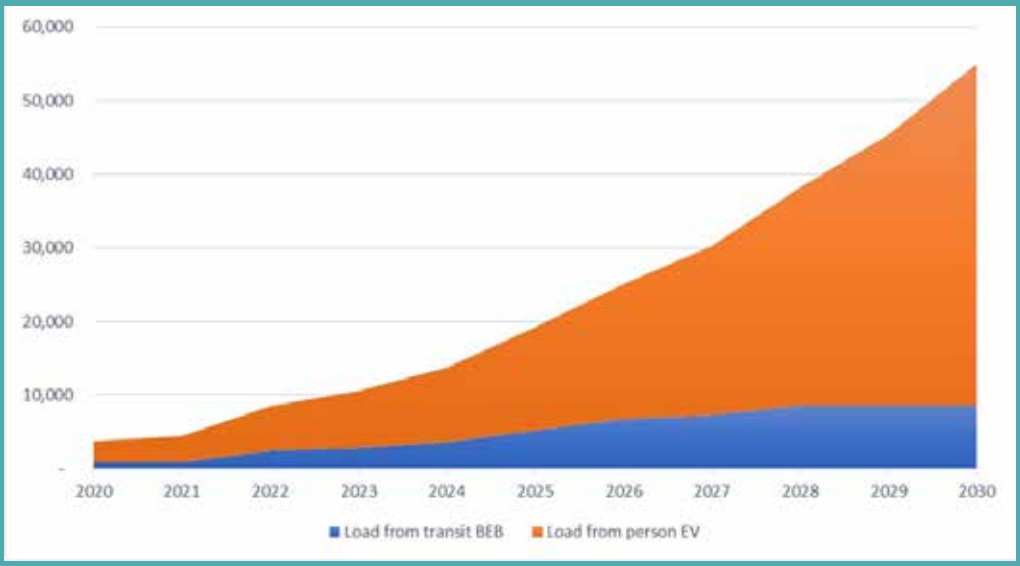
GRAPH 2 **EV MWH, YOY Growth Scenarios**



Graph 2 – HCE Added Energy (MWH) by EV Scenario

Based on the results of this analysis, HCE decided to include the "HCE Realized Growth" scenario in the base load forecast (Graph 3).

GRAPH 3 **Annual EV Load in Base Forecast (MWH)**



Graph 3 – Annual EV Energy in Base Scenario Forecast (Personal and Transit)

