

Intermountain Western Alternative Fuel Corridor Convening



Wednesday, November 6, 2019

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SUMMARY REPORT

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Background

Section 1413 of the Fixing America's Surface Transportation (FAST) Act requires the Secretary of Transportation to designate national electric vehicle (EV) charging, hydrogen, propane, and natural gas fueling corridors. The Federal Highway Administration (FHWA) is working with other federal, state, and local officials, as well as private industry, to help plan and promote an interstate network of stations that will fuel vehicles powered by clean and domestically produced alternative fuels, so commercial and passenger vehicles can reliably travel between cities, regions, and across the entire nation. FHWA has completed three rounds of alternative fuel corridor designations, the first in 2016, the second in 2017, and the third in 2018. In October 2019, FHWA announced a fourth round of nominations that are due on February 26, 2020. One of two designations have been assigned to each nominated highway segment:

- "Corridor-Ready" - A sufficient number of facilities exist on the corridor to allow for corridor travel using one or more alternative fuels; and
- "Corridor-Pending" - An insufficient number of facilities currently exist on the corridor to allow for corridor travel using one or more alternative fuels.

Designation status for each fuel type were based on the following criteria:

- EV charging: EV charging¹ facilities at 50-mile intervals along designated EV corridors.
- Hydrogen: Hydrogen fueling facilities at 100-mile intervals along designated hydrogen corridors.
- Propane: Propane fueling facilities at 150-mile intervals along designated propane corridors.
- Natural gas: Compressed natural gas (CNG) and liquefied natural gas (LNG) facilities at 150-mile intervals and at 200-mile intervals respectively, along designated corridors.

In 2018, FHWA initiated a series of regional convenings to encourage multi-state and regional coordination for the development and implementation of alternative fueling infrastructure along corridors. The convenings foster an important opportunity for states to evaluate the potential of shared infrastructure investments and improved collaboration for education/outreach efforts among and between the public and private sectors. The Intermountain Western Alternative Fuel Corridor Convening was the fifth and final convening in the series and was held in Salt Lake City, UT on November 6, 2019. The convening facilitated meaningful engagement among stakeholders to identify key barriers and opportunities to expand the network of alternative fuel corridors in the Intermountain Western region. To support a regionally-tailored program on Intermountain Western priorities, a planning committee was organized to help shape the goals and objectives of the convening's program and included stakeholders from state and city departments of transportation, state energy and environmental departments, metropolitan planning organizations (MPOs), alternative fuel infrastructure providers, and Clean Cities Coalitions.

Convening Summary

The Intermountain Western Alternative Fuel Corridor Convening was held in Salt Lake City, UT on November 6, 2019. Seventy-six stakeholders including the planning team participated in the convening. States represented at the convening included Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, and Wyoming. The day was

¹ FHWA's objective is to establish direct current fast charge (DCFC or Level 3) infrastructure at 50-mile intervals for corridor designations made in 2017, and later.

held in partnership with the National Association of State Energy Officials (NASEO) and hosted by PacifiCorp at their facilities in Salt Lake City.

The day kicked off with opening remarks by Carlos Braceras, Executive Director of the Utah Department of Transportation (UDOT). Next, welcome introductions were made by NASEO, PacifiCorp, and FHWA leadership, followed by an overview of the goals and objectives for the convening. Stakeholders then went around the room and introduced themselves and their organizations. The first session provided participants with useful tools for assessing existing gaps and supporting planning efforts for alternative fuel corridor development. The session featured presentations by the National Renewable Energy Laboratory (NREL) which developed online resources such as the Alternative Fuels Data Center (AFDC) which includes the Alternative Fueling Station Locator and the Electric Vehicle Infrastructure Projection Tool (EVI-Pro) Lite tool. To help bring awareness and discussion around alternative fuel corridor activity in the Intermountain Western region, the second session, a two-part panel discussion, focused on existing alternative fuel corridor initiatives in the Intermountain Western region. The first panel in this session focused on electric vehicle corridor initiatives while the second panel focused on hydrogen, natural gas, and propane corridor initiatives.

Sessions following the lunch break focused on key aspects related to improving and expanding the regional network of alternative fuel corridors. The “Filling the Gap” panel session featured alternative fuel infrastructure provider and utility perspectives. The “Designing Partnerships for Corridor Development” session involved breakout group discussions on roles, responsibilities, and key action items for stakeholders involved in alternative fuel corridor build-out and expansion. The closing session focused on the next steps and partner commitments for advancing alternative fuel corridors and recommendations to FHWA on tasks/needs to prioritize moving forward.

Key Takeaways

The following are the key takeaways for enhancing and expanding alternative fuel corridors in the Intermountain Western region that emerged throughout the day’s presentations and discussions (Figure 1):

- In the Intermountain Western region, a wide set of stakeholders support development of alternative fuel corridors and demonstrate interests across multiple fuels, including: electricity, hydrogen, natural gas, and propane.
- Public funding for alternative fuel corridor stations in the Intermountain West comes mainly from state energy offices, state departments of transportation, and electric utilities.
- Renewable gas has recently become a popular fuel choice for operators of natural gas vehicles due to the greenhouse gas emission benefits.
- AFDC provides mapping capabilities that can help transportation planners analyze which alternative fuel corridor routes need to be optimized, determine how best to increase fueling station access for public alternative fueling shuttle buses, and identify where to increase fueling stations for multiple fuel and vehicle types. The data for each fueling station is vetted at least annually but can be more frequent.



Figure 1. Convening attendees participate in discussions about alternative fuel corridors.

- The long driving distance between destinations in the Intermountain Western region poses unique challenges to development of refueling stations, rarely experienced elsewhere in the United States. For electric vehicle charging, meeting the 50-mile interval requirement under FHWA's corridor designation process is challenging on multiple fronts. For example, some rural areas do not have access to electricity along roads and lack plausible or safe locations to install charging stations. Rural refueling stations have low utilization, which impacts the financial viability of developing new stations. FHWA will also look at applications for corridors that come close but do not meet the requirements on a case-by-case basis if a justifiable explanation is included.
- Alternative fuel corridor signage has several benefits, including reducing range anxiety for drivers of alternative fuel vehicles (AFVs), increasing awareness of non-AFV adopters, and sending a public signal that a given jurisdiction supports development of alternative fuels.
- The Regional Electric Vehicle Plan for the West (REV West) can serve as a model to other regions in the country for how to foster collaboration across state lines on alternative fuel corridor investment by coordinating corridor build-out, establishing voluntary standards, and sharing best practices. The REV West [Memorandum of Understanding](#) (MOU) signed by all participating states outlines the commitments of the partnership.
- Having alternative fuel infrastructure available can bring economic development opportunities, including to rural gateway communities, as drivers stop to fuel or charge their vehicles.
- There is a strong interest in building out hydrogen corridors in Utah to support goods movement and heavy-duty transportation with state coordination opportunities in Colorado.
- Alternative fuels best suited for heavy-duty vehicle applications include natural gas, propane, and hydrogen. When natural gas is sourced from methane captured from landfills, it offers significant emissions reductions benefits compared to gasoline- and diesel- powered vehicles.
- There are emerging technologies available for medium- and heavy-duty (MHD) electric vehicles. Consideration should be made around charging availability to support MHD EV charging along corridors.
- Utilities play a critical role in promoting charging networks by aiding in the removal of barriers to EV adoption through rate designs that encourage EV use, incentive programs, and customer education on the benefits of EVs.
- As explored in the afternoon breakout session, each organization type has a unique role and responsibility in terms of the deployment of alternative fuel corridors. The Corridor Convening Planning Team will compile results of breakout activities into a matrix demonstrating the interplay of roles, responsibilities and planning steps by stakeholder group.
- National parks and truck stops can be good locations for alternative fuel station sites.
- There is an electric highway system organized by the Nevada Governor's Office of Energy and REV West in Nevada. Utilities like NV Energy played a major role in the success of the electric highway. The highway was funded in part by VW Settlement funds, utilities, and funds available to the Governor's Office.
- Signage reduces range anxiety for drivers of AFVs and increases awareness of alternative fuel refueling station availability for all drivers.

- Some challenges for the EV market include coordinating on infrastructure gaps, limited options for site host selection, a long return on investment, and coordinating with utilities on demand charges and connection costs.
- Hydrogen fuel cell vehicles most often use tanks for storage. The fuel is compact and scalable as well.
- The propane market is decentralized and is highly competitive, which differs greatly from the natural gas and electricity markets. Fleets may be able to use this to their advantage by negotiating favorable fuel price contracts, which could also include the propane fuel marketer providing fueling infrastructure.

Convening Proceedings

Opening Remarks

Carlos Braceras, Executive Director, UDOT, and Former President, American Association of State Highway Transportation Officials

The day kicked off with opening remarks provided by Carlos Braceras.

- Mr. Braceras highlighted that Utah was celebrating the 150-year anniversary of the “Golden Spike” ceremony which marked the completion of the Transcontinental Railroad in 1869. This historic event was notable in transforming the transportation sector. Mr. Braceras drew parallels between that point in time and today’s technological innovations in alternative fuel infrastructure.
- He described three paradigms currently in motion in this age: automation, mobility services, and changing fuel types (i.e., electrification of fleets).
- Mr. Braceras explained that the public is demanding cleaner technologies and the purpose and nature of this convening is responding to that demand. Alternative fuel deployment will drive progress forward.

Welcome

James Campbell, Legislative Policy Adviser, PacifiCorp

The next session included a warm welcome provided by James Campbell, a representative from PacifiCorp and host of the convening. Mr. Campbell gave an overview of PacifiCorp’s work (Figure 2).

[See presentation for more information.](#)

- PacifiCorp is an electric utility with three primary subsidiaries, one of which is Rocky Mountain Power. Rocky Mountain Power has service territory throughout Utah, Wyoming, and Idaho. Mr. Campbell discussed the origins of electricity and transportation in Salt Lake City and PacifiCorp’s role in facilitating transportation and electrification with street cars in 1915 as “Utah Light & Traction Co.” which later became Rocky Mountain Power.
- Over 100 years after Utah Light & Traction Co. was involved in transportation electrification through street car operations, PacifiCorp has participated in a transportation electrification initiative called



Figure 2. James Campbell provides an overview of PacifiCorp’s alternative fuel corridor work.

“WestSmart EV” in partnership with several other organizations such as Utah Clean Cities, Breathe Utah, Utah Department of Environmental Quality, Idaho National Lab, Utah State University, University of Utah, Park City, Utah Transit Authority, and Salt Lake City.

- “WestSmart EV” involves electrifying 1,500 miles of electrified interstate with more than 65 DCFCs; holding workshops and supporting the installation of more than 600 Level 2 chargers at work stations; promoting incentives for more than 200 EV purchases; collecting data, analyzing, and modeling for WestSmart EV Central; considering all electric solutions in urban areas for smart mobility; and conducting outreach including sharing lessons learned; distributing materials; and hosting workshops.
- Mr. Campbell presented maps displaying data on urban and state-wide usage by EV owner locations of DCFCs. He noted that the most frequent usage comes from EV drivers who live outside of population centers and that urban DCFC usage tends to be less frequent.
- Mr. Campbell discussed PacifiCorp’s partnership with Lyft to help transition Lyft drivers towards EV usage through funding, training, DCFC access, and the use of a downloadable app that tracks charging location and characteristics. PacifiCorp also helped launch an electric car sharing program at a housing development for residents with a group called “Envoy There.”
- There are six electric buses in the Park City bus route which has allowed the compilation of data of both charger and bus performance for two years. This is the second year of developing an electric bus system planning tool in Salt Lake City. PacifiCorp is assisting in the development of multi-modal transit hubs as well.

