

# Federal Highway Administration Development and Implementation of Regional Alternative Fuel Corridor Convenings

## Alternative Fuel Corridor Convenings Final Summary Report



Credit: CALSTART.



U.S. Department  
of Transportation  
**Federal Highway  
Administration**

**ALTERNATIVE  
FUELS  
CORRIDOR**

## Acknowledgements

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Figure 1. Research team for the convenings. Credit: CALSTART.

## Contents

Acknowledgements.....	i
Alternative Fuel Corridor Program Background .....	1
Executive Summary.....	3
Regional Initiatives.....	5
Challenges .....	5
Solutions.....	5
Building Awareness & Leveraging Partnerships.....	8
Challenges .....	8
Solutions.....	8
Filling the Infrastructure Gap.....	12
Tools for Corridor Planning .....	18
Our Path Forward.....	20
Appendix A: Convening Materials.....	A-1

## Alternative Fuel Corridor Program 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. By designating alternative fuel corridors, commercial and passenger vehicles can reliably travel between cities, regions, and across the entire nation with access to multiple clean fuels. Launched in 2016, FHWA has completed four rounds of alternative fuel corridor designations over the last four years. 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 charging<sup>1</sup> 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 natural gas corridors.

Since the start of the program, 79 nominations have been made, including portions or segments of 100 Interstates, along with 76 US highways/State roads, within 46 States and the District of Columbia. With all alternative fuels combined, designated corridors cover over 135,000 miles of the National Highway System (all fuels combined).

In 2018, FHWA initiated a series of regional convenings to encourage multi-State, multi-stakeholder regional coordination for the development and implementation of alternative fueling infrastructure along corridors. The convenings fostered an important opportunity for States to evaluate the potential of shared infrastructure investments and improved collaboration for education and outreach efforts between the public and private sectors. Five convenings were held across the country between June 2018 and November 2019, with the first in St. Paul, Minnesota for the **Midwest** region, the second in Charleston, South Carolina for the **Southeast** region, the third in Arlington, Texas for the **South Central** region, the fourth in Providence, Rhode Island for the **Northeast and Mid-Atlantic** regions, and the fifth in Salt Lake City, Utah for the **Intermountain Western** region. The convenings engaged a total of 42 States and the District of Columbia (Figure 2) and were attended by over 260 stakeholder participants.

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<sup>1</sup> FHWA's requirements for designations made in 2016 allowed for Level 2 or direct current fast charge (DCFC or Level 3) infrastructure at 50-mile intervals, but this changed to only DCFC for corridor designations made in 2017 or later. Also, in 2019, both connector types (CCS and CHAdeMO) were required for DCFCs.

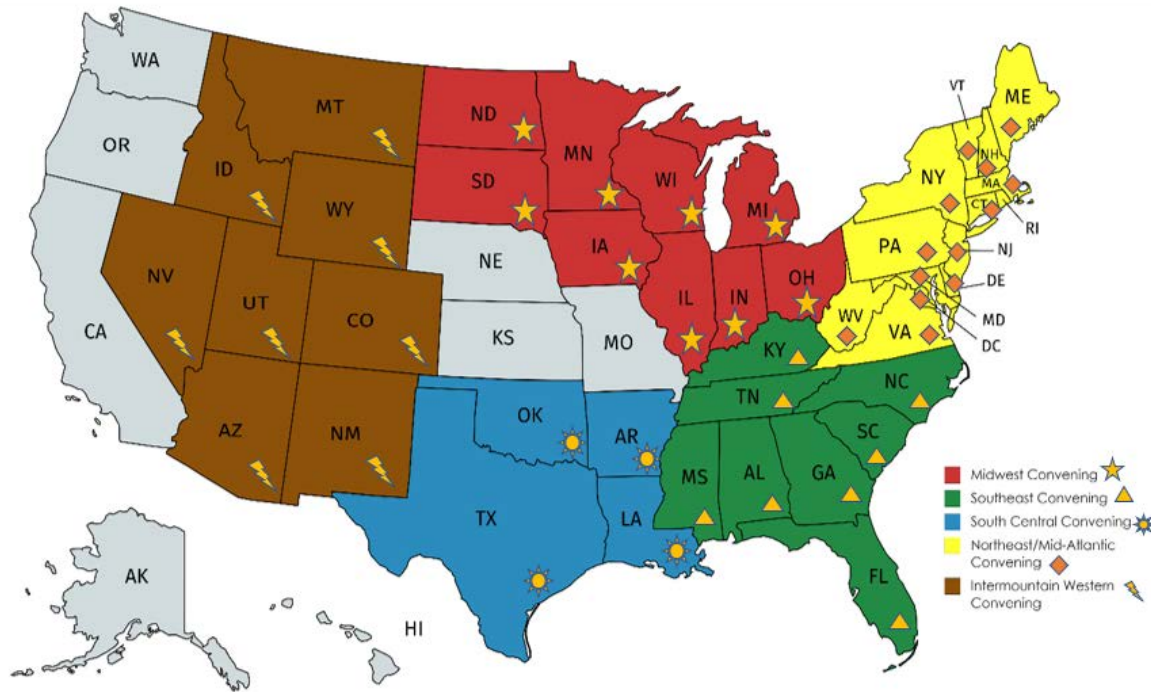


Figure 2. States engaged for the five alternative fuel corridor convenings held by FHWA.

States were selected for each convening based on areas with high-priority corridors that span across borders and regions with active initiatives such as Regional Electric Vehicle (REV) West or the Northeast Diesel Collaborative. FHWA continues to engage all States in its corridor efforts through the Alternative Fuel Corridor Program and will continue to offer technical assistance beyond the convenings. Ahead of each convening, FHWA assembled a planning committee comprised of FHWA Division Offices; State transportation, energy, and environmental agencies; Clean Cities Coalitions; utilities; and other alternative fuel stakeholders in the region to develop a targeted invitation list and provide input into program development based on regional priorities. FHWA purposefully reached out to a diverse set of stakeholder groups in each region to foster collaboration and strengthen partnerships between entities with critical roles in corridor development. In addition to engaging alternative fuel stakeholders during each convening, FHWA worked closely with a host organization that played a critical role in providing the meeting space, logistics, and partner outreach. These organizations are recognized in the Acknowledgements section above and FHWA thanks them for their dedication to the convenings' success.