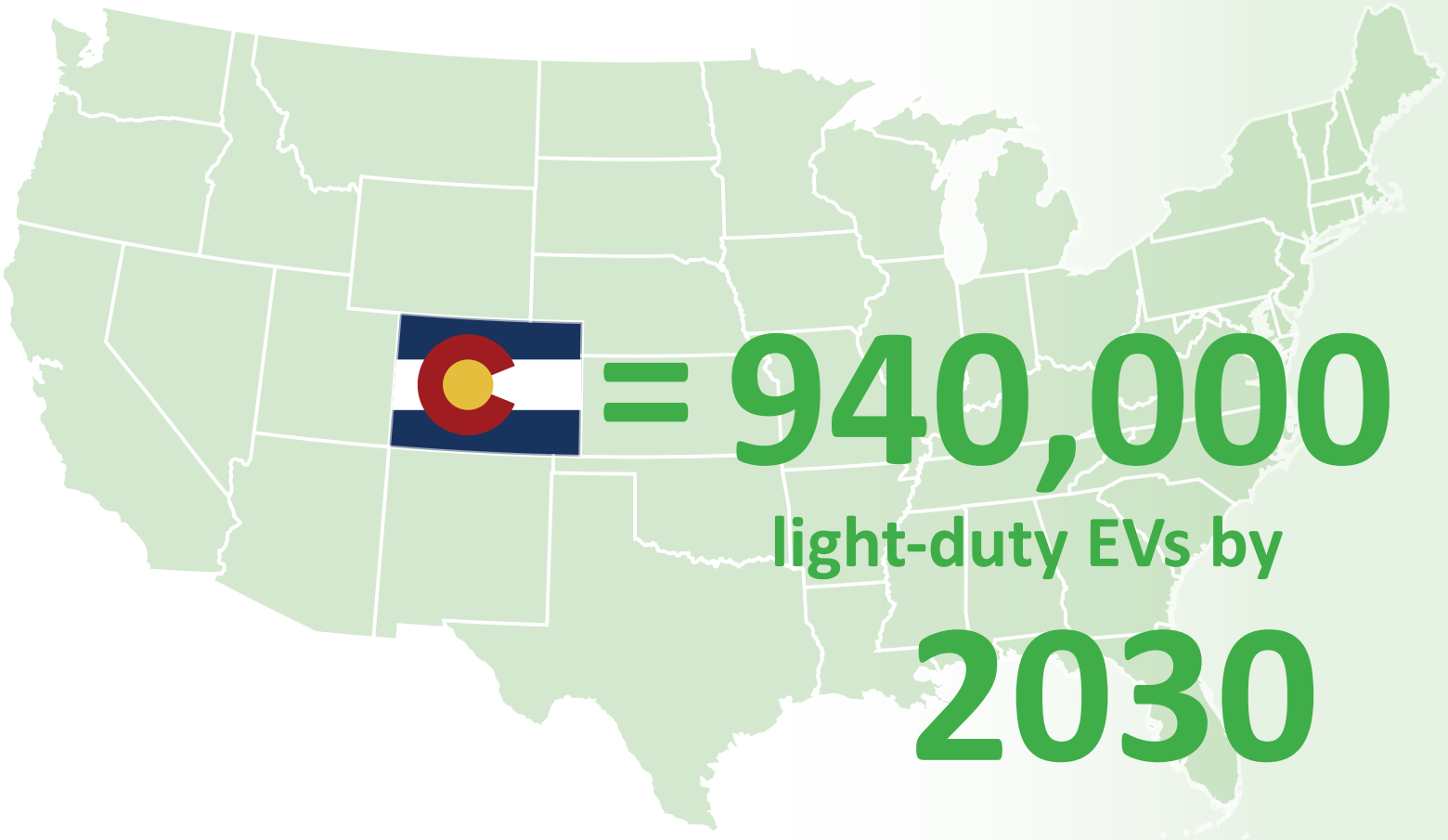
Leadership from the State and Local Communities

The State of Colorado has set a goal to get 940,000 light-duty EVs on the road by 2030. Since the release of the Colorado EV plan, the state has more than doubled the number of EVs registered from 11,238 in August 2017 to over 24,000 in June 2019 and now over 35,000 in 2021.

At this pace, HCE estimates 12,000 registered personal EVs in the service territory by 2030, constituting 48 GWh of additional sales per year.

To help with this initiative, Colorado regulators voted overwhelmingly in August 2019 for the state to join nine others in adopting zero-emission vehicle (ZEV) regulations that will pressure automakers to develop more electric vehicle models.

Adopting the ZEV mandate will save Colorado up to $65 million annually by 2025 and up to $2.2 billion a year by 2040, "in economic and pollution benefits," according to an analysis by the Environmental Defense Fund.



There are four significant programs adopted by the Colorado Energy Office (CEO) that have guided Colorado's EV adoption.

1. **Alt-Fuel Vehicle Tax Credit**
   Tax credits are available in Colorado for the purchase or lease of electric vehicles and plug-in hybrid electric vehicles.

2. **Electric Vehicle Fast-Charging Corridors**
   In Spring 2018, the Colorado Energy Office (CEO) launched the EV Fast-Charging Corridors infrastructure grant program. This program will build out EV fast-charging infrastructure through public-private partnerships and in coordination with other programs.

3. **Charge Ahead Colorado**
   The CEO and Regional Air Quality Council (RAQC) jointly administer the *Charge Ahead Colorado* EV charging infrastructure grant program. Grants are available for electric vehicles and community-based Level II and direct current fast-charging (DCFC) stations.

   Charge Ahead Colorado typically has three application rounds per year in January, May, and October.