Cassie Powers, Managing Director, Programs, National Association of State Energy Officials

- Cassie Powers introduced NASEO as a facilitator for the Regional Electric Vehicle Plan for the West, which is a union of eight states (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming) whose governors signed a memorandum of understanding (MOU) to enable EV transport across major transportation corridors in the western United States.
- Ms. Powers discussed the value of the MOU encouraging states to work across state lines to coordinate on alternative fuel corridor investment with similar goals of corridor build-out, establish voluntary standards, share best practices, and achieve climate goals. Ms. Powers noted that this REV West partnership serves as a model for the country.
- In addition to meeting energy and climate targets, governors who signed the REV West MOU want to encourage economic growth through building more opportunities for EV drivers to travel through their states.

Diane Turchetta, Transportation Specialist, U.S. Federal Highway Administration

[See presentation for more information.](#)

- Diane Turchetta welcomed everyone, thanked PacifiCorp for hosting the convening, and presented on FHWA’s role in facilitating the National Alternative Fuel Corridor Program (Figure 3).

- Under the FAST Act Section 1413, the U.S. Department of Transportation was authorized to designate national corridors along major highways for the following fuels:

- Plug-in EV charging;
- Hydrogen fueling;
- Propane (liquefied petroleum gas [LPG]) fueling; and
- Natural gas (CNG, LNG) fueling.

- FHWA led three rounds of designations, in 2016, 2017, and most recently in 2018. One week prior to the convening, FHWA released its solicitation for the fourth round of nominations under the FAST Act, with a deadline in 2020. The designation process was established without funding support.



Figure 3. Diane Turchetta giving an overview of FHWA's alternative fuel corridor program.

- The criteria for corridor designation were determined in conjunction with industry, the US Department of Energy (US DOE) and NREL.
- There are several benefits of having a national system of designated alternative fuel corridors. These include:
 - Enabling inter-city, regional, and national travel using clean-burning fuels;
 - Reducing energy dependence;
 - Addressing range anxiety;
 - Integrating corridor planning with existing transportation planning processes;
 - Increasing public interest and awareness of alternative fuel availability; and
 - Accelerating the adoption of alternative fuel vehicle technologies.
- To date, there have been 79 nominations during rounds 1 through 3 comprising 46 states and Washington, D.C. Designations of all alternative fuels cover over 135,000 miles of the National Highway System, including segments of 100 interstates and 76 US highways or state roads.
- FHWA provides highway signage guidance to State Departments of Transportation (DOTs) through a Manual on Uniform Traffic Control Devices (MUTCD) Memorandum. A useful resource located on FHWA's website is a list of frequently asked questions to address questions that several state DOTs may have. This is located here: https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/resources/faq/#toc494791843.
- The first corridor signs were installed along I-94 in Minnesota and I-26 in South Carolina.
- Ms. Turchetta provided an update on the regional alternative fuel corridor convenings that have already been completed: in the Midwest, Southeast, South Central, and Northeast/Mid-Atlantic regions.
- The convenings have served an important role in bringing stakeholders from neighboring states together and have strengthened coordination and collaboration to get more corridor designations on the map. They have helped FHWA to evaluate regional priorities and needs, programs, and resources to expand corridors,

identify critical infrastructure gaps, draft a regional strategy to promote clean vehicle adoption, and encourage partnerships.

- Ms. Turchetta encouraged attendees to visit the US DOE's AFDC for a variety of useful tools related to alternative fuel corridor planning at www.afdc.energy.gov.
- The FAST Act will expire in 2020 but there is currently a draft of the next reauthorization bill in the Senate.

Setting the Stage: Partnership Goals and Objectives

Oana Leahu-Aluas, Associate, Sustainable Transportation Practice, Cadmus

[See presentation for more information.](#)

- Ms. Leahu-Aluas presented on the diversity of stakeholders participating in the convening, reviewed the responses to poll questions attendees were asked prior to the convening, and presented a word cloud showing what attendees indicated they were hoping to get out of the meeting.

The breakdown of attendees at the convening is shown above (Figure 4).

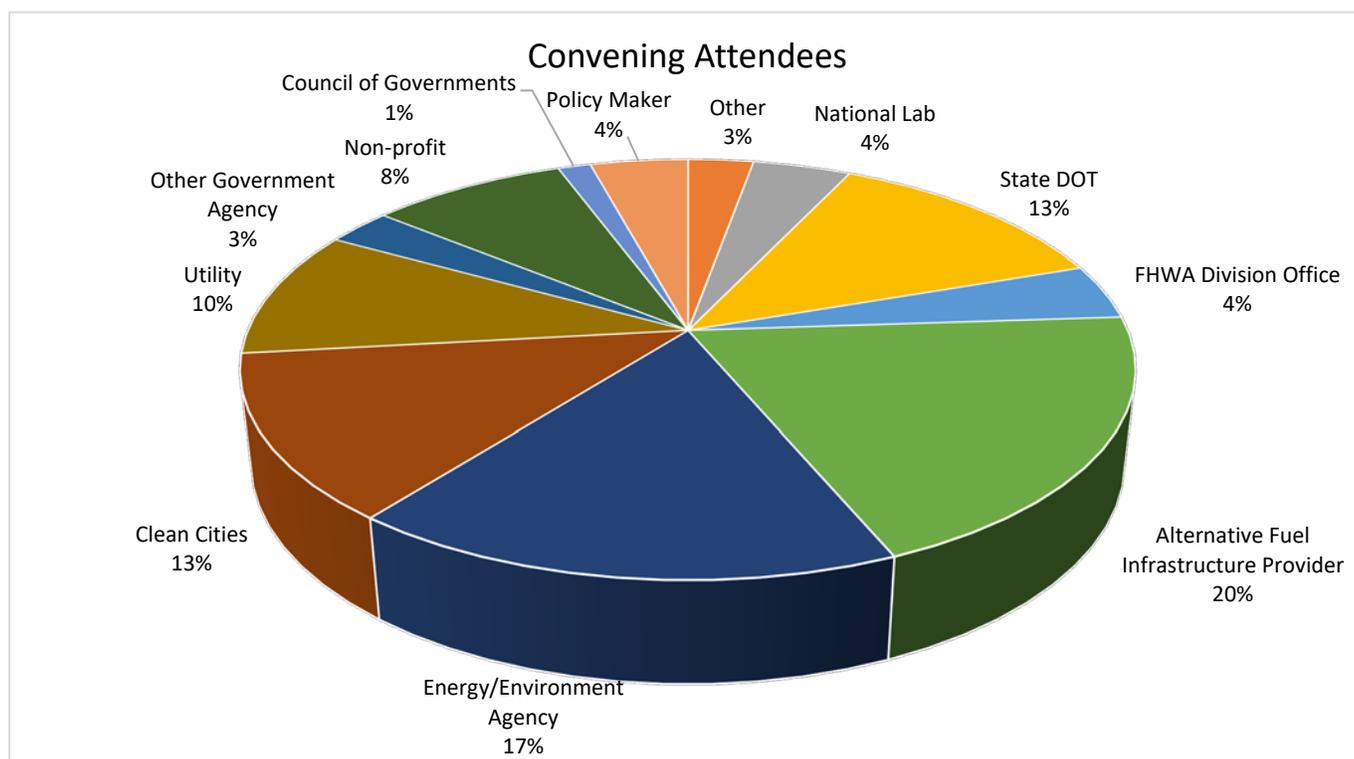


Figure 4. Breakdown of Intermountain Western attendees by representative organization.

The results of the three questions posed to attendees before the convening are shown below (Figure 5, Figure 6, Figure 7).

Which alternative fuel are you most interested in advancing/deploying?

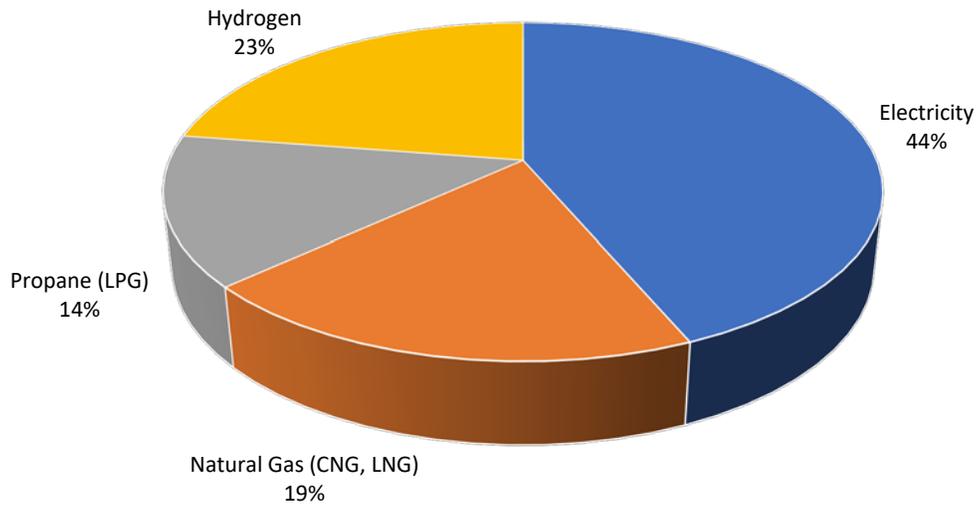


Figure 5. Pie chart showing which alternative fuels attendees were most interested in advancing or deploying.

Which stakeholder(s) are you most looking forward to connecting with at the convening?

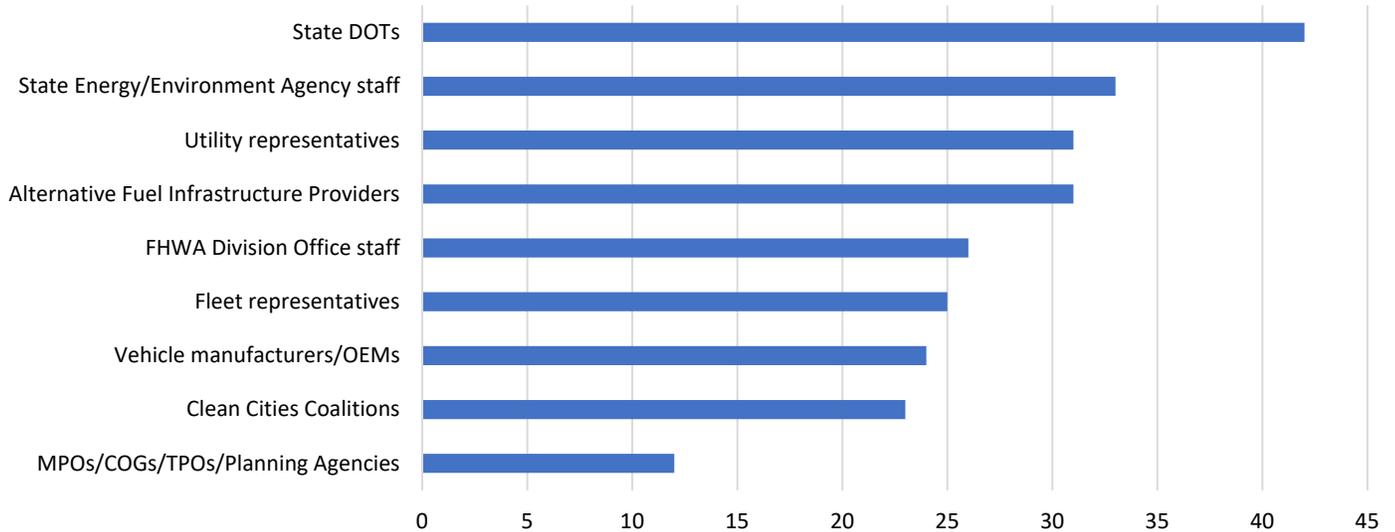


Figure 6. Bar graph showing the stakeholders whom convening attendees were most interested in connecting with.

What do you think are the top three barriers to creating successful alternative fuel corridors?