## Executive Summary

Establishing a robust network of alternative fuel corridors across the United States is critical for facilitating mid and long-range travel of commercial and passenger vehicles using clean-burning fuels, mitigating range anxiety, accelerating public interest and awareness of alternative fuel availability, and achieving substantial reductions in harmful vehicle emissions. Since highways cross jurisdictional boundaries and installing alternative fuel infrastructure requires multi-stakeholder input, collaborating regionally and establishing stakeholder partnerships are particularly important for expanding and enhancing the corridor network. Between June 2018 and November 2019, FHWA held five regional day-long convenings to support collaboration and strengthen partnerships among corridor stakeholders. Figure 3 showcases the key stakeholder groups that were engaged across all five convenings.

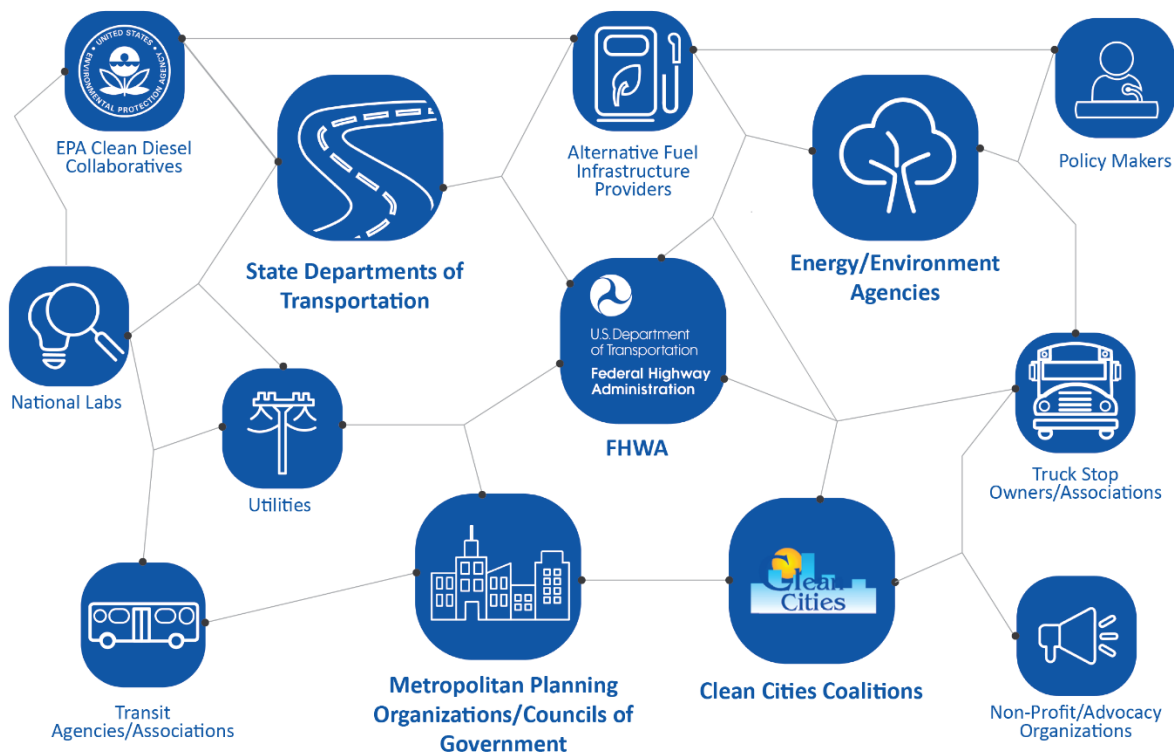


Figure 3. Stakeholder groups engaged for the convenings.

Expanding the growth of alternative fuel corridors requires coordination among partners across numerous functions, including outreach and education, policy, signage, incentives, data analysis, infrastructure development, fuel supply, and vehicle technology delivery. By collaborating with each planning committee, FHWA developed convening programs that addressed these issues. Although convening sessions varied depending on regional needs, there were several themes that remained consistent throughout the series. This report is structured to reflect the main themes:

- Regional Initiatives;
- Building Awareness & Leveraging Partnerships;
- Filling the Infrastructure Gap;

- Tools for Corridor Planning; and
- Our Path Forward.

This report showcases the extraordinary work stakeholders are undertaking to overcome barriers to corridor development by implementing innovative solutions. Throughout the report, case studies highlight key corridor initiatives, and quotes from convening participants demonstrate the value of engaging with FHWA's corridor program. Materials from all convenings, including summary reports and presentations, are available on the [Alternative Fuel Toolkit website](#), which serves as a repository of maps, tools, and resources on alternative fuels, primarily for State and local transportation agencies.

Based on the collaborative discussions throughout the convenings, the following five observations emerged as ways to build upon success to date and continue the expansion of alternative fuel corridors:

1. **Corridor Funding:** Funding to support infrastructure development and upgrades, as well as signage, was identified as the number one barrier to corridor growth and vehicle adoption.
2. **Regional Coordination:** Continuing ongoing engagement and outreach with regional partnerships is critical for ensuring coordination, aligning corridor priorities, and promoting technical knowledge exchange.
3. **Elevate Value Proposition:** Defining the value proposition of alternative fuel corridors in a way that includes the economic, environmental, and social benefits and resonates with various audiences is key for demonstrating the importance and impact of continued corridor development.
4. **Encourage Vehicle Incentives:** Incentives for alternative fuel vehicles (AFVs) will continue to encourage adoption and spur transformational growth in alternative fuel infrastructure development along corridors.
5. **Address Barriers:** In addition to lack of funding, numerous other barriers to alternative fuel corridor development were suggested by participants, such as complex permitting processes, low conventional fuel cost, and the inability to charge a fee for fueling or charging services for infrastructure located in rest areas that are located on the Interstate right-of-way. Continued stakeholder collaboration is necessary to develop informed approaches for addressing these challenges.