4. **Recharge Colorado**
   The *ReCharge Colorado* program works to advance the adoption of EVs and installation of charging infrastructure in Colorado by providing ReCharge coaches to help consumers, local governments, workplaces, and multi-unit housing developments identify monetary savings, grant opportunities, and other advantages related to deploying EVs and charging infrastructure.

For more information visit:
energyoffice.colorado.gov/charge-ahead-colorado

Environmental & Health Benefits

There are tremendous environmental and health benefits that accompany the electrification of transportation.

Reducing pollution reduces exposure to greenhouse gas and critical emissions including carbon dioxide (CO2), ozone-forming oxides of nitrogen (NOx) and other health-harming pollutants.

The largest benefit is in the transit segment, which in 2020 saved 550 metric tons (MT) of CO2 emission based on HCE's renewable energy mix and kilowatt hours (kWh) sales when compared to diesel.

"The easiest way to make a lasting impact on local green house gas (GHG) emissions is to drive an EV.

The average EV charged from today's HCE's grid will reduce your GHG emissions by roughly 2.5 metric tons per year.

And with HCE's commitment to 100% renewable energy by 2030, these emissions reductions will more than double along the way."

- Chris Bilby
Research & Program Engineer

Member Satisfaction & Outreach

In a market research study, over 40% of HCE members report that they would like HCE to offer electric vehicle charging. As with any new technology, building consumer confidence can take many different forms. For some, its education transitioning into knowledge that inspires confidence to purchase. Others need to try before they buy. HCE developed strategies to address both types of consumers.

HCE has positioned itself as a thought leader in the EV space with easy-to-access information and by training HCE staff to become EV specialists to answer questions.

HCE also supports ride-and-drive workshops with community nonprofits committed to carbon reduction, featuring different makes and models of EVs.

Due to these efforts, HCE was awarded 2nd place at the National Rural Electric Cooperative Association's Spotlight Awards for its 2019 electrification of transportation communication campaign.

HCE also works closely with local car dealerships, municipalities, HOA's, and other community partners to make the conversion to electricity an easy and well-informed decision.

HCE EV Programs Update

HCE has developed four distinct programs addressing the electrification of transportation. Three of the programs are externally designed to facilitate EV adoption among interested individuals, businesses, and organizations in the HCE service territory. The last program focuses on internal beneficial electrification implementation.

CHARGE AT HOME. CHARGE AT WORK.

The *Charge at Home. Charge at Work* program has been successful with a total of 307 program applications and 270 Level II chargers distributed in the past 30 months at a rate of one new EV charger online every three days.

Members report a high degree of satisfaction with the program, citing the easy online application process, quick access to a quality charger, no upfront cost for the charger, and no upfront for installation costs. Members also appreciate having access to resources on the HCE website, such as the installation guide, charger specifications, and a contractor list.

Another measure of the program's success is that many *Charge at Home. Charge at Work.* participants have also enrolled in other HCE programs, including *Peak Time Payback,* residential energy audits, energy efficiency rebates, and TOD rate.

EV owners also care where their fuel comes from, as nearly half the participants also have solar panels or have signed up for HCE's PuRE program, so the energy used to drive their vehicles can be 100% renewable.

HCE learned a few critical lessons by implementing the *Charge at Home* program and listening to members:

• Most members need coaching from start to finish. They want information about the charger specifications and installation upfront, which is now available on the HCE website.

• Members appreciate having the flexibility to choose their contractors. Some members use HCE's contractor list to find electricians to install their chargers if they do not have a preferred contractor. Some installation delays have been due to the extremely busy schedules of local contractors.

- HCE's step-by-step guide from application to activation is not always enough to get members to comply with all terms of the contract. Some members need to be contacted several times to guide them through the activation process to join HCE's e-VIP EV network giving HCE access to their data.
- Members often inquire about specific EV rates, which HCE does not currently have. Instead, members are directed to HCE's TOD rate and *Peak Time Payback* program as additional ways to save money on their bills. Smart chargers are also available to schedule refueling during off-peak hours.