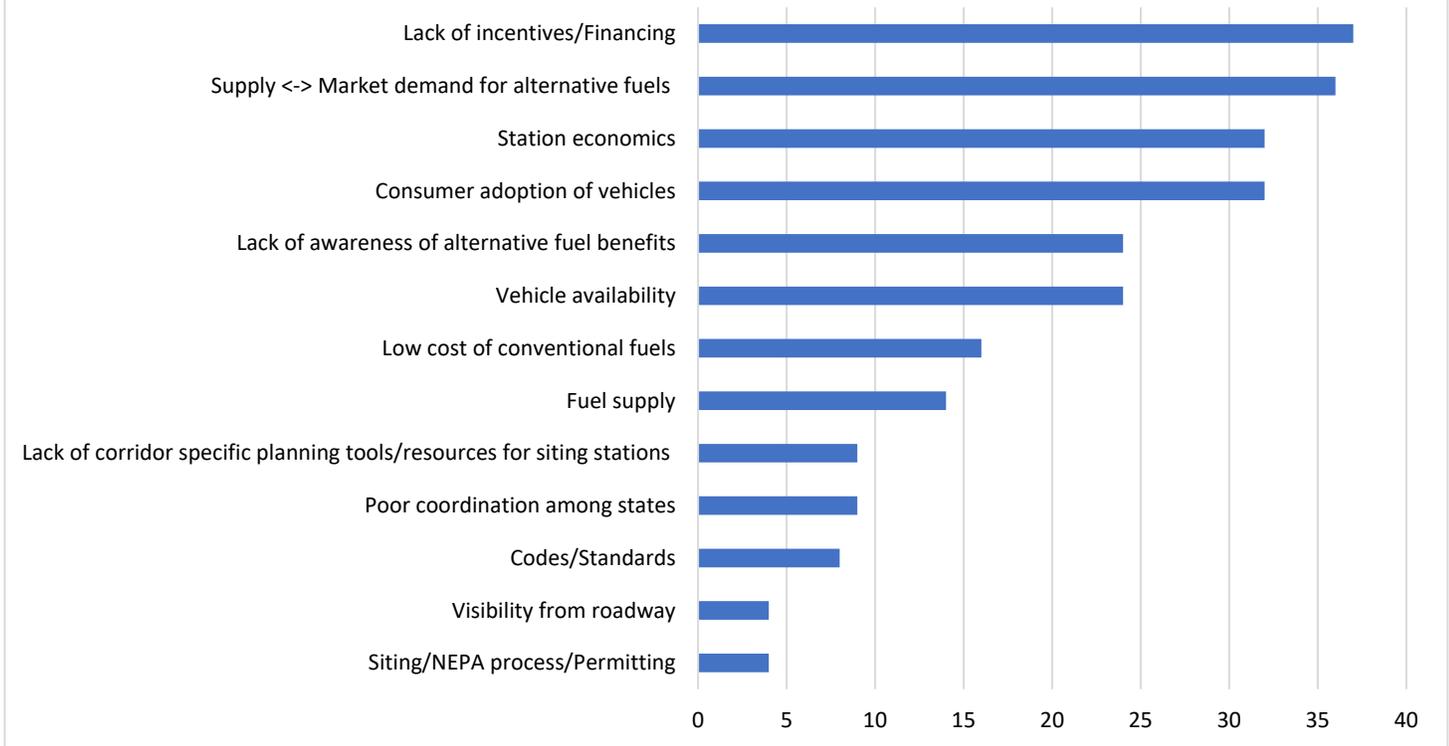


Figure 7. Bar graph showing the top barriers for creating successful alternative fuel corridors based on convening attendee rankings.



Figure 8. Word cloud showing what attendees hoped to achieve during the convening, using one word.

Alycia Gilde, Director, CALSTART

[See presentation for more information.](#)

- Ms. Gilde outlined the goals and objectives for the day, including identifying key barriers to alternative fuel corridor development, evaluating needs, increasing awareness, developing a regional strategy, and building sustainable partnerships.
- She explained the importance of attendee engagement and participation throughout the day.

Alternative Fuel Corridor Planning Tools

Attendees learned about the NREL tools and those used by REV West which are available to support states in planning for and mapping alternative fueling infrastructure. They also learned about the capabilities of FHWA's Planning, Environment, Realty (HEP) GIS mapping website.

Mike Scarpino, Transportation Project Engineer, U.S. Department of Transportation Volpe Center

[See presentation for more information.](#)

- Mike Scarpino presented on the FHWA HEPGIS website. This website is an interactive geographic map which hosts all the alternative fuel corridor maps, enabling users to navigate, view, and print these maps. These maps are interactive and allow users to select by fuel and designation round. There are several other layers that are available on these maps and can aid in corridor analysis and planning.
- To illustrate the mapping capabilities of the HEPGIS website, Mr. Scarpino displayed a map of Utah and analyzed EV corridor nominations and designations. He noted that the only corridors designated as “Ready” in Utah were in the Salt Lake City region.
- Layer options, such as viewing alternative fueling stations, are available in the map. If the user clicks on one of the alternative fuel stations displayed on the map, they will see details about that specific station.
- Mr. Scarpino walked through some additional layers on HEPGIS which might be helpful to users. HEPGIS allows users to add layers that can assist with their corridor analysis such as showing the locations of truck stops, rest areas, national parks, and intermodal facilities, such as airports, bus terminals, train stations, ferry terminals, and other connections.
- Mr. Scarpino indicated that there is an additional layer displaying forecast traffic volume for all vehicles, with a baseline in 2012. These maps indicate significant traffic volume growth in the Salt Lake City area.
- One corridor that looks viable for alternative fueling infrastructure, based on project traffic growth, is Interstate 215.

Matt Rahill, Alternative Fuels Data Center Lead, National Renewable Energy Laboratory

[See presentation for more information.](#)

- Matt Rahill introduced the AFDC website, which provides a wealth of data on fuels and hosts numerous interactive tools and maps. The AFDC is funded by the DOE and uses data collected by industry to display federal and state laws and incentives, replicable case studies, and more. The targeted audience of AFDC is fleet and transportation planners. There are more than ten million visits to the website each year.

- NREL’s AFDC is primarily focused on alternative fuels and is fuel agnostic. The AFDC provides data, maps, and information related to fuel conservation and alternative fuels, vehicles, and stations.
- Mr. Rahill presented the AFDC Alternative Fueling Station Locator. The AFDC Station Locator is updated regularly with new station data. AFCD’s Alternative Fueling Station Locator allows users to filter by location and fuel type. This tool also enables users to map driving routes.
- The tool uses existing infrastructure data provided by NREL and other sources. The tool is refreshed daily. The AFDC is the only place where users can download station data on Combined Charging System (CCS) and CHAdeMO connectors for DCFCs. An EV that uses either a CCS connector or CHAdeMO connector encounters charging gaps along certain corridor segments.
- Users may apply filters when using the AFDC Station Locator to search by location, fuel type, and station type. Users may reach out to NREL if there are certain datasets they would like to collaborate on. Users may download data in the bottom left corner of the screen. Data is downloadable by comma-separated values file and shapefile for each state and fuel type. Shapefiles are a standard way to represent data visually.
- The AFDC hosts simple interactive maps that show existing corridors and station locations that meet FHWA corridor nomination process requirements for Corridor-Ready or Corridor-Pending status. Users may view where there are enough stations within five miles of a highway to consider designating a new corridor. Maps will also show users where adding one more station will increase eligibility. There are five map options, one for each fuel type. These maps are very user-friendly, even to those unfamiliar with GIS.

Johanna Levene, Manager, Transportation Data and Tools, National Renewable Energy Laboratory

[See presentation for more information.](#)

- NREL works with Clean Cities Coalitions to maintain the AFDC website and database for alternative fueling station locations. NREL has maintained this website for decades, and the impetus for developing maps of corridors specifically connecting each alternative fueling station location came at the request of FHWA.
- Johanna Levene (Figure 9) presented several interactive AFDC maps useful for agencies measuring the distance between stations and looking to nominate alternative fuel corridors. These maps can help transportation planners understand the distances required between stations for fueling infrastructure development in order to nominate corridors as Ready or Pending.
- Certain highway sections were designated with EV corridor status with Level 2 chargers but will need additional DCFC installations for future designation. When state planners are looking at highway sections with gaps, they should look at locations where there are already Level 2 chargers and consider putting a DCFC station there instead.
- In conducting its corridor analysis, NREL is assessing which corridors currently



Figure 9. Johanna Levene presenting alternative fuel corridor planning tools developed by NREL.

designated as Pending might have the most potential to become designated as Ready with the addition of new fueling stations. FHWA and NREL can coordinate to designate a Pending corridor as Ready once new alternative fueling stations become operational and once that corridor meets the requirements necessary for Ready status. FHWA does not have to issue a new request for nominations for a corridor to become designated as Ready.

- EVI-Pro Lite is a tool to provide a simple way to estimate how much EV charging is needed at a city-and state-level. The EVI-Pro Lite tool allows transportation planners to set goals for the number of plug-in EVs they want to support in a given state or city. It also allows users to adjust the anticipated vehicle mix and provides information about costs associated with stations, projections for EV growth, site-specific considerations, and more. The EVI-Pro Lite tool will be able to estimate load profiles for EV charging once further updates are made.

Mark Brady, Program Manager, Nevada Governor's Office of Energy

[See presentation for more information.](#)

- Mark Brady presented on the REV West ArcGIS Modeling Tool. Some goals for the tool include illustrating some of the corridor gaps, assisting in the coordination of a regional effort across state lines, presenting NREL data with the ability for users to modify using Google Sheets, and for the platform to be maintained by users on Google Sheets. Some limitations include that the Modeling Tool does not assess divided highways, measure along highways, include Level 2 chargers or “safety locations,” or analyze trips including factors that account for EV performance (i.e., weather, gradient, speed, battery size, driving style, and range).
- Mr. Brady then showed the REV West ArcGIS Modeling Tool online. The tool includes data for all eight REV West states. Interstate routes are symbolized in a bold red, highways are symbolized in a light red, existing charging station infrastructure sites are symbolized using blue dots, and infrastructure being planned is symbolized using orange dots.
- A link to the REV West ArcGIS Modeling Tool is here:
<http://uplan.maps.arcgis.com/home/webmap/viewer.html?webmap=ed0b145ad1e445a3916987523743df45>.
- Mr. Brady also presented on the WestSmart EV Initiative, which was also previously discussed during Mr. Campbell’s presentation. Utah State University assisted with the WestSmart EV Initiative and conducted analysis on traffic patterns, geography, and determined where key charging infrastructure should be located based on where drivers most frequently travel and how far/long it takes.

During the discussion that followed, the following emerged as key takeaways:

- During the nomination process, transportation officials should identify highway segments to FHWA which minimally exceed the distance requirements between stations to be classified as a Ready corridor (which would otherwise result in a Pending corridor designation). If there are extenuating circumstances on why the nominating officials believe that FHWA should consider this segment to be designated as Ready (such as due to geographic realities, or this is the only logical location for a station along the corridor), FHWA will take this information into consideration and final classifications will be made on a case-by-case basis.

- The FHWA 50-mile requirement between EV charging stations to qualify a corridor for Ready status was developed using typical charging times, the number of charging ports per charging location, the range of available EVs on the road, and had the intent of including EVs that have lower ranges. FHWA hopes the 50-mile requirement will ultimately strengthen the resiliency/redundancy of fueling availability along the corridor.
- In the western regions of the United States, some rural parts of each state do not have access to electricity along roads or any plausible location to install EV charging stations. Some locations are not safe for rest stops too. Additionally, some laws restrict investment of infrastructure to private investors. For states encountering issues like this, they can try to coordinate with the National Park Service (NPS) or truck stops to locate potential sites to install charging infrastructure.

Regional Alternative Fuel Corridor Initiatives: Progress to Date, Partnerships, Funding: Electric Vehicle Corridor Initiatives

Partners throughout the region presented on innovative programs currently advancing alternative fuel corridors in the Intermountain Western U.S.