## Regional Initiatives

Regional initiatives advancing the development of alternative fuel corridors were highlighted during each convening (Figure 4). These initiatives are supported by collaborative partnerships among FHWA; State transportation, energy, and environmental agencies; metropolitan planning organizations (MPOs) and council of governments (COGs); alternative fuel infrastructure providers; technology providers; utilities; Clean Cities Coalitions; industry associations; and nonprofit groups. Partnership efforts include public outreach, public-private investment in alternative fuel infrastructure and incentive programs, and the integration of multiple fuel types at refueling stations. By highlighting regional corridor initiatives, partners had the opportunity to share how stakeholders collaborate to forge partnerships, successes in the advancement of alternative fuel adoption, challenges encountered, and the solutions to address them.



Figure 4. Initiatives panel from the South Central convening. Credit: CALSTART.

### Regional Electric Vehicle West Plan

Governors from eight western States – Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming – signed a memorandum of understanding (MOU) to provide a framework for creating an Intermountain West EV Corridor that will make it possible to drive an EV across major transportation corridors in the west. Through State leadership and coordination, the [multi-State partnership](#) hopes to educate and encourage customers, coordinate EV charging station location, create minimum standards for EV charging stations, encourage EV manufacturers to stock EVs, and collaborate on funding opportunities.



## Challenges

Although many of the regional initiatives demonstrated successful partner coordination and infrastructure development along corridors, challenges often occurred along the way. One challenge that was frequently mentioned was lack of funding for alternative fuel corridor projects and initiatives since resources are needed to help build awareness, as well as plan for and implement infrastructure development. Other challenges included obtaining fleet commitments to transition to alternative fuels and utilize planned infrastructure, maintaining momentum despite staff turnover, and securing a strong champion.

## Solutions

Representatives from regional alternative fuel corridor initiatives noted numerous best practices, strategic approaches, and observations, and offered solutions to various challenges at the convenings.

**Funding for Alternative Fuels:** There are a number of Federal funding programs that can support regional alternative fuel corridor initiatives, including the following:



- FHWA Congestion Mitigation and Air Quality Improvement (CMAQ) Program;
- US Environmental Protection Agency's (EPA) Clean Diesel Program / Diesel Emissions Reduction Act (DERA) grants;
- US Department of Energy Vehicle Technologies Office's Technology Integration grants; and
- Federal Transit Administration Grants for Buses and Bus Facilities Program.

More details about these and other funding resources can be found in the fact sheets section of each convening's page on the <http://altfueltoolkit.org/> website. Both Federal and State-funded alternative fuel programs were discussed at the convenings. Chicago Area Clean Cities administered a CMAQ-funded program called Drive Clean Chicago which offers voucher incentives for medium- and heavy-duty AFVs, light-duty EV incentives for taxis and liveries, and funding for charging and natural gas refueling stations. Ohio's Diesel Emission Reduction Grant Program provides funding for alternative fuel

replacements of diesel trucks. Additionally, the New York State Energy Research and Development Authority's New York Truck Voucher Incentive Program provides point-of-sale discount vouchers to end-users for the purchase of new medium- and heavy-duty AFVs. The State of Pennsylvania offers a unique funding opportunity for alternative fuel infrastructure development that syncs with FHWA's Alternative Fuel Corridor Program. Through its Alternative Fuels Incentive Grant program, Pennsylvania promotes the installation of alternative fuel infrastructure along Interstate highways in Pennsylvania and is focused specifically on corridors designated as Corridor-Ready or Corridor-Pending. In addition to Federal and State sources, convening participants emphasized the importance of leveraging local and private funds, including by securing the participation of fleet operators such as Frito-Lay and UPS to contribute cost share to grant-funded programs.

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*The FHWA's alternative fuel corridor designations in Pennsylvania provide the Commonwealth of Pennsylvania the opportunity, through Pennsylvania's "FAST Act Corridor Infrastructure Grant" under the Alternative Fuels Incentive Grant Program, to fund projects that are consistent with national strategies and the planned expansion of alternative transportation fuels using reimbursement grants to install alternative fuel public refueling stations along these corridors. Through national planning and targeted State support, we can do more to reduce our dependence on foreign oil, improve air quality, reduce emissions, and advance economic development in the transportation sector; which are all key goals in Pennsylvania's Alternative Fuels Incentive Act.*

*- Joshua Dziubek, Pennsylvania Department of Environmental Quality*

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**Securing a Champion:** Many alternative fuel initiatives are driven by the support of a strong champion. For example, [EVolue Houston](#), which is a coalition intended to accelerate clean transportation and zero emissions goods movement through electrification in the Houston, Texas area, was bolstered after finding a champion in the mayor of Houston. The mayor was supportive of electrification to improve air quality, especially after seeing the high contribution to local nitrogen oxide emissions from on-road vehicles. A political leader can also galvanize action to develop a new initiative, as was the case when Nevada's governor issued a directive in the State's 2016-2020 Strategic Planning Framework to develop an electric highway system.

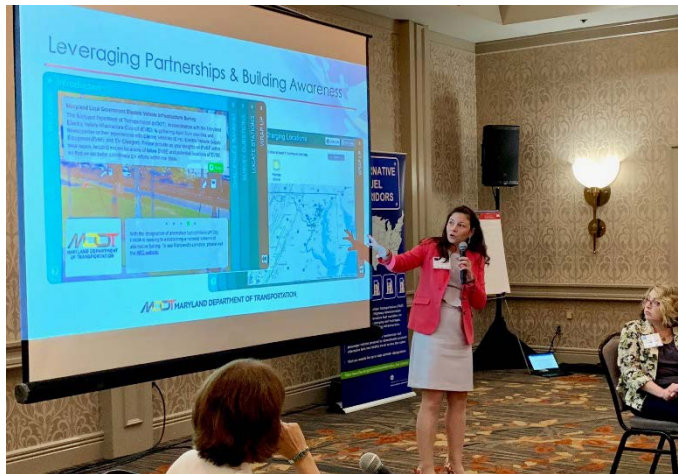


Figure 5. Building Awareness panel at the Northeast and Mid-Atlantic convening. Credit: CALSTART.