Aspen Skiing Company acquired the first electric snowmobile in North America and is part of HCE's electrification of transportation initiatives.

The *Charge at Work* program has been a more difficult business to understand and predict, with maturity still needed in the industry.

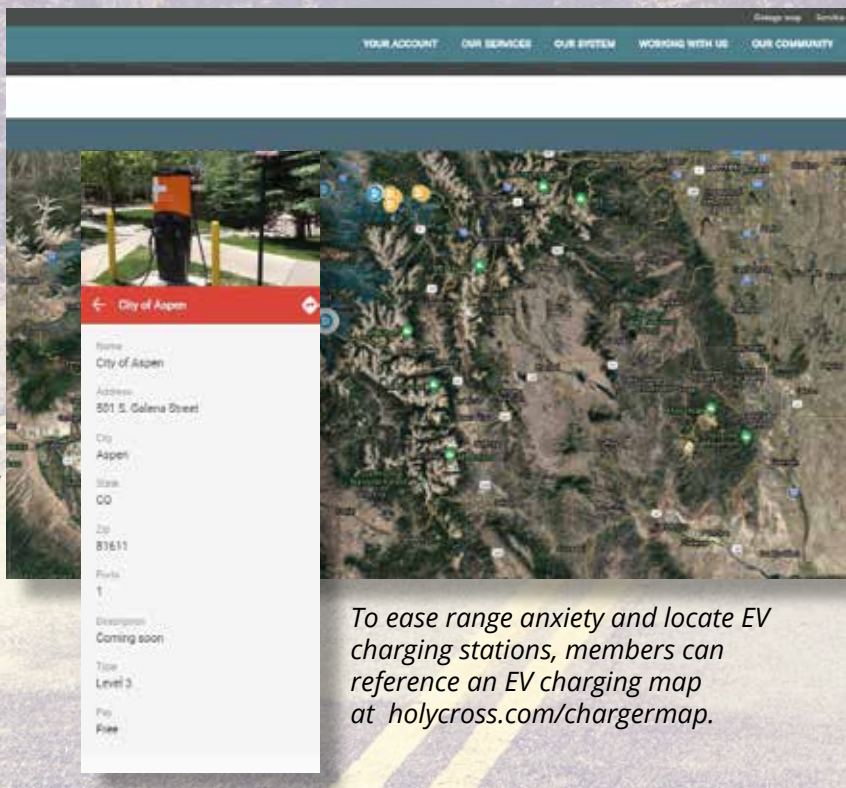
- There is more analysis required to understand where cars are parked for over four hours, infrastructure needs, and how to work with commercial members to understand the return on investment (ROI). This market has a high level of competition where commercial members can find wholesalers and find less expensive chargers that do not include communication or networking capability associated with the *CEO Charge Ahead* program. This information is crucial to understanding and coordinating the charging profiles. Despite strong relationships, commercial partners will often choose the less expensive option.
- Grant programs do help but require navigation of expectations. HCE also offers assistance with the associated grant data request, going as far as setting up a subgroup of commercial plugs to share data with the CEO during the five-year data-sharing terms linked to the C*harge Ahead Colorado* grant program. Having a utility or third-party provider take responsibility for the data requirement associated with grants is very useful to the owner of the unit.
- As companies transition their fleets to EVs, this industry will grow, and workplace charging will have a bi-fold benefit; provide fleet charging during the evening and employee charging during the day.

COMMUNITY CHARGING

HCE's *Community Charging* program has evolved over the first two years. The program first focused on public corridor charging through the CEO EV Fast-Charging Corridor, but when the HCE territory was not selected by the CEO, the HCE board resolved to focus on providing a service to the community to help relieve range anxiety. This program now provides financial assistance with the electric infrastructure upgrade cost for local partners, providing community DCFC stations.

HCE staff has strategically pre-selected over 70 locations where DCFCs are the least expensive to install. HCE then awarded electric infrastructure upgrades based on a community partner's plan for development. HCE helps manage the installation process, including procurement, setup, and communications. The community partner manages the *Charge Ahead Colorado* grant process, site preparation, and ongoing maintenance.