Tammie Bostick, Executive Director, Utah Clean Cities

[See presentation for more information.](#)

- Tammie Bostick (Figure 10) gave a presentation on Utah Clean Cities' role in facilitating partnerships to promote adoption of alternative fuel infrastructure and vehicles for individuals and fleets. Utah Clean Cities works with Rocky Mountain Power on a "Work Electric" workplace charging program.
- Another Utah Clean Cities program to facilitate alternative fuel vehicle awareness and access is a partnership with the US National Park Service. This partnership, Core West EV, was part of a cooperative agreement with Zion National Park and with a rural gateway community. Utah Clean Cities also worked with Zion National Park to support a program for propane shuttles in the park. In addition to promoting alternative fuel vehicles, the partnership aimed to increase visitation to the parks in the region.
- Utah Clean Cities finds that national parks and truck stops serve as good locations for transportation planners to consider when siting alternative fueling stations.
- A "First Responders Response and Resiliency Advanced Fueled Vehicles" program facilitated by Utah Clean Cities includes partnering with federal, state, municipal, public, and private entities to help first responders understand and familiarize themselves with natural gas, biofuels, propane autogas, and EV options.



Figure 10. Tammie Bostick presents on the role of Utah Clean Cities in implementing alternative fuel corridor initiatives in Utah.

Mark Brady, Program Manager, Nevada Governor's Office of Energy

[See presentation for more information.](#)

- The Nevada Governor's Office of Energy is working with REV West to complete an electric highway system by 2020. The partners involved see the benefits of an electric highway system as reducing the amount of imported fossil fuels over the next decade and reducing carbon emissions. The impetus for an electric highway system came from a directive by the governor in Nevada's 2016-2020 Strategic Planning Framework.
- Funding for this electric highway system comes in part from the renewable energy funds available to the Governor's Office, utilities, Volkswagen Mitigation funds through grants to host sites through service providers, and an NV Energy incentive (Senate Bill 145). The Governor's Office of Energy worked with several utilities to develop this incentive policy, which was successfully passed by the state legislature and an effort to increase EV charging infrastructure along state corridors.
- Mark Brady discussed REV West, which identifies priority EV corridors, standards, and best practices across eight states and is guided by an MOU signed in October 2017. REV West is currently encouraging new governors to sign the MOU. REV West is working to increase EV infrastructure along corridors in the Intermountain Western region.
- Some challenges for establishing alternative fuel infrastructure in Nevada are that there are several interstates with very little access to electricity, existing infrastructure, or plausible locations to build charging infrastructure at rest stops. Increased coordination across multiple levels of government can help create solutions to address these challenges.

Vincent Veilleux, Manager, Distributed Energy Resources, NV Energy

[See presentation for more information.](#)

- NV Energy, an electric utility in Nevada, works with Nevada Governor's Office of Energy on the Nevada Electric Highway initiative that Mr. Brady had also presented on. As Mr. Brady mentioned, legislative support through Senate Bill 145 helped to move this initiative forward to "expand and accelerate the deployment of EVs and supporting infrastructure" in Nevada.
- There was a \$15 million set aside to prioritize programs that assist in the Nevada Electric Highway buildout. The initiative targeted 14 sites along several routes across Nevada.
- NV Energy, represented by Vincent Veilleux, (Figure 11) incentivizes up to \$500,000 per charging site. The Nevada Governor's Office of Energy has agreed to allocate \$937,000 and will incentivize up to 25% of the actual costs of each site until the cap is met. There are also requirements to include one DCFC and one additional charger at each site.



Figure 11. NV Energy presentation on a utility's role in implementing EV corridors.

- The Nevada Electric Highway initiative involves a competitive bidding process where incentive distribution occurs in two stages: during the preconstruction task order phase and during the construction task order phase.
- So far, six sites along the Nevada Electric Highway have been selected, with design in progress for three and construction completed for one, which is located south of Las Vegas.

Mike King, Assistant Director of Electrification & Energy, Colorado Department of Transportation

[See presentation for more information.](#)

- Mike King discussed signage initiatives in Colorado. Colorado DOT (CDOT) has the sole responsibility of installing signage along corridors in that state. CDOT works closely with the Colorado Energy Office on alternative fuel corridors.
- Designated corridors do not receive any funding from FHWA; developing signage for corridors is at the discretion of each state.
- The major corridor nominations in Colorado include I-36 and I-34 for EV; I-70, I-76, I-85 and I-287 for CNG; and I-70 for hydrogen. There are three corridors that have been fully designated (I-25, I-70, and I-76) and those are the priorities for signage in Colorado. CDOT could technically add signs along the Corridor Ready portions of routes now, however the agency is waiting to install signs until they have a more robust network and increased redundancy along corridors.
- The benefits of signage are that it reduces range anxiety for drivers of AFVs and increases awareness of alternative fuel refueling station availability for all drivers.
- CDOT follows the Manual on Uniform Traffic Control Devices (MUTCD) published in 2009 by FHWA for requirements on signage.
- CDOT updated its internal signage policy guide with CDOT alternative fuel fleets in mind. The following minimum criteria were developed for EV signage deployment:
 - DCFC equipment with CCS and CHAdeMO port compatibility;
 - Maximum distance from the highway interchange of one mile (in urban areas) or three miles (in rural areas);
 - Public restroom facilities available;
 - Service available for a minimum of 12 hours per day and seven days per week;
 - Drinking water available; and
 - A detailed map, aerial photo of the site, and a photo or other proof of a station indicator visible from the interstate crossroads.
- EV charging station signage implementation can be challenging because there are more hurdles to get through than for signage of gasoline stations. Electric vehicle supply equipment (EVSE) providers do not typically install signage for charging stations, so EV stations aren't as well marked as gas stations. In urban areas, traffic engineers are often concerned about signage clutter that can compete with drivers' attention. Sometimes CDOT finds it difficult to resolve differing perspectives on where alternative fuel signage should be located.

- A bill in the Colorado House of Representatives, HB19-1298, is intended to place signage near parking spots designated for EVs. Below are major components of the bill:
 - Internal combustion engines and non-charging EVs can be fined for occupying EV charging spots;
 - Signage must be posted and include a reference to the legislation and associated penalties;
 - Penalty for a violation is \$150 plus a \$32 surcharge; and
 - It applies to both public and private property and can be enforced by a peace officer on private property.

During the discussion that followed, the following emerged as key takeaways:

- Utah Clean Cities coordinates with public and private partners to ensure a range of fuels are available at refueling stations. In Utah, there is currently a small tax on EVs to offset a potential loss of revenue generated from less money flowing in from the gas tax.
- NV Energy funds its program through a tariff system and from allocating funds for a solar generation program to EV initiatives.
- Panelists agreed that most of their funding generation models have worked and can serve as examples for other parts of the country. Partnerships through REV West result in increased coordination between DOTs, utilities, and other stakeholders. Mr. King and Mr. Veilleux emphasized the importance of utility partnerships for innovation, capacity, and program support. Mr. Veilleux noted a useful partner, FreeWire, who helped integrate an alternate battery system into plans for a rural EV site.
- Mr. Brady discussed how the Nevada Governor's Office of Energy is integrating accessibility into its parking spaces for AFVs. Nevada DOT built one site shown on one of Mr. Brady's slides. This site has parking spaces that are wider than most and these are marked by handicap signs.
- While many EV drivers prefer faster charging times, it can still be beneficial for localities to have EV chargers with longer charging times to increase human traffic to local businesses hosting charging stations, which can generate revenue for those businesses and communities.

Regional Alternative Fuel Corridor Initiatives: Progress to Date, Partnerships, Funding: Hydrogen, Natural Gas, & Propane Corridor Initiatives

Partners throughout the region presented on innovative programs currently advancing alternative fuel corridors in the Intermountain Western U.S. (Figure 12).

Dale Prows, Head of Hydrogen Supply Chain, Nikola Motor

[See presentation for more information.](#)

- Dale Prows provided a description of Nikola Motor, a manufacturing and energy company which is currently integrating hydrogen fuel cell vehicles and EVs, hydrogen stations, EV drive trains, and other EV components. Nikola is looking to increase its deployment of hydrogen fuel cell and electric power semi-trucks. Nikola focuses on Class 6 and Class 8 vehicles.
- Nikola is partnering with Anheuser-Busch to convert some its heavy-duty fleet to hydrogen fuel cell vehicles.

- Nikola has a Complete Leasing Program to simplify and lower the total cost of ownership for fleet and truck owners, where owners have the option to trade in their vehicle for a new Nikola vehicle every 700,000 miles or 84 months.
- The company has a goal of building 700 hydrogen refueling stations by 2028. The goal would be for each station to produce about eight tons of hydrogen each day through an electrolysis process, which can be energy intensive.
- A typical Nikola hydrogen refueling station is intended to create energy onsite. This would happen through renewable power generation using solar and wind farms. The electricity generated would be converted to hydrogen using electrolysis. Hydrogen would then be supplied onsite in a storage facility. Fueling stations and hydrogen dispensers will both operate at a pressure of 70 megapascal, which is considered fast.
- Nikola currently operates a demo station at its headquarters in Phoenix, Arizona with about 1,000 kg hydrogen storage and dispensing capabilities. It will have a pilot station ready for deployment in 2020 in Phoenix for fuel cell research, development, and fueling. In 2021, Nikola will have a commercial fueling station in operation in Van Nuys, California to be used for Fleet Test Beta Trucks for Anheuser-Busch.

Reed Page, Operations Manager, Fleet Saver, LLC

[See presentation for more information.](#)

- For heavy-duty vehicles, natural gas solutions offer a lower-emission alternative to gasoline- and diesel-powered vehicles. CNG and LNG generated from waste in landfills and biodigesters is known as renewable natural gas (RNG). Vehicles powered by RNG are associated with 88 and 84 percent lower emissions than gasoline- and diesel-powered vehicles, respectively. RNG can be sold to fuel refiners to be created into a renewable fuel blend. RNG can also offset the costs of purchasing fuel, with improved price delivered to the end user. RNG is typically available for class 4 through 8 vehicle applications.
- Converting fleets from conventional fuels to RNG alternatives can result in reductions in greenhouse gas (GHG) emissions, fine particulate matter, volatile organic compounds, and nitrogen oxides.
- Several original equipment manufacturers (OEMs) have partnered with Fleet Saver to convert to CNG applications, including Kenworth, Peterbilt, Freightliner, MCI, Volvo, Mack, Autocar, New Flyer, NovaBus, ARBOC, and others.
- Fleet Saver has strategic partnerships with utilities and commercial fleets. Fleet Saver aims to alleviate infrastructure challenges by facilitating increased access to RNG markets. Fleet Saver also constructs private access stations. Fleet Saver serves freight corridors in the Intermountain Western region including Interstates 15, 80, 40, 10, 70, 84, and 90.



Figure 12. Panelists share details on their alternative fuel corridor initiatives in the Intermountain Western region.

Larry Osgood, President, Consulting Solutions

[See presentation for more information.](#)

- Larry Osgood presented on propane vehicle applications. He serves as an advisor for the Propane Education & Research Council.
- Propane is most similar in energy content to gasoline and diesel. For an alternative fuel, propane can enable heavy-duty vehicles to travel longer distances (i.e., 300-600 miles) and carry significant weight. Fuel transfer is quick and fairly similar to gasoline and diesel vehicles. The cost of dispensing propane is similar to gasoline and diesel vehicles as well.
- There are currently about 20,000 propane dispensers in the United States. Onsite propane autogas stations are the most affordable to install compared to conventional or other alternative fuels.
- Propane gas infrastructure is easily scalable depending on the demand. The amount of space required for onsite fueling stations for propane can vary depending on need.
 - Standard private stations are optimal for fleets needing a central refueling location. A typical setup includes a 1,000- to 2,000-gallon tank and a single propane autogas fuel dispenser.
 - Advanced private stations could be the best choice for larger fleets needing a central refueling station. The setup can include higher capacity fuel storage tanks with a canopy and multiple propane autogas fuel dispensers.