### Using Innovative Collaborative Approaches:

Successful regional initiatives require strong coordination among numerous stakeholders. Using innovative techniques to collect and share information can keep momentum going and prioritize infrastructure development. Louisiana Clean Fuels uses a crowdsourcing website to solicit input from EV owners about where they need to charge their cars for the purpose of helping transportation planners identify optimal locations for siting alternative fuel infrastructure. This platform allows drivers to upload data such as the type of car they drive and good commercial locations for potential

chargers, such as local grocery stores. Eventually, Louisiana Clean Fuels will give this data to the State to help them inform where infrastructure should go. Maryland Department of Transportation (DOT) presented its (Figure 5) Maryland Local Government Electric Vehicle Infrastructure Survey which collects input from counties and municipalities on their EVs, EV infrastructure, and EV charger experiences. The tool allows the public to drop pins on its maps so that users can indicate their location preferences. Additionally, New York City DOT uses heat maps showing rates of cardiovascular hospitalization and asthma, and this allows the New York State DOT to target emissions and pollution reduction efforts in locations that are hardest hit.

### Northeast Clean Freight Corridors Initiative

Northeast Clean Freight Corridors (NEFCF) is an initiative of the [Northeast Diesel Collaborative](#) (NEDC) and was formed to facilitate the adoption of cleaner fuels, technologies and strategies by freight carriers in the Northeast by coordinating across agencies, sectors, boundaries and modes with a focus on key freight corridors. NEFCF provides a regional platform for coordination among State and local agencies to promote cleaner and more efficient freight corridors. In 2016, NEFCF focused efforts in supporting Northeast States and local agencies in submitting applications under the FAST Act Section 1413 for designation as alternative fuel corridors. As part of these efforts, NEFCF has held multiple partnership meetings, webinars and working groups, including the successful “Clean Corridors Meeting” in Troy, New York in 2016 that inspired this national series of alternative fuel corridor convenings. The NEDC hosted the Northeast Regional Alternative Fuel Corridor Convening in July 2019 in Providence, Rhode Island.



*The Northeast Diesel Collaborative (NEDC) was happy to collaborate with FHWA in pairing the NEDC biannual Partners Meeting with the FHWA Northeast Alt Fuel Corridor Convening in July 2019. NEDC's Clean Freight Work Group greatly benefits from the expertise and resources that FHWA brings to the table in working with State DOTs to identify and build needed alt-fueling infrastructure for the freight sector to help reduce emissions.*

*- Abby Swaine, US EPA Region 1*

## Building Awareness & Leveraging Partnerships

Stakeholders in every region of the country emphasized the importance of communicating the availability and benefits of alternative fuels, AFVs, and alternative fuel corridors to the public. Strategic outreach can drive demand and market growth for AFVs, which in turn drives demand for installation and utilization of alternative fuel infrastructure, including along corridors. Building awareness and leveraging partnerships in support of alternative fuel corridors can come in the form of improving visibility through corridor signage, developing effective education campaigns and outreach strategies, and forging partnerships with potential infrastructure site hosts.

### Challenges

Convening participants identified challenges associated with building awareness and communicating about AFVs in their communities. Two related challenges are the lack of awareness of AFV options and of AFV refueling station availability, which are exacerbated due to lack of signage. Another challenge is the lack of incentives available to encourage dealerships to sell EVs; the lack of AFV awareness among dealerships combined with the lack of purchase incentives may lead to fewer AFV purchases overall. Additionally, State representatives noted lack of funding resources, in-house capacity and unclear procedures, and lack of buy-in as challenges that hinder the development and installation of signage.

### Solutions

Despite the challenges, many solutions and best practices were mentioned throughout the convenings to enhance awareness of alternative fuel options and leverage partnerships to further expand alternative fuel corridors.

**Improved Visibility through Signage:** Having signage along corridors that conveys the availability of alternative fueling stations eases range anxiety, communicates an important message for fleets considering alternative fuels, alerts and guides existing AFV drivers to new refueling opportunities and available infrastructure along their usual routes, and may encourage more people to adopt AFVs. There are a variety of considerations when it comes to designing and installing signage. Signage can be placed along ramps and along smaller roads to direct drivers off interstates and highways to refueling locations. CMAQ funding may be used to support alternative fuel corridor signage. In addition to signage, States can also consider ways that alternative platforms such as electronic boards or even available pavement can be used to raise driver awareness of alternative fuel availability.

One successful example of a signage effort is the South Carolina Energy Office's partnership with the South Carolina DOT's Traffic Engineering Office to produce and post alternative fuel signs for its corridors. Palmetto Clean Fuels hosts information and resources about South Carolina's signage effort at

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*The Southeast Alternative Fuel Corridor Convening helped bring together key stakeholders in our region to coordinate strategies aimed at increasing alternative fuel infrastructure along corridors. The convening identified barriers and allowed for deep-dive discussions on how to overcome those barriers. Getting to network with counterparts in each State and discuss across State lines has spurred multi-State initiatives to map and plan along corridors.*

*- Landon Masters, South Carolina Energy Office and Palmetto Clean Fuels*

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<http://palmettocleanfuels.org/afvcorridors>, which can serve as a guide for other States seeking to install alternative fuel corridor signage. States interested in signage guidance may refer to FHWA's "[frequently asked questions](#)" on the topic, which include a link to the "[Signing for Designated Alternative Fuel Corridors](#)" memorandum.

**Collaborating with Clean Cities:** The U.S. Department of Energy established the Clean Cities Program in 1993 to help strengthen and build capacity in communities throughout the United States on the benefits and adoption of AFVs. Clean Cities Coalitions can serve multiple awareness-building functions such as organizing events to bring stakeholders together; identifying businesses interested in hosting refueling stations; identifying potential signage locations; leading and/or assisting with the preparation of corridor nomination proposals; helping to secure funding; facilitating fleet conversion to alternative fuels; collecting data; conducting educational campaigns, and more. Agencies find that starting with their local Clean Cities Coalitions to raise public awareness has been essential. Coalitions often host public AFV "ride and drives," which are often held in tandem with popular local events and both educate event attendees on AFVs and allow them to take AFV test drives. Chicago Clean Cities discussed partnering with the Chicago DOT to raise public awareness of EVs at a jazz festival through a "ride and drive" event, which offered event attendees the opportunity to test drive a Chevy Volt.