In 2019 there were two installations of DCFCs in Basalt and Eagle. In 2020, HCE installed ten with a plan of approving one community charging program participant in each town within HCE's service territory. As of mid-2021, there are now 21 DCFC locations with 38 ports in and around HCE's service territory with more on the horizon. HCE is not engaged in owning DCFC at this time, and based on utilization data, once there is a DCFC in every town, HCE may conclude this program.



To ease range anxiety and locate EV charging stations, members can reference an EV charging map at holycross.com/chargermap.

GRAPH 4 **DCFC 50 KW TOD vs Demand**

Graph 4 – Comparison of rates vs utilization
Although DCFCs at HCE's community hubs provide an essential service for many visitors, such as EV drivers without access to home charging or EV scavengers (drivers looking for free energy), load growth at DCFCs has been low, and only responsible for 18% of Electric Transit (ET) sales. For this reason, all HCE simulations for load growth at DCFC's were placed on a low projection of 8.7%.

HCE offers a TOD rate for DCFC, providing an additional benefit for low utilization because the rate waives a demand charge component. As the number of EVs charging per month increases above 280, a demand rate becomes more economical.

TOD is a good rate for DCFC, providing a 30-minute refueling time. For DCFCs with a higher dispensing rates (for example, a 10-minute refueling time, but is perhaps rarely visited), TOD makes it hard for the utility to recover their cost.

Although TOD is a tool to help shape load profiles by changing behavior, it will not have the same effect when a driver charging at a community charger does not have a choice on the time of day they need to charge.

Because of this, HCE will place the utility meter on TOD, but recommend leaving the cost of fuel dispensed at a fixed rate to not cause confusion. For one DCFC, a 12-cent dispensing rate was selected to break even with the TOD rate at the meter.

There are examples of very high dispensing rate costs, which discourages utilization, therefore extending the ROI. This should be avoided because it has an adverse effect on EV adoption.