During the discussion that followed, the following emerged as key takeaways:

- The potential of RNG to transform the CNG field through the recapturing of methane is significant, especially because it creates a circular economy. The average lifetime of a heavy-duty truck is about 13-14 years. If these trucks, which typically run on diesel, convert to RNG and CNG, there is a significant opportunity to drastically reduce emissions typically associated with heavy-duty vehicles. Applications of this fuel type are ready now.
- Hydrogen can be applied to infrastructure for buildings such as airport facilities. Pricing tends to be lower for hydrogen used in building applications. It is a portable fuel and can be delivered through pipelines. Additionally, power companies that use hydrogen may be able to store unused energy during off-peak hours and distribute it to peak-demand times of day.
- Renewable propane is an alternative fuel that is also available. Most renewable propane markets are in California and Oregon. Renewable propane applications depend on feedstock availability. Research is also being conducted on cellulosic-based fuel applications for propane.
- Hydrogen fuel cell vehicle refueling stations require a significant amount of water and space, which is one challenge for the market. A ten-acre hydrogen station for Nikola would require about 100-acres devoted to solar panels for the fuel to run on renewable energy. In terms of the water impact, Nikola is planning to use gray water for a portion of its water consumption and filter using onsite water purification facilities.

Filling the Gap: Technology and Infrastructure to Build Out Corridors

Alternative fuel infrastructure providers discussed the unique opportunities and challenges for filling the alternative fuel infrastructure gaps along corridors.

Alaric J. Babej, Project Manager, Product Development, Public Service Company of New Mexico

[See presentation for more information.](#)

- The Public Service Company of New Mexico (PNM) is the largest utility in New Mexico. It serves about 540,000 residential, commercial, and industrial customers.
- There are two important legislative measures that have influenced PNM’s own energy conservation and clean energy policies.
 - The “Energy Transition Act” was passed in 2019 and states that the electricity sector in New Mexico needs to be free of emissions by 2045. All utilities across the state have made commitments to this. PNM has a target to be carbon free by 2040.
 - House Bill 521 requires investor utilities to promote transport electrification. PNM has a program that provides DCFC infrastructure installation rebates and sets rates for EVs based on volume consumed only.
- Alaric Babej (Figure 13) views the role of the utility as aiding in the removal of barriers to EV adoption, designing rates that encourage EV use, providing incentive programs, and educating customers on the benefits of EVs.
- Branding and marketing of electrification can make significant inroads in educating consumers. The West Coast Electric Highway serves as an example for other states.
- Some barriers from PNM’s perspective include the high upfront cost associated with EVs, demand charges, interoperability, lack of availability of rebates at the point of sale, low utilization, and an uncertain return on investment. Some opportunities to overcome these barriers include utility incentives, setting volumetric rates, increased corridor signage, redefining rest stops to support businesses, and coordination with local tourism boards.



Figure 13. Alaric Babej shares his perspective on filling the gap in the state of New Mexico.

John Schott, Senior Grant Operations Manager, ChargePoint

[See presentation for more information.](#)

- ChargePoint operates the world's largest network of EV charging stations in North America, Europe, and Australia. It was founded in 2007 and has more than 800 employees around the world.
- ChargePoint has over 103,000 charging station locations with over 1,600 DCFC locations. The company is adding roughly 2,000 charging ports to its network each month. ChargePoint provides ongoing service

support and repairs stations. It also provides turnkey services such as site acquisition, site assessment, and project management. The company also sometimes serves as an EVSE provider.

- Grants such as the Volkswagen Settlement fund (over \$30 million available now) serve as an important opportunity for the market. Because there are different mechanisms to deploy alternative fuel corridors, the market is more competitive. Another opportunity is the potential for partnerships with visitor centers, tourism agencies, municipalities, and tourism offices who all agree on the value of providing public EV charging solutions.
- Some challenges for the market include coordinating on infrastructure gaps, limited options for site host selection, a long return on investment, and coordinating with utilities on demand charges and connection costs (i.e., a connection fee, a transformer, and conduit and trenching).

Alan Mace, Market Manager, Heavy Duty Applications, Ballard Power Systems

[See presentation for more information.](#)

- Ballard Power Systems builds fuel cell technology such as fuel cell engines for medium and heavy-duty vehicles including fuel cell electric buses. Ballard sells clean energy power products with the goal of reducing customer costs and risks. Ballard also provides technological support to partners who are already investing in fuel cell programs. Ballard is not an infrastructure provider nor a power distributor; its role is implementing hydrogen solutions for partners.
- Fuel cell technology provides electric power through the conversion of energy, similar to the way an engine works. The transport sector is responsible for 22% of global energy related GHG emissions. Given this, Ballard is excited to be a company contributing to zero-emission transportation solutions. Fuel cell energy can also be powered by renewable energy.
- Most hydrogen fuel cell technology uses batteries for storage. Fuel cell batteries are lighter weight and carry a higher payload than EV batteries typically do.
- Hydrogen is a compact, scalable fuel. The larger a fleet is that runs on hydrogen fuel cell power, the lower the cost of the fuel overall.
- Hydrogen is transportable and can provide operational flexibility. It can be a useful option for centralized on-site fueling of large heavy-duty fleets. It can also be supplied as a compressed gas or liquid.

Chelsea Jenkins, Executive Director of Government Affairs, ROUSH Clean Tech

[See presentation for more information.](#)

- ROUSH Clean Tech's primary specializations include engineering, testing, prototype development, manufacturing, and motorsports management. ROUSH Clean Tech works on advanced clean energy solutions for propane, gasoline, CNG, hydrogen, and electricity, and develops products for medium-duty vehicles in the commercial truck, school bus, and transit markets. The company also develops capabilities for connected vehicles, fleet management software, and autonomous vehicles.
- ROUSH Clean Tech is not an infrastructure provider. Ms. Jenkins sees opportunities in the autogas sector because of the low cost of infrastructure and refueling. Autogas is a scalable fuel without need of a minimum load. It can be used by almost every class 4 through 7 vehicle application.

- Renewable propane is an autogas solution that can be less GHG and carbon intensive -- near zero emissions. It can be used in the same vehicles as classic propane vehicles.
- Autogas adoption is much more fleet-based than consumer-based. It is best suited for medium-duty, heavy-duty, and off-road applications, with key growth opportunities in medium-duty applications.
- The autogas market is decentralized and reflects a highly competitive nature of supply, which differs greatly from the natural gas and electricity markets. More cross-sector collaboration and a multi-stakeholder approach would be helpful for the autogas industry.
- One of ROUSH Clean Tech's successful projects that can serve as a model was the Southeast Propane Autogas Development Program (SPADP). This program involved converting almost 1,200 public and private fleet vehicles from gasoline to propane autogas across ten southeastern states. SPADP installed more than 30 refueling stations in the mid-Atlantic and Southeast regions and displaces about 1.2 million gallons of gasoline annually. This amounts to about 6,000 tons of carbon dioxide eliminated. This project also created dozens of jobs.

During the discussion that followed, the following emerged as key takeaways:

- Taking a comprehensive approach to drive the market for alternative fuels will help these fuels be more successful. Collaborating with more partners can enhance marketing and branding. Looking to industries other than transportation for energy storage, transport, and decarbonization solutions can enhance the alternative fuel market and even provide resilience during natural disasters.
- Fleet adoption of AFVs can be an effective way to increase larger scale alternative fuel awareness, market penetration, and utilization. Fleet fuel conversion will assist in bringing the cost per unit of hydrogen and other alternative fuels down because of the higher volume that is being demanded.
- Electricity rates are stable compared to other fuel types and enable consumers and EV users to plan costs in advance. An effective strategy for increasing use of electric corridors and promoting economic development is to plan EV charging station locations along scenic routes where drivers are already stopping and getting out of their cars.
- Consistent and clear state and federal policies will help push alternative fuel adoption, especially if these policies are over several years. For example, when a state like Colorado has a Zero-Emission Vehicle (ZEV) mandate, the certainty that AFVs will be on the road will spur infrastructure development and support the growth of alternative fuel markets. Market confidence in alternative fuels will ensure that OEMs continue to invest in and manufacture more AFVs.

Designing Partnerships for Corridor Development: Establishing Stakeholder Roles and Responsibilities for Effective Collaboration

Attendees split up into breakout groups based on their organization's role in building out the network of alternative fuel corridors in the Intermountain Western. Each group discussed the key elements necessary to foster effective collaboration among stakeholders. Attendees came back together to refine stakeholder responsibilities and identify next steps for stronger regional partnerships.

The three breakout groups were based on stakeholder groups related to: transportation planning, market development and outreach, and public/private partnerships. Each function group answered the following three questions:

1. What is your role in corridor planning and development?
2. What support/resources do you need for corridor development?
3. What are three to five critical steps for partner coordination and planning?

Attendees then presented discussion results (Figure 14). Roles, resources, and critical steps for each function group stakeholder are listed below and summarized in a separate matrix attachment.

What is your role in corridor planning and development?

Transportation Planning (Group Discussion Led by Diane Turchetta, Dylan Tucker, Geoff Morrison & Johanna Levene)²

DOT

- Administer alternative fuel corridor funding opportunities such as for Congestion Mitigation and Air Quality (CMAQ), signage, and other air quality or sustainable transportation efforts
- Install signage along alternative fuel corridors
- Collect and present data on a variety of transportation topics related to traffic patterns, travel modes, highway performance monitoring system, freight travel, and passenger travel

MPO/COG

- Prioritize resources and funding for alternative fuel corridor projects
- Responsible for infrastructure gaps along corridors between urban areas
- Implement CMAQ grants
- Work with other state and regional partners to submit nominations for alternative fuel corridors

FHWA

- Provide guidance and advice on issues such as right-of-way
- Work with other agencies and stakeholders involved in implementing alternative fuel corridors
- Collect best practices from states around the country and share findings through informational material and educational forums



Figure 14. An attendee reports back following the break-out sessions.

Market Development (Group Discussion Led by Mike Scarpino, Stephen Costa, and Alycia Gilde)

² MPOs and COGs were included in the transportation planning function group but did not end up being discussed as they were not represented in the breakout group.

Technology/Fuel Provider

- Serve as an enabler and a project manager
- Generate and export alternative fuels
- Transport alternative fuels
- Provide alternative fuel applications
- Continue to advance technological development
- Educate and share information on the functionality of alternative fuels and technology
- Provide:
 - Power rates
 - Training
 - Technological assessments such as those related to implementation
 - Financial assessments
 - Market reliability with certain fuels (i.e., RNG)

Utility

- Provide incentives and investment through mechanisms such as rate-basing
- Conduct evaluations on alternative fuel technology
- Serve as a project manager for alternative fuel corridor projects
- Develop creative rate strategies such as charging by the volumetric amount consumed
- Conduct analysis on capacity planning such as electricity distribution, the lining process, and build out
- Serve as a resource to support alternative fuel corridor policies
- Build out renewable energy options to support the electric grid
- Develop more partnerships

End-User

- Provide capital expenditure to support alternative fuel corridor projects
- Make a commitment to utilize alternative fuels
- Prove investments are cost effective through purchases
- Help to validate alternative fuel corridor technology
- Voice and provide feedback through market trends
- Support the business case for alternative fuel technology
- Provide location for alternative fuel corridor sites
- Provide third-party end users

Outreach and Public/Private Partnerships (Group Discussion Led by Oana Leahu-Aluas, Cassie Powers, and Matt Rahill)

Clean Cities Coalitions/Associations/Non-Profits (presented by a discussion leader in Figure 15)

- Maintaining relationships with the right stakeholders
- Clean Cities have a role to coordinate and educate the public. They are perceived as neutral and credible and can lobby on behalf of local interests. Clean Cities Coalitions are also less constrained than other stakeholders.
- Finding optimal meeting locations and holding convenings with all appropriate partners
- Function in a “boots on the ground” role to facilitate and implement alternative fuel corridors
- Disseminate information from stakeholders and other respected authorities such as state agencies

Energy/Environmental Office

- Set regulations to govern public practices; create change through regulatory power
- Manage funding opportunities and distribute funding through grants and other mechanisms
- Work regionally and statewide with other agencies such as DOTs
- Establish performance standards for successful alternative fuel implementation
- Use the most recent research and technology to make informed decisions



Figure 15. Oana Leahu-Aluas presents outcomes from her group in the break-out session.