**Outreach Methods:** Other general education, marketing, and outreach strategies include sharing and disseminating alternative fuel information through

newsletters, webinars, billboards, radio shows, automotive magazines, and other print and online forums. For example, South Shore Clean Cities (located in northern Indiana) airs a "Green Fleet Radio" segment on its local National Public Radio station to highlight and recognize alternative fuel initiatives. Francis Solar, a solar and energy solutions provider, promotes the integration of solar with EVs and uses outreach strategies such as "ride and drives" and hosting "lunch and learns" among other events. Additional strategies to raise awareness

include partnering with local business hosts of alternative fuel infrastructure and having them publicly advertise their refueling infrastructure, highlighting alternative fuels during forums on related topics such as sustainability and air quality goals, integrating alternative fuel station availability into smartphone applications, and incorporating social media influencers into outreach campaigns, which may help attract new audiences. Visual tools, such as maps that demonstrate the ability to drive between key points of interest on alternative fuels alone can be very valuable marketing and communications materials.

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*We've come a long way but there is still much work to be done if we wish to transition to a transportation system that meets environmental goals while being financially and technically feasible. Convenings are an excellent way to help develop more comprehensive and collaborative solutions to some of the challenges faced by industry, government and non-governmental organizations.*

*- Chelsea Jenkins, ROUSH CleanTech*

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### Alternative Fuels Council by the National Association of Truck Stop Operators

In 2018, the National Association of Truck Stop Operators ([NATSO](#)) formed the Alternative Fuels Council to work with its members to evaluate the integration of alternative fuels at truck stops. In addition to advocating for low carbon fuels, NATSO has played a role in policy advocacy and stakeholder coordination for the future of electric charging station development. To help build out electric charging at truck stops throughout the U.S., NATSO formed a partnership with ChargePoint that will leverage \$1 billion to deploy charging infrastructure at more than 4,000 travel plazas and fuel stops across the United States over the next decade.



**Awareness Partnerships:** Forging partnerships with a range of stakeholders is an important step in achieving corridor build-out and spreading public awareness of alternative fuels and corridors. For example, [the Midwest Electric Vehicle Opportunities: Learning, eEvents, Experience \(EVOLVE\) program](#) is a joint effort between the American Lung Association and seven upper Midwest Clean Cities Coalitions to increase public awareness of EVs through test drives, charging station installations, and educational events. Additionally, the Department of Energy funded Michigan to Montana (M2M) initiative demonstrates strong regional corridor coordination by spearheading an educational and training program that promotes the adoption of electric, natural gas, and propane fueling infrastructure along I-94 from Billings, Montana to Huron, Michigan.

Original equipment manufacturers (OEMs), EV owners' groups, convenience store associations, local or county associations, statewide political representatives, and dealerships all were mentioned as influential and useful partners for gaining access to multiple stakeholders at once and for increasing awareness. For example, the Oklahoma Transit Association has forged a promising partnership with Trillium on establishing EV and CNG refueling infrastructure at Love's truck stops while transitioning transit agencies to using alternative fuel buses. Participants agreed that car dealerships, in particular, are often lacking education and awareness on alternative fuels, though once they become aware of available AFVs and benefits, they can have significant influence on consumer awareness of AFVs and vehicle purchases. Agencies can partner with dealerships by engaging them in voucher programs, having their staff participate in and host test drives, and providing them with educational materials.

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*FHWA's Regional Alternative Fuel Corridor Convenings gave MnDOT a unique opportunity to meet with national experts and both current and future partners for alternative fuel corridor planning. We shared our lessons learned and learned from others' experiences promoting alternative fuel corridors. The best part for me was being able to meet in-person with some of the people we had coordinated with remotely to sign an MOU to designate I-94 an EV Charging Corridor from Minnesota to Michigan.*

*- Tim Sexton, Minnesota DOT*

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**Effective Siting of Refueling Stations:** Infrastructure site hosts are key partners in promoting the availability of alternative fuels. Ideal sites for AFV refueling infrastructure, such as EV charging stations, are where people already congregate, such as universities, business centers, or public government agencies. Locations where there already are power upgrades (e.g., recreational vehicle parks) may also be suitable. Pennsylvania has been considering evolving its corridor siting requirements for direct



current fast charge (DCFC) stations for its AFIG grant program so it can include traditional gas stations as DCFC station locations.

Maryland has an Electric Vehicle Infrastructure Council comprised of State agencies, public utilities, OEMs, MPOs, and other local partners who identify their preferences for new EV infrastructure installation locations. This allows them to leverage a variety of perspectives to inform their infrastructure siting decisions.

### **Interstate Highway 45 Alternative Fuel Corridor**

The Interstate Highway 45 (IH-45) corridor from the Houston-Galveston area to the Dallas-Fort Worth (DFW) urban core is a heavily trafficked corridor and is particularly strategic for freight transport as goods move between the inland ports of DFW and the coastal ports near Houston. This corridor is currently designated as “Corridor-Ready” for compressed natural gas, and North Central Texas Council of Governments (NCTCOG) has identified existing infrastructure that will transition the corridor from “pending” to “ready” for propane designation. NCTCOG will utilize funding made available from FHWA to invest planning resources to develop a deployment plan over 12 months, to establish the 290 miles of the IH-45 from the coastal ports to the DFW urban core as a zero emission vehicle (ZEV) Corridor that includes both hydrogen and electric charging infrastructure. The focus of this effort will be on building infrastructure that can serve heavy-duty vehicles in the goods movement sector.

Through the deployment plan, optimal sites for infrastructure development will be identified through engagement with a broad network including TxDOT, utilities, fleet end-users, consumer interest groups, and fueling providers and associations to foster well-rounded discussion that includes all necessary perspectives for successful implementation.