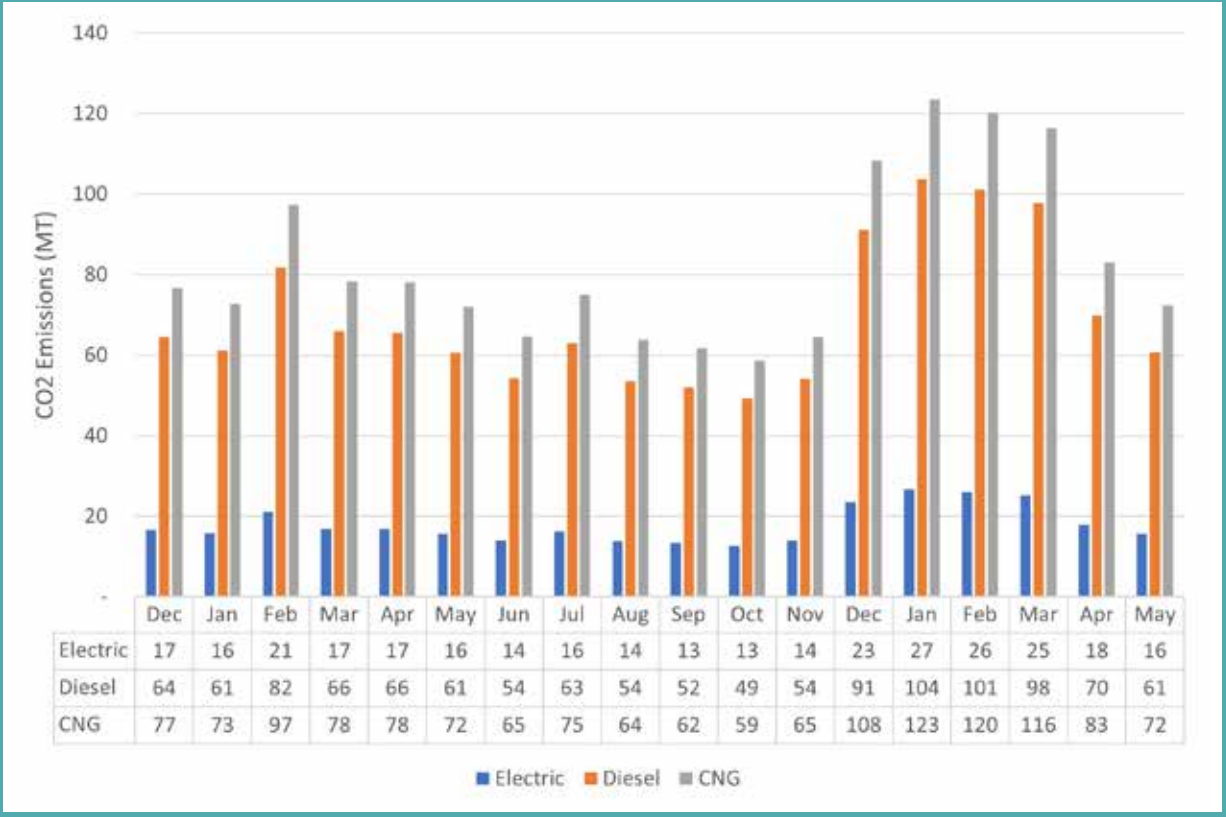
TRANSIT

It took over two years of planning with the Roaring Fork Transit Authority (RFTA) and the City of Aspen to bring eight battery-electric buses (BEBs) online. In December 2019, they began service in Aspen. The BEBs performed as expected in the mountainous terrain, and their range was well within the estimated amount. Like most new EV drivers, the transit authorities needed to reduce their range anxiety through experience and the addition of more charging locations and on-route options to increase operations.

Energy use was more efficient than initial estimates based on miles driven and outside conditions. Most BEBs are currently running above half their daily battery capacity and could double their monthly usage once testing is complete and routes are expanded.

2020 brought seven new BEBs to the Eagle-Vail valley and more on the way in 2021. This could potentially increase the number of transits BEBs in HCE territory to 20 by end of 2021 through investments by Eagle County Transit (ECO), Town of Avon, Town of Vail, and Aspen School Districts.

GRAPH 5 **CO2 Equivalent for Transit**



	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Electric	17	16	21	17	17	16	14	16	14	13	13	14	23	27	26	25	18	16
Diesel	64	61	82	66	66	61	54	63	54	52	49	54	91	104	101	98	70	61
CNG	77	73	97	78	78	72	65	75	64	62	59	65	108	123	120	116	83	72

Graph 5 – A comparison of CO2 emissions of transit buses based on kWh sales

Transit is also allowed to participate in the TOD rate knowing that if they fuel up on-peak, it will still be less expensive than diesel. If too much on-peak charging occurs, HCE may develop a critical peak pricing program to compensate for the increased demand during system peak events.

Anyone who has stood at a bus stop and watched a bus pull away can visually see the effects that fossil fueled powered buses have on the environment. One of the best opportunities for environmental impact reduction by EVs is in the transit and medium-duty segments. This is shown in graph 10 where an electric bus at HCE's 44% renewable energy mix is compared to a diesel bus and a compressed natural gas (CNG) bus.

The comparison is based on energy input through the meter. The results show that on average the BEB charged from the HCE grid has a reduction in emissions of 74% compared to diesel and 78% when compared to CNG.

In 2020, RFTA's new fleet of BEBs at half utilization reduced 550 MT of CO2 emission from fuel switching and provided increased air quality and decreased noise pollution.

HCE FLEET AND FACILITIES

HCE recognizes the unique position it has in the community to be a resource for members and employees and to promote the advancement of EVs. As EVs become increasingly popular in the HCE service territory, it is an opportunity for HCE to provide leadership as an early adopter to support members' transition to EVs. In 2018, three Chevy Bolts were added to the HCE fleet. In 2019, three more were added. EVs now make up 6% of HCE's overall fleet and 11% of cars (non-trucks).