Policy Makers

- Provide oversight
- Allocate resources effectively
- Work in a bipartisan manner to set goals and mandates
- Consider many factors including the environment, the economy, and any externalities resulting from policy

What support/resources do you need for corridor development?

Transportation Planning

DOT

- Updated website with useful information for the public with resources such as case studies, reports, and maps
- Flexibility to discuss criteria
- Legislative support on issues such as right-of-way, alternative fuel corridor funding, etc.

FHWA

- Updated gas tax standards

- Legislative action such as a gas tax
- Support at the executive and leadership levels

Market Development

Technology/Fuel Provider

- Understanding which tariffs are in place
- Support from utilities and alternative fuel suppliers
- Receive clear expectations and timelines from agencies and market participants
- Electricity and hydrogen fuel cell rates
- Balanced policy
- Fuel neutrality in goals
- Guidance from other stakeholders that can better inform solutions
- Facilitation to build out corridors through leading a strategic location approach and identifying the “multiplier effect”
- The costs of alternative fuels must be viable
- There must be reasonable and consistent code, and the code must be enforced consistently
- Evaluate ways to leverage existing infrastructure vs. building out new infrastructure

Utility

- Availability of good training and educational programs for customers will help raise awareness
- Coordination between utilities can be effective, especially for branding and marketing
- Guaranteed market and demand for energy
- Need a highly engaged energy office partner at the state level
- Understanding of customer demands and utilization patterns
- Workforce development trainings and maintenance programs

End-User

- Need to address the business case, particularly addressing the price gap between capital expenditures and operating expenses
- Adjustment in incentives to meet end-user needs
- More outreach opportunities
- Enabling policies to support AFV and technological advancement which can contribute to AFV adoption
- Financial and other incentives
- Need to be included “in the room” when decisions are made so that they can provide better guidance and contribute in working group settings

Outreach and Public/Private Partnerships

Clean Cities Coalitions/Associations/Non-Profits

- Clean Cities need to stay fuel neutral despite the challenges of different regions having varying fuels of choice
- Financial incentives, funding packages, and more financial investments would be helpful for carrying out organizational mission
- More opportunities to collaborate with important stakeholders
- More trainings for local stakeholders
- Access to data from research agencies and organizations such as the national laboratories

Energy/Environmental Office

- Increased funding for staff overall and those specifically involved in program operations and human resources departments
- Delegated authority to create and administer programs that promote alternative fuels
- Clear priorities from agency leadership
- Training opportunities and more access to technical resources, knowledge, and academic material

Policy Makers

- Support for alternative fuel initiatives from constituents (i.e., more civic participation, more lobbying on behalf of these fuels)
- More opportunities to learn practical information related to alternative fuels and become educated on their importance
- Access to fuel-neutral case studies, research, white papers and reports, and “real-world” applications of alternative fuels
- Access to knowledge about what policies other states are working on and knowing what regulations and legislation is most applicable to one’s own state

What are three to five critical steps for partner coordination and planning?

Transportation Planning

DOT

- Publish more data on website and distribute information to the public on topics such as:
 - Electricity sources for each state
 - Land available for site locations
 - Technologies available such as opportunities to power charging stations with solar in areas with electricity gaps
 - Where demand and drivers are highest and lowest
 - Travel patterns to identify where infrastructure is needed
 - Which drivers charge at DCFCs vs at other types of charging stations
- Work with utilities to determine actual costs of siting

- Make the business case for siting at gas stations and truck stops
- Educate the public on alternative fuel corridors and various alternative fuel technologies available. Discuss these issues more publicly, such as at large statewide events
- Work with dealerships to offer more AFVs and ensure they are well-educated on these vehicle types

FHWA

- Develop better marketing solutions to publicize knowledge about corridors that have already been designated

Market Development

Technology/Fuel Provider

- Use tools that have already been created to identify infrastructure gaps
- Include more partners (i.e., prospective fleets) during the infrastructure build-out phase to support needs
- Develop and vet applications for users

Utility

- Dedicate resources to design and engineer alternative fuel corridor planning programs
- Design cost-effective rate programs
- Develop funding and capacity-building plans
- Identify site locations and achieve necessary permitting
- Advocate for EVs through incentive policies and programs

End-User

- Willingness to try new technologies and demonstrate them to create future demand
- Aggregate demand and utilize alternative fuel technologies
- Develop:
 - Best practices
 - A team to support alternative fuel corridor implementation
- Identify:
 - Public and private partners
 - Opportunities to share AFV access
 - Models available to support AFV and alternative fuel technology and infrastructure deployment

Outreach and Public/Private Partnerships

Clean Cities Coalitions/Associations/Non-Profits

- Develop letters of support to deliver to DOTs who are responsible for nominating corridors
- Hold meetings with local stakeholders
- Educate the public on alternative fuel corridor planning tools such as those available on the AFDC

- Work with stakeholder partners to identify and fill infrastructure gaps along corridors and identify optimal locations for fueling stations

Energy/Environmental Office

- Become more educated on available alternative fuel corridor planning tools
- Continue to strengthen regional coordination and improve public and private partnerships with organizations like REV West
- Tighten planning with DOTs and planning administrations in each state
- Work with state general services administrations to purchase more AFVs and alternative fuel infrastructure. Incorporate AFVs into state contract requirements.

Policy Makers

- Lead by example. Issue more executive orders related to alternative fuel corridor and AFV deployment with specific requirements (i.e., designate a certain percentage of fleet operations to run on a specific type of fuel)
- Use shared language in messaging and communications to the public
- Set aside more public funding for alternative fuel corridor development and provide incentives for public and private projects designated for alternative fuel development and deployment
- Organize roundtables with bipartisan groups such as bipartisan legislative caucuses to tackle these issues

Our Path Forward: Sustaining Partnerships for Corridor Growth

Partners summarize convening outcomes, evaluate opportunities to improve regional coordination, commit to partnership, and put forth actions to expand alternative fuel corridors and the marketplace for advanced vehicle technologies in the Intermountain Western U.S. During this session, FHWA seeks feedback on how it can help states meet their corridor goals.

During this session, participants were asked for the key action items that resulted from the convening, both for themselves and their organizations (Figure 16 and Figure 17). Participants were also asked to suggest ways FHWA and Clean Cities could continue supporting corridor efforts. The responses included the following:

- Build on the new relationships formed at the convening and continue working with these partners on future initiatives.
- Work with FHWA, NREL, and Volpe colleagues to take a close look at Round 4 nominations alongside regional maps and



Figure 16. An attendee shares her next steps for promoting corridor growth in her state.

understand the corridor landscape in more depth. Identify which areas are more vacant and rural with very few services.

- Work with the DOE and NASEO to develop new programs to better assist local efforts. Conduct case studies and work with Clean Cities Coalitions to gather more public data.
- Offer more opportunities to hear public input.
- Collaborate more closely with other actors in the state such as the Department of Natural Resources, Clean Cities Coalitions, and DOT.
- Work with the state DOT to make sure there are Round 4 nominations for Idaho.
- Work with neighboring states such as Montana, Idaho, and Wyoming to submit Round 4 nominations. Get more mapping data.
- Work with the DOT to identify any infrastructure gaps and prioritize certain corridors for designation. Use data to identify priority areas to use Volkswagen funding for.
- Explore and apply some of the tools discussed in the Tools session such as the AFDC website.
- Develop an interstate calendar to unify efforts. Leverage Clean Cities relationships.
- Capitalize on this convening's outcomes and work with a more regional focus in mind.
- Help achieve Corridor-Pending status for more interstate routes through partnerships.
- Find more opportunities to receive funding support.
- Work more closely with federal agencies to promote alternative fuel corridor efforts.
- Get a designated propane corridor in Nevada.
- Be more of an active participant in engaging stakeholders and assisting in corridor efforts. Ensure deadlines are met. Work with the Department of Energy and USDOT to leverage some new corridor development tools.
- Strengthen support for utility investment to develop regional corridors.
- Continue collaborating with MPOs and Council of Governments (COGs) in Colorado.
- Continue working with REV West, state agencies, and utilities on the Core West EV project.
- Educate more stakeholders on the benefits and feasibility of alternative fuels.
- Continue to balance environmental goals and transportation goals. Determine how best to use funding to move the region forward and participate in alternative fuel advocacy.
- Use the tools that have been developed to identify corridors that are designated as Pending. Direct resources in each state to target the gaps that have been identified and fill those gaps.
- Increase regional collaboration.



Figure 17. Attendees report out on key action items they will take following the Convening.

- Coordinate with partners who might be willing to make strategic investments and align strategy and interests. Engage oil and gas actors in alternative fuel infrastructure site development.
- Conduct more public education and outreach initiatives.
- Realize that the role of the DOT is more than simply paving roadways; take the concept of EVs and AFVs back to state DOT office.
- Promote more RNG initiatives and work to engage more utilities in Colorado to get involved in these efforts.
- Increase public awareness for newer alternative fuel technologies.
- Develop a plan to designate I-10 in Arizona to transition it from Pending to Ready for CNG and EV.
- File more transportation electrification plans and collaborate with more state agencies and other stakeholders in attendance at the convening.
- Monitor corridor initiatives and support state agencies.
- Complete an NPS study with Volpe to identify infrastructure gaps on corridors leading to the national parks and communicate these gaps to the regions and the associated parks.
- Make sure that alternative fuel corridor planning tools are linked to local and state agency websites.
- Identify any missing stations on the AFDC, seek more feedback from the public, and assist regional partners who need more data.

Summary of Convening Evaluations

An online survey was distributed to attendees on November 12, 2019. The survey was intended to assess the effectiveness of the convening, as well as inform the development of future material for alternative fuel corridor engagement. A total of 22 attendees responded to the survey. Their answers are summarized below.

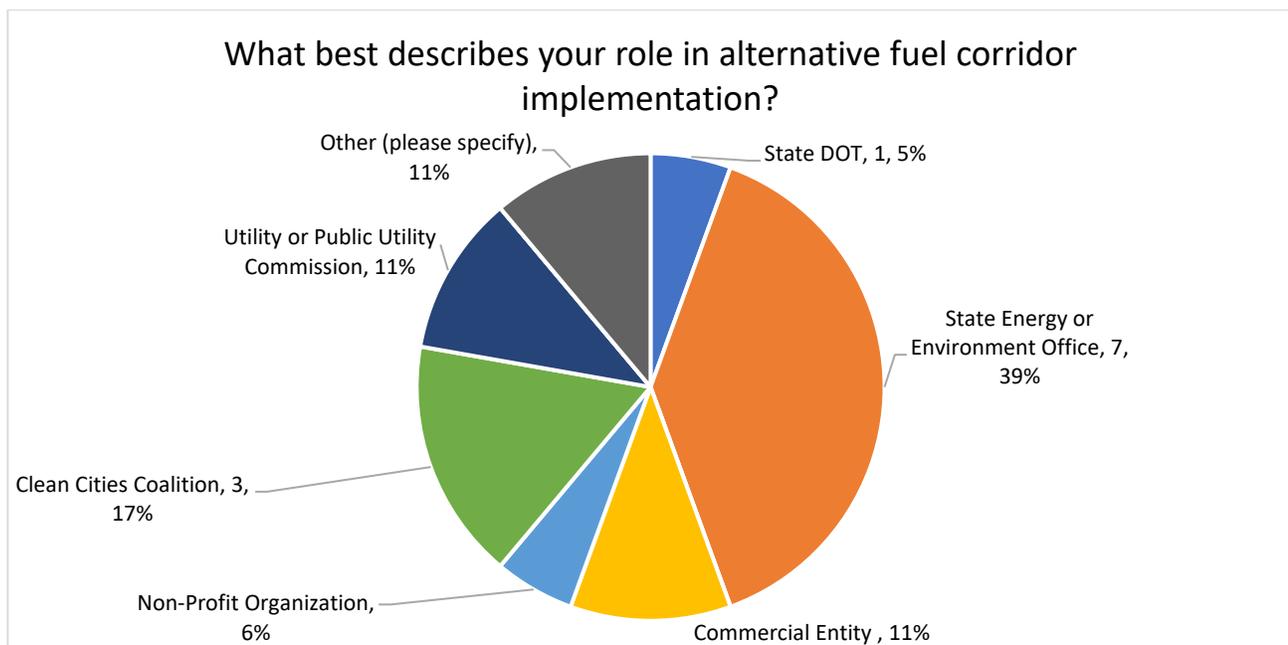


Figure 18. Breakdown of survey respondents by role in alternative fuel corridor implementation.