*The South Central Alternative Fuel Corridor Convening was key to our success in developing the I-45 ZEV Corridor proposal for FHWA’s funding opportunity to develop corridor deployment plans, as the convening introduced us to several key stakeholders and reinforced existing relationships that will be critical for project success. Following the convening, we have launched periodic hydrogen stakeholder discussions, and the convening attendee list formed the basis for the initial stakeholder invitations, so it has continued to pay dividends in fostering ongoing conversations about developing infrastructure.*

*- Lori Clark, NCTCOG and DFW Clean Cities*

## Filling the Infrastructure Gap

The Filling the Infrastructure Gap session allowed convening attendees to confer with one another about the barriers to alternative fuel corridor expansion along interstate and State highways and then share suggestions on the best solutions to address these barriers. For instance, alternative fuel corridors that have been designated “Corridor-Pending” lack the needed infrastructure to reach a “Ready” designation status and may face several key challenges contributing to those existing gaps. Other missed opportunities for establishing corridors with good viability may be due to barriers such as lack of partner coordination, benefits awareness, and/or funding



Figure 6. Filling the Gap panel in Utah. Credit: CALSTART.

availability. The FHWA’s alternative fuel corridor convenings presented an important opportunity for diverse stakeholders to participate in a focused results-driven discussion on identifying leading key barriers and working together to develop suggestions to overcome challenges to filling in infrastructure gaps (Figure 6). Each convening invited critical industry and government partners to help facilitate a meaningful dialogue by engaging unique perspectives, sharing case studies, and presenting best practices for advancing strategies and solutions to build infrastructure along corridors supporting the adoption of electric, hydrogen, natural gas, and propane vehicles.

### I-15 Electric Corridor

In Nevada, the 124 mile stretch of I-15 that runs between California and Arizona has become the first Electric Vehicle Corridor interstate designation in the intermountain west. The development of charging stations in Nevada has been hailed as a successful, joint partnership between Nevada State agencies, utilities, and private industry like Flying J Truck Stop and Eagle’s Landing Travel Center. This project is part of continued work on the Nevada Electric Highway Plan, initiated by former Governor Brian Sandoval and continued by current Governor Solisak, which aims to create charging infrastructure throughout the State.



**The following present three stakeholder-suggested barriers and solutions to filling in the infrastructure gap:**

**High Costs:** The high cost of infrastructure and the incremental cost of AFVs remain the biggest barriers to the advancement of alternative fuel corridors. Depending on the fuel, its associated infrastructure, and vehicle availability, development and procurement costs can vary greatly. For instance, locating infrastructure to fuel natural gas trucks along a corridor can cost between \$1.5 and \$4 million per station depending on throughput, and the cost of a natural gas truck can range from \$40,000 to \$80,000 higher than its conventionally fueled counterpart. Charging infrastructure for EVs can also vary widely

depending on application and the required build out from the utility to provide access and increased capacity, potentially resulting in high costs. Without the presence of policies and incentives to support development, opportunities for advancing these cleaner fuels can be limited.

### Solutions:

- **Infrastructure Planning and Development**

**Incentives** – Providing incentives to support public and private industry with infrastructure planning and development emerged as one approach to addressing high costs. Station operators and fleet users across alternative fuel types have struggled with the unknown costs of infrastructure development. It is critical that users have the necessary resources to appropriately plan for infrastructure development to understand buildout requirements, lead times and associated capital, and operational costs. Additionally, incentives to help support infrastructure development and construction were deemed critical to help bring down upfront costs. One infrastructure funding opportunity for States is the Volkswagen Clean Air Act Civil Settlement, particularly for States that are using up to 15% of their funds to develop Light Duty Zero Emission Vehicle Supply Equipment for EVs and hydrogen-powered vehicles.

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*ChargePoint continues to support implementation of electric vehicle (EV) charging infrastructure along the Federal Highway Administration's alternative fuel corridors which make up the nation's major highways, travel routes and rural areas. Recently, ChargePoint entered into a collaborative agreement with the National Association of Truck Stop Operators (NATSO), called the National Highway Charging Collaborative, which will deploy DC fast and L2 charging stations at more than 4,000 locations around the country by 2030. In an effort to continue the buildout of alternative fuels corridors along highways, ChargePoint also supports Federal efforts to increase the availability of charging infrastructure.*

*- Kevin Miller, ChargePoint*

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- **Vehicle Voucher Incentive Programs** – Designing incentive programs for medium- and heavy-duty AFVs to apply “point of sale” discounts at the time of vehicle purchase will enable a seamless transactional process for the end-user. Vehicle voucher incentive programs like California’s Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), New York’s Truck Voucher Incentive Program, and Illinois’ Drive Clean Chicago voucher incentive program are all designed to alleviate vehicle purchasers with lengthy grant applications and to provide discounts at the time of the transaction. These voucher incentive programs are structured to have eligible dealerships and vehicle manufacturers administer the appropriate documentation on behalf of the end-user and are reimbursed once vehicles are delivered to the customer. Voucher incentive programs have proven to be effective market acceleration mechanisms to increase market demand and reduce incremental cost by 80 to 100 percent, while driving the adoption of AFVs. Funding for these programs have come from California Climate Investments, Congestion Mitigation Air Quality Act (CMAQ) funding, and Volkswagen (VW) Mitigation funds.
- **Utility EV Policies and Rate Design** – Working with utilities and respective public utility commissions to develop and implement EV policies and programs is highly beneficial to help reduce infrastructure costs and incentivize EV adoption. FHWA convening partners, like Alliant Energy, offer attractive rebates for electric vehicle supply equipment (EVSE), EVs, electric forklifts, and Transport Refrigerated Units in the Midwest. California utilities, such as Southern California Edison and Pacific

Gas and Electric, have designed special EV rates to encourage EV adoption and provide make-ready investments to support infrastructure development for medium- and heavy-duty electric vehicles.

- **Innovative Finance and Inducement Models** – Apply innovative strategies to help buy down infrastructure and vehicle procurement costs. Strategies discussed during the FHWA convenings included: States setting aside funding to support alternative fuel corridor planning and development; leveraging public and private partnerships by combining funds to finance development; reducing demand charges and resiliency concerns with integration of energy storage and microgrids for electric fleets; developing aggregated procurements to reduce vehicle costs; and evaluating utilization of public and private funds to support long-term station ownership models.

**Lack of Awareness:** Understanding of the benefits and availability of AFVs continues to be a big barrier to infrastructure development. Without strong messaging and visibility to the benefits of AFVs, consumers will continue investing in conventionally fueled vehicles. If there are no AFVs being purchased, then there will be no infrastructure – and without infrastructure, there will be no vehicles. The lack of effective educational campaigns and accurate information, as well as misconceptions of AFVs, are hindering vehicle adoption. Poor visibility or the lack of infrastructure signage, along with generally insufficient information on the availability of refueling and charging infrastructure also inhibits market and corridor growth.