For HCE employees to become familiar with EVs, a short presentation was given to teams across the co-op, including senior staff. Laminated sheets were created on Tips for Driving the Chevy Bolt and EV Charging Locations at HCE that can be found in each EV. A scrolling "EV Miles Driven" and an "EV Info Slideshow" were added to HCE's internal website. HCE also offered EV test drives – allowing a one-on-one driving experience to become familiar with the small nuances and increase comfort with driving EVs. These team efforts have resulted in 25+ employees driving an EV that never had before and increased the usage of our EV fleet, making the Chevy Bolt the most popular pool vehicle of 2019.

HCE also added an EV Corner to its monthly employee newsletter. This gives EV users an opportunity to share with all employees how they are using HCE EVs for everyday work-related trips. It also provides an opportunity to address hot EV topics such as EV charger waitlists, winter driving tips, types of chargers, future vehicles, and long-distance EV trips. The newsletter helps keep EVs at the forefront of employees' minds.

HCE staff provides data about its own fleet usage to management. To understand which vehicles are good candidates to be replaced with an electric vehicle, HCE started tracking the monthly mileage on all cars and trucks, and the daily mileage on eight vehicles. While range itself does not seem to be a limiting factor based on the daily miles driven in vehicles, current electric fleets do not fit all requirements for every need (4WD, truck bed, etc.). Once an electric truck becomes available and is priced competitively, it could dramatically change the composition of HCE's fleet.

Although the Bolts and the charging stations have the technology to only charge during non-peak hours, HCE keeps the pool EVs constantly charged to be ready for the next trip. As popularity increases, HCE may have to adapt its booking system to allow time for recharging in between trips. In the future, to better understand fleet usage, HCE may want to use a fleet booking management software that is paired with telemetry.

During a recent board meeting, the HCE Glenwood Campus EV charging ports were very busy!

- Drone footage by Robert Rittner

This would allow HCE to better manage charge times in between EV checkouts and to have better data with which to do an EV suitability assessment of its current fleet.

Another important consideration as HCE transitions its fleet to EVs is to ensure that the infrastructure to handle additional EVs is adequate. In 2019, HCE added nine more Level II ports throughout its facilities, with six more ports installed in 2020 for a total of 18. At the Glenwood facility, the outdoor ports are also available to the public, currently free of charge. HCE employees have also purchased personal EVs and are charging while they are at work.

Although this puts additional time demands on the ports, a waitlist function has been implemented that is working well. All of the chargers are tied to the solar array on the roof of one of HCE's campus buildings. This means that the majority of EV charging at the Glenwood campus is being charged directly from sunshine.

HCE will continue to evaluate its fleet and EV infrastructure as technology, availability, and range continues to develop. HCE may look at delaying the replacement of older vehicles to allow the EV truck market to mature.

EVs by the Number

67,706	**HCE EV miles driven**
36,887	**EVs on the road in CO**
3,112	**Level 2 ports in CO**
1,105	**Member EVs on the road**
451	**DC fast charge ports in CO**
278	**Community level 2 chargers in HCE service territory**
270	**EV chargers on line through HCE's *Charge at Home. Charge at Work.* program.**
38	**Community DC fast charge ports in HCE's service territory**
18	**EV charging ports at HCE facilities**
6	**HCE-owned EVs on the road**
4	**HCE employee-owned EVs on the road**

Source: As of June 1, 2021 Colorado Energy Office

Safety

For members to participate in any of HCE's EV programs, safety conditions must be met. Chargers must be placed in locations that minimize the possibility being struck by vehicles and buried or struck by snowplows.

In addition, HCE requires the use of Ground Fault Interruption (GFI) protection of feeder circuits as a best practice for safety to reduce the risk of electric shock if charging equipment is damaged. HCE's safety team will evaluate and continually monitor EVSE safety best practices.

Conclusion

The electrification of the transportation sector is the quickest way to draw down carbon emissions and continues to present both opportunities and challenges within HCE's service territory. By focusing on expanding the infrastructure needed for EVs, removing range anxiety, and educating members on the benefits of EVs, HCE is positioned to provide members with the knowledge and expertise needed to transition to a clean energy future.

For more information visit:

holycross.com

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