Out of those that responded to the survey, most were state energy or environmental office representatives. "Other" responses included "Public Transportation" and "EV Infrastructure Consultant."

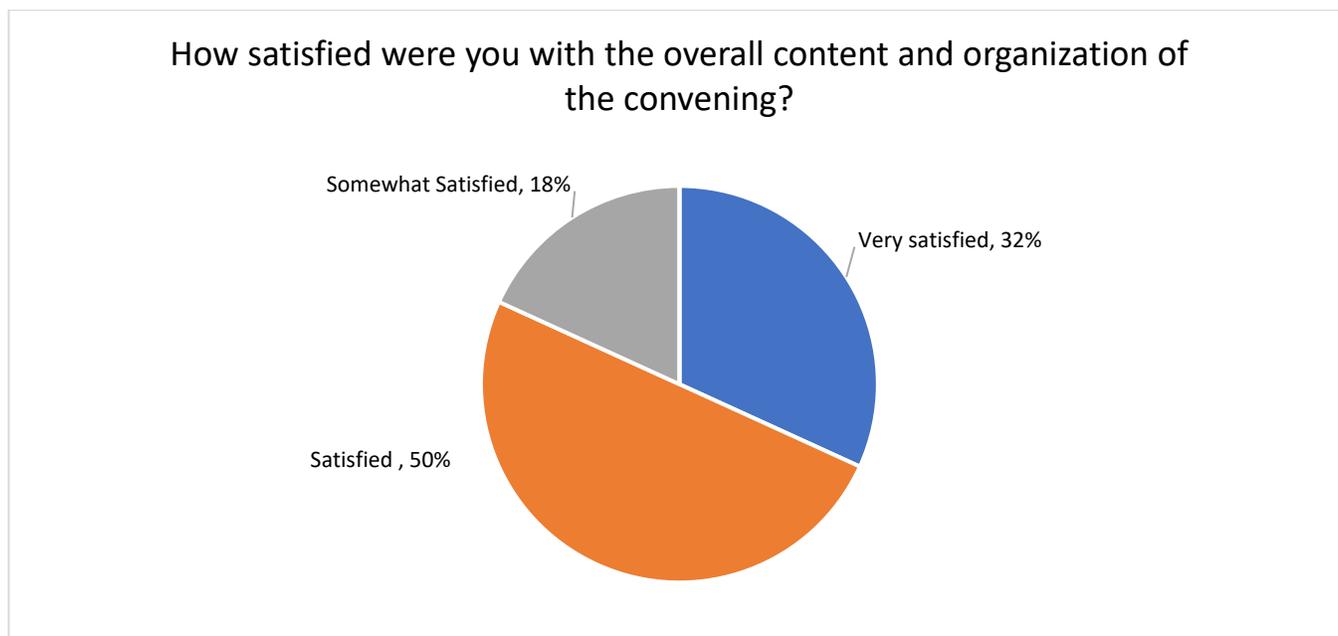


Figure 19. Pie chart showing respondents' satisfaction with the overall content and organization of the convening.

Most respondents (82%) were either satisfied or very satisfied with the overall content and organization of the convening. 18% responded that they were "somewhat satisfied" and none responded that they were "not satisfied."

What were the most valuable aspects of the convening for you?

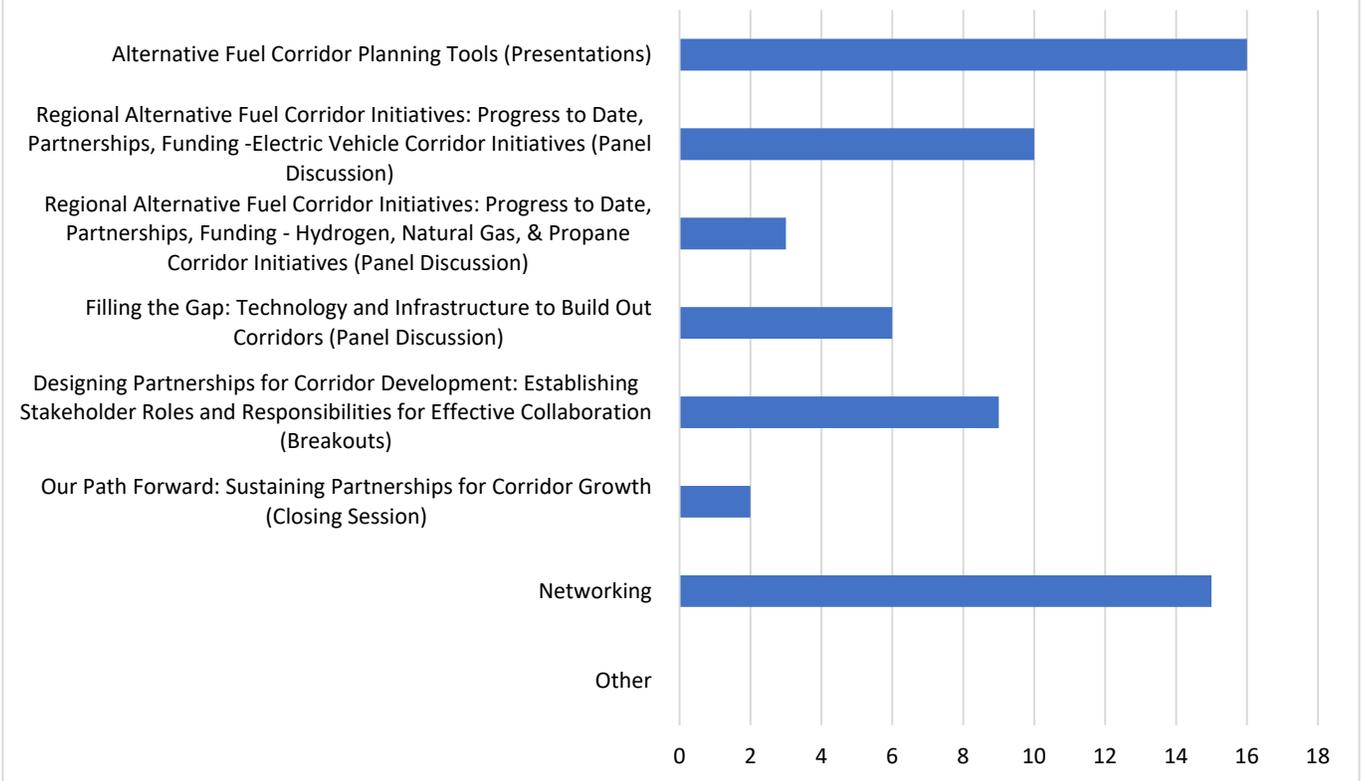


Figure 20. Bar graph showing the most valuable aspects of the convening, according to attendees (each respondent received multiple votes).

Survey respondents noted that the Alternative Fuel Corridor Planning Tools panel was the most valuable portion of the convening. The next most popular portions of the day included the networking opportunities, the Regional Alternative Fuel Corridor Initiatives: Progress to Date, Partnerships, Funding - Electric Vehicle Corridor Initiatives (Panel Discussion), and the Designing Partnerships for Corridor Development: Establishing Stakeholder Roles and Responsibilities for Effective Collaboration (Breakouts). No respondents selected “Other.” Respondents could select more than one answer to this question.

As a result of the convening, do you feel you developed a solid understanding of the alternative fuel policy and infrastructure landscape in the Intermountain Western region?

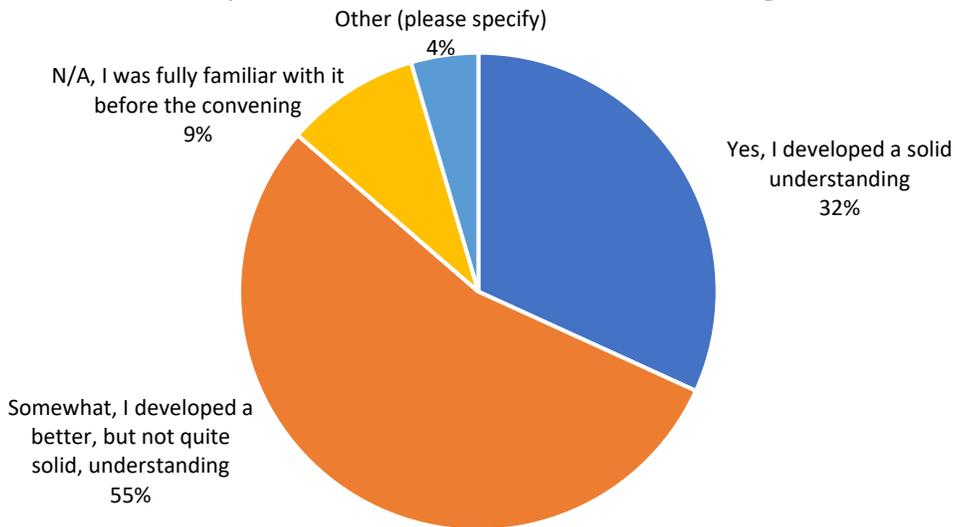


Figure 21. Pie chart of respondents' understanding of the alternative fuel policy and infrastructure landscape in the Intermountain Western region, as a result of the convening.

32% of respondents felt they developed a solid understanding of the alternative fuel policy and infrastructure landscape in the Intermountain Western region, as a result of the convening. More than half of the respondents (55%) noted that they developed a better, but not quite solid understanding. No respondents selected "No, I do not feel familiar with the policy and infrastructure landscape," and two people responded "N/A, I was fully familiar with it before the convening." One respondent selected "Other" and noted that they were "Already very familiar on tech, progress etc. Filled gaps on policy."

Did the convening help you establish, maintain, or strengthen partnerships for promoting and enhancing alternative fuel corridors in the Intermountain Western region?

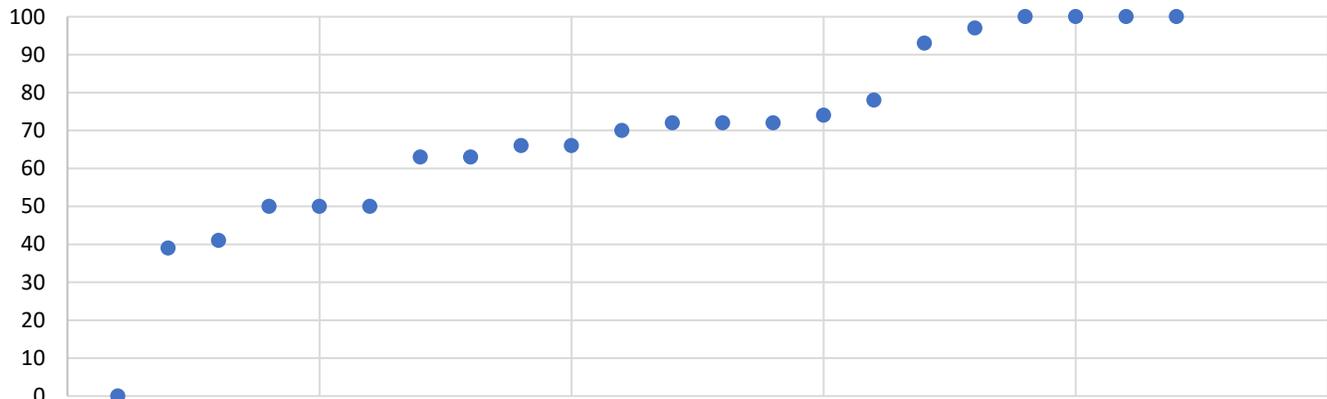


Figure 22. Scatter plot showing the degree to which the convening helped establish, maintain, or strengthen partnerships, rated from 0 to 100.