### Solutions:

- **Clean Cities Coalitions** – Collaboration with the local Clean Cities Coalition can be utilized to support and carry out education and outreach on the benefits of AFVs and infrastructure. Clean Cities Coalitions are the “boots on the ground” that support stakeholders with evaluating the benefits and deployment AFVs. From administering incentive programs, running marketing campaigns, to assisting fleets one-on-one with their procurement decisions, Clean Cities Coalitions are important and critical partners to advancing AFVs. Additionally, Clean Cities Coalitions now have a mandate to support with the planning and development of alternative fuel corridors.

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*The Federal Highway Administration’s alternative fuel corridor convenings have been valuable to DOE and its vehicle technology stakeholders. Bringing together local private and public partners to discuss alternative fuel accessibility along the highway corridor system is an important step toward providing clean and resilient fuel choices to end users.*

*-Linda Bluestein, Vehicle Technologies Office, Energy Efficiency and Renewable Energy, Department of Energy*

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- **Alternative Fuel Corridor Signage** – Increasing visibility of available alternative fuel stations can be accomplished by locating signage along designated alternative fuel corridors. Under the Alternative Fuel Corridor Program, State DOTs are permitted to provide signage along corridors that have been designated by FHWA for eligible alternative fuels. By providing signage in strategic locations along corridors (i.e., at a certain distance before an exit), users of AFVs can be aware of available fueling infrastructure, can plan appropriately and have confidence in fuel availability and access. Signage of available fueling infrastructure also helps create normalcy among consumers and helps encourage AFV adoption.

- **Public Workshops and Ride and Drives** – Organizing informational workshops and hosting alternative vehicle ride and drives are a great way to engage public and private stakeholders on the benefits, availability, and use of AFVs and infrastructure. By facilitating highly informative sessions in a public forum, participants can learn firsthand about the technologies, benefits, costs, guidance on use and management, and best practices to successful adoption. Hosting “Ride and Drive” events at these public forums also provide users and consumers the opportunity to “kick the tire” and get behind the wheel to experience an AFV first-hand. To organize workshops and public meetings, it is important to work with multiple partners to incorporate the right perspectives, diversity of information and skillsets, and resources to put on a successful event. Partners may include Clean Cities Coalitions, government agencies, vehicle manufacturers, infrastructure and fuel providers, fleet end-users, dealerships, and community groups/organizations.
- **Strong Branding and Marketing Campaigns** – Awareness starts with developing clear messaging and branding that resonates with consumers on the benefits of AFVs. An effective communications, marketing, and outreach strategy is needed to support increased awareness among consumers on advanced vehicle technologies and infrastructure needs. Messaging must be clear, effective, and memorable and should focus on the benefits to the consumer such as the business case, benefits to community, and the environment. Posting of communications and campaigns should come in the form of multiple mediums and should be tailored to meet the needs of the specific audience. Mediums could include signage or posters at convenient stores and other public locations, billboards, television and radio, print media or journals, social media and websites, and online educational tools.
- **Dealer Engagement and Education** – Local dealers can be trained and educated on the benefits and use of AFVs. Dealer engagement is critical to advancing sales and adoption of AFVs. Often, it is heard that a customer will go to a dealership and work with a salesperson who is not educated or familiar with the AFVs on its lot or the available incentives that could support the buy down of those vehicles. Extensive training and incentives can be considered to help educate and motivate dealers to learn more about AFVs, utilize tools available to help inform them and their customers, and understand the benefits to increasing vehicle sales.

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*“One of the main benefits from participating in the Southeast Alternative Fuel Corridor Convening was the chance to network with people who work on similar initiatives. This allowed us all to bounce ideas off each other and share thoughts about initiatives that we may not have even considered.”*

*- Bernadette Dupont, FHWA Kentucky Division Office*

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- **Inclusion of Outreach Goals within Grant Programs** – Government agencies can consider developing specific marketing and outreach tasks within a clean transportation program or grant administration scope of work. Often, specific tasks and resources are not set aside to help with meaningful outreach. Carving out specific outreach tasks and a budget for those activities can help bridge important information gaps around the technologies and program implementation. By incorporating important communication and outreach goals, a program manager or administrator can be thoughtful about putting forward actions to increase awareness, develop informational collateral or fact sheets, and host workshops and technology transfer events.



- **Relationship Between Supply and Market** – Building strategic partnerships to help create market demand and awareness around AFVs by using data and leveraging public-private partnerships can help identify infrastructure needs and prioritize the placement of alternative fuel stations to advance vehicle deployment. By using the National Renewable Energy Laboratory's (NREL's) [Alternative Fueling Station Locator](#) and alternative fuel corridor maps (described further below), partners can evaluate current availability and work with fleets to understand fueling and charging needs to identify appropriate locations for infrastructure development. Also, understanding data such as EV purchases and charger utilization within specific geographies, for example, can help with identifying additional needed charging at public locations and commercial centers and along transportation corridors.

**Lack of Policy:** Another key barrier to alternative fuel corridor development is the lack of policy and support from policy leaders. Without the development of strong policies and incentives that support the advancement of alternative fuels, there will be no market growth. Support at the highest levels of government within a State and its cities is critical to the continued deployment of AFVs and alternative fuel infrastructure.

### Solutions:

- **Value Proposition for Policy Makers** – Presenting the value proposition to policy makers across fuel types of the economic, social, and environmental benefits is important to provide policy makers with clear and effective information and tools on the benefits of AFVs and how those benefits support State and local goals. Measuring and communicating the benefits of building out an alternative fuel corridor will help decision-makers understand corridor-level impacts.
- **Policy Certainty** – Putting forward policies that support sustainable and dependable growth in the advancement of AFVs and infrastructure will improve policy certainty. Policy certainty is essential for companies to make a business case. This is especially true for utilities. Consistent and clear State and Federal policies will help push alternative fuel adoption. For example, States that have signed and committed to the Zero-Emission Vehicle Memorandum of Understanding are putting forward State goals, policies and incentives to help drive the adoption of zero-emission vehicles. With policy certainty, this enables both the public and private sectors to invest in infrastructure to support those markets. Market confidence in alternative fuels will ensure that vehicle manufacturers continue to invest in and manufacture more AFVs.
- **Standardization** – Developing standards that provide flexibility for technology adoption across fuels and infrastructure will allow seamless, safe, and sustainable integration. For example, a lack of site standardization, as well as lack of redundancy and resilience along corridors, pose a challenge for consumers. The Oregon DOT is addressing this issue by upgrading the Oregon portion of the [West Coast Electric Highway](#) to allow for fast charging using CHAdeMO or CCS connectors at each site. Additional solutions to overcome this challenge include increased industry coordination, co-locating AFV infrastructure, and producing public guidance based on successful models.