This question presented respondents with a slider that they could shift along a numbered spectrum, with 100 indicating a response of “very much so,” 50 indicating a response of “somewhat,” and zero indicating a response of “not so much.” Four respondents provided a response of 100. The average rating among all 22 respondents was 71.

What additional steps could FHWA take to help you improve alternative fuel corridors in the Intermountain Western region?

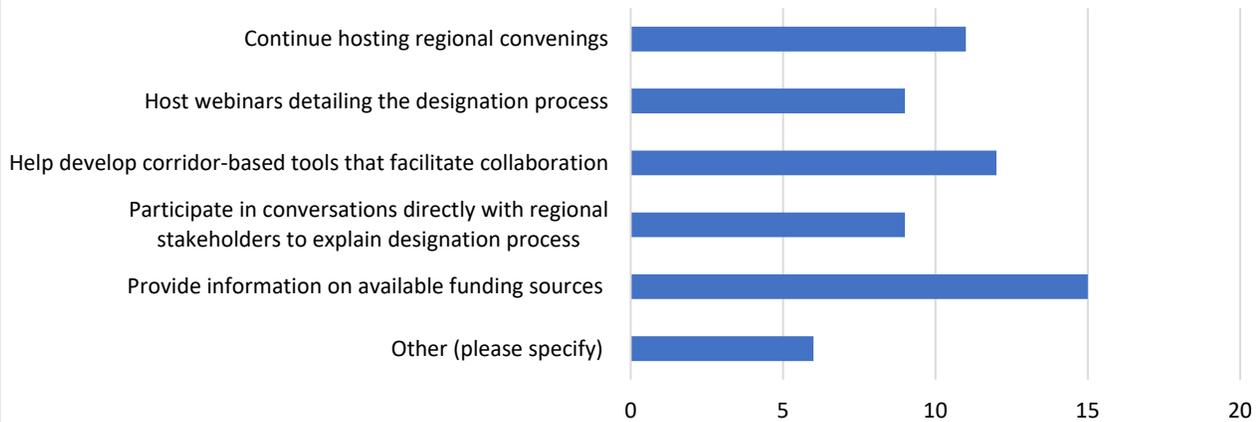


Figure 23. Bar graph showing FHWA steps to improve alternative fuel corridors in the Intermountain Western region (each respondent received multiple votes).

Survey respondents most commonly selected “Provide information on available funding sources” as an additional step that the FHWA could take to help improve alternative fuel corridors in the Intermountain Western region. Six respondents selected “Other,” and elaborated by writing:

- "Help develop state events that educate the public on corridor efforts"
- "Consider designation guideline exceptions for the challenging geography of the west and evolving EV characteristics."
- “Look at and address current barriers that affect states in the west in establishing Alt Fuel Corridors, e.g. 50 mi max and charging for charge at federal funded rest areas.”
- “Push for a more fuel-neutral approach. It seemed like an EV roadshow. I understand where much of the funding is coming from, however, there is still a ton of electricity being generated from Coal.”
- “Get states to work closer together on a regular basis.”
- "Help develop corridor strategies accounting for harsh geography and low population in the region.”

The last three questions in the survey were open-ended. The first of these asked “What was your key takeaway or action item from the discussion at the end of the day during the "Our Path Forward" session?” Several respondents (7) referenced continuing regional engagement and partnership as their biggest takeaway. Some responses are captured below:

- Some states are ahead and some are behind when it comes to developing corridors. However the corridors that are developed are robust and follow a good set of guidelines
- There is a gap between the plans and desires of govt/NGO stakeholders and the practical aspects of implementation.
- Collaboration and communication is key in being successful.
- There are still limited options for the western states to participate in this program
- We need to work on getting NG corridors designated
- Continue to network, converse, call officials and engage.
- I really like the development of the planning tools.
- Collaborating to designate corridors as corridor pending is an important first step.
- continue to support/advocate for REV West
- Update agency website information
- There’s a lot going on and it will take action for government, utility, private sector, and other stakeholders to get things done.
- States need to designate corridors.
- There's still a lot of work to do and coordination needed. We need more direct involvement
- FHWA team rocks; wish they would get funding.
- I would like to encourage a similar planning and convening process within the State of Colorado so that the regions of the state can take initiative to plan and develop their own locally-focused corridors.
- Work with Clean Cities and DOT to submit a nomination for New Mexico (3 possible corridors, at least one is corridor ready)

- The need to sharing "market ready" technologies and strategies
- Work to nominate corridors by Feb 2020 deadline
- follow up with partners I met with & review tools
- help facilitate a meeting in Wyoming and Montana
- There is a need for continued education on the benefits of H2 and fuel cells in HD applications.

The second open-ended question asked, "The convening planning team will host webinars as a follow up to the convenings. Please provide any webinar suggestions, such as helpful topics to cover or ways to use the webinars to further strengthen regional coordination on corridors." Respondents replied with the following:

- Webtools, how to host events in each state to educate the public.
- How to create rural alt fuel corridors that would work in the western US.
- A webinar on how to effectively use planning tools and to keep updated as they evolve.
- Webinar topics on what to do about designating corridors on rural interstates and in locations with limited access to power. Also, federal funding opportunities and announcements for corridors, infrastructure or related to alternative fuels, particularly electrification.
- Webinars that offer demonstrations of the tools that were discussed would be helpful as a reminder of how to use the tools.
- I think the more you could bring utilities and national utility associations into these discussions the better. We had a few at the event but the better understanding they have of these issues the easier it will be to work with them in the future.
- I would love to have access to past nominations to be able to review content
- What to look for in an EVSE site and the costs involved Long term O & M Data collection from EVSE
- Different models for financing stations, particularly low-use, rural stations.
- Any sort of case studies that explains how a corridor designation has led to anything positive, new or increased business to locations close to fueling infrastructure or access to funding.

The final comment box allowed respondents to provide additional open-ended feedback or suggestions for future convenings. Respondents replied with the following comments:

- The program overall was very good. For me the weak spot was the breakout. I was in the utility / provider group, which ended up being an odd assortment of electrical utility people and a couple of EV-focused people like me, and a bunch of NG/propane vehicle and infrastructure vendors. I support the multiple solutions concept, but the challenges are different in many respects and this grouping prevented really digging deeply into the specific actions necessary
- How this program is currently designed limits its use in the Western US. Maybe look out how to retool the program to include allowances and variances for states that cannot conform to the current program. Not all states are alike and many have challenges that others don't. Making a more flexible program will allow all states to participate, not just those that fit the framework of the current program
- The regional meeting was great to keep stakeholders connected. Sometimes webinars and reports become to impersonal overtime

- The Intermountain West has some very specific challenges that we continue to face when attempting to establish completed corridors. I feel like it would be really helpful to us if FHWA continues to invite representatives from this region to the table as they plan future policies and rules around corridor planning.
- Thanks for a great event!
- Thank you for a very productive day.
- Great job! Happy to have attended.
- Thank-you very much for offering this convening, it was so helpful to have this workshop that brought everyone in the room. The professional level of the pre-convening coordination really added to the legitimacy of the program. As I have tried to work with MT DOT for a long time, I think this really helped show the value of the program considering an entire room of people took the time and effort to travel to Salt Lake to meet for a full day. Thank-you!

Appendix I: Convening Agenda

- 8:00 AM** **Registration and Networking**
Sign in, introduce yourself to new partners, and participate in a short interactive poll.
- 8:30 AM** **Opening Remarks**
Carlos Braceras, Executive Director, Utah Department of Transportation, and Former President, American Association of State Highway Transportation Officials (AASHTO)
- 8:40 AM** **Host Welcome and Alternative Fuel Corridors Overview**
James Campbell, Legislative Policy Adviser, PacifiCorp
Cassie Powers, Managing Director, Programs, National Association of State Energy Officials (NASEO)
Diane Turchetta, Transportation Specialist, U.S. Federal Highway Administration

PacifiCorp, NASEO, and the Federal Highway Administration's (FHWA's) lead on alternative fuel corridors provide welcome and introductory remarks on the importance of regional coordination and partnerships to support the development of alternative fuel corridors and a sustainable transportation network.
- 9:10 AM** **Partnership Goals and Objectives**
Oana Leahu-Aluas, Associate, Cadmus
Alycia Gilde, Director, Fuels and Infrastructure, CALSTART

Get ready to "roll up your sleeves" for day-long, results-driven discussions as meeting hosts present convening objectives to enhance multi-state collaboration, evaluate key barriers, and find solutions to advance alternative fuel corridors in the Intermountain Western U.S.
- 9:20 AM** **Around the Room Partner Introductions**
Each attendee briefly introduces themselves by providing name and organization.
- 9:45 AM** **Alternative Fuel Corridor Planning Tools**
Mike Scarpino, Transportation Project Engineer, U.S. Department of Transportation Volpe Center
Johanna Levene, Manager, Transportation Data and Tools, National Renewable Energy Laboratory
Matt Rahill, Alternative Fuels Data Center Lead, National Renewable Energy Laboratory
Tim Ularich, Implementation Engineer, Utah Department of Transportation

Learn about the National Renewable Energy Laboratory tools and those used by REV West which are available to support states in planning for and mapping alternative fueling infrastructure. Gain insight into the capabilities of FHWA's HEPGIS mapping website.
- 10:35 AM** **Regional Alternative Fuel Corridor Initiatives: Progress to Date, Partnerships, Funding**
Electric Vehicle Corridor Initiatives
Tammie Bostick, Executive Director, Utah Clean Cities
Mark Brady, Program Manager, Nevada Governor's Office of Energy
Vincent Veilleux, Manager, Distributed Energy Resources, NV Energy
Mike King, Assistant Director of Electrification & Energy, Colorado Department of Transportation

Hydrogen, Natural Gas, & Propane Corridor Initiatives

Dale Prows, Head of Hydrogen Supply Chain, Nikola Motor

Reed Page, Operations Manager, Fleet Saver, LLC

Larry Osgood, President, Consulting Solutions

Partners throughout the region present on innovative programs currently advancing alternative fuel corridors in the Intermountain Western U.S. Hear first-hand about the partners, technologies, and funding that are making it possible.

12:15 PM **Lunch**

1:15 PM **Filling the Gap: Technology and Infrastructure to Build Out Corridors**

Alaric J. Babej, Project Manager, Product Development, Public Service Company of New Mexico

John Schott, Senior Grant Operations Manager, ChargePoint

Alan Mace, Market Manager, Heavy Duty Applications, Ballard Power Systems

Chelsea Jenkins, Executive Director of Government Affairs, Roush Cleantech LLC

Alternative fuel infrastructure providers discuss the unique opportunities and challenges for filling the alternative fuel infrastructure gaps along corridors.

2:10 PM **Break**

2:25 PM **Designing Partnerships for Corridor Development: Establishing Stakeholder Roles and Responsibilities for Effective Collaboration**

Attendees will split up into breakout groups based on their organization's role in building out the network of alternative fuel corridors in the Intermountain Western U.S. Each group will discuss the key elements necessary to foster effective collaboration among stakeholders. Attendees will then come back together to refine stakeholder responsibilities and identify next steps for stronger regional partnerships.

4:10 PM **Break**

4:20 PM **Our Path Forward: Sustaining Partnerships for Corridor Growth**

Partners summarize convening outcomes, evaluate opportunities to improve regional coordination, commit to partnership, and put forth actions to expand alternative fuel corridors and the marketplace for advanced vehicle technologies in the Intermountain Western U.S. During this session, FHWA seeks feedback on how it can help states meet their corridor goals.

5:00 PM **Adjourn**

5:15 PM **Optional: Q&A with FHWA**

Appendix II: Convening Participant List

| State | Contact Name | Title | Organization | Contact Email |
|-------|--------------------|--|--|--|
| AZ | Ed Stillings | Senior Transportation Planner | Arizona FHWA Division Office | Ed.Stillings@dot.gov |
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| UT | Mark Watkins | Vice President, Operations | Power Innovations | mwatkins@power-innovations.com |
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