### I-80 Alternative Fuel Corridor

In October 2019, FHWA selected the Illinois Department of Transportation (IDOT) as one of five transportation agencies to receive applied research funding to develop deployment plans for alternative vehicle fueling and charging facilities along Interstate corridors. The plans are intended to help fill infrastructure gaps and enable targeted corridors to be designated as “Corridor-Ready.” Through the Mid-America Alternative Fuel Corridor Partnership led by IDOT, partners including State DOTs, Clean Cities Coalitions, utilities, fuel providers, charging and fueling networks, large fleets, and OEMs will work together to evaluate infrastructure gaps along I-80, the second-longest Interstate Highway in the United States. IDOT aims to move “Pending” corridor designations to “Ready” by developing a deployment plan for natural gas and electric infrastructure along the stretch from New Jersey to Omaha on the Iowa-Nebraska border within one year. Currently, there are 18 public quick-fill CNG stations and 35 DCFC electric stations along the corridor.



## Tools for Corridor Planning

Several maps and tools have been developed by FHWA and NREL specifically to help with alternative fuel corridor development. FHWA hosts maps of all designated alternative fuel corridors at [https://www.fhwa.dot.gov/environment/alternative\\_fuel\\_corridors/maps/](https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/maps/). These maps not only allow users to view corridors by fuel and designation round, they also include features to aid with corridor analysis and planning. These features include information on traffic projections to evaluate corridors with the highest potential infrastructure demand, and locations of potential alternative fuel infrastructure site hosts, such as rest areas, truck stops, national parks, and intermodal facilities.

FHWA's online mapping tool, [HEPGIS](#)

(Figure 7) hosts over one hundred interactive thematic maps. The tool allows users to display, locate, and download spatial data, as well as print maps and tables. The Alternative Fuel National Corridor maps for the five alternative fuels are included in HEPGIS under the 'Highway System' dropdown menu. These interactive maps display 'ready' and 'pending' corridors. The maps also include the ability to display additional layers on the maps, such as refueling stations, traffic volume (present and projected growth), rest areas, and intermodal facilities, as well as to view each layer's tabular data.

Furthermore, NREL has developed interactive maps available for each alternative fuel type at <https://afdc.energy.gov/corridors> that allow users to see where stations would need to be added in order to complete or expand a corridor. NREL also hosts the Alternative Fuels Data Center (AFDC), an online resource on AFVs which provides calculators, Federal and State laws and incentives, replicable case studies, and other tools, including the Alternative Fueling Station Locator. The Alternative Fueling Station Locator is a map that allows users to filter by location and fuel type to identify alternative fuel stations. Data is downloadable by comma-separated values file and shapefile for each State and fuel type. The Station Locator also enables users to map driving routes using alternative fuels. NREL recently added a Corridor Measurement Tool (Figure 8) to the

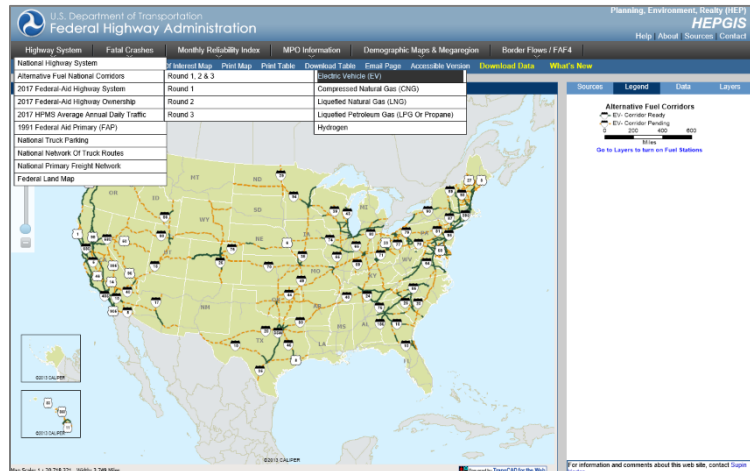


Figure 7. FHWA's HEPGIS tool.

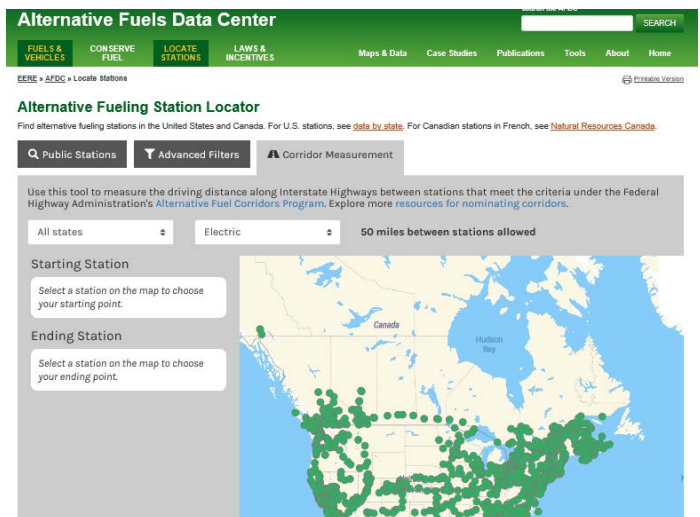


Figure 8. NREL's Corridor Measurement Tool.

Station Locator to allow users to measure the driving distance along interstate highways between stations that meet the criteria under FHWA's Alternative Fuel Corridor Program.

NREL also hosts the [EVI-Pro Lite tool](#), which helps estimate how much EV charging is needed at a city-and State-level. It 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.

In addition to the tools developed by FHWA and NREL in support of the Alternative Fuel Corridor Program, other entities have created customized tools to plan alternative fuel infrastructure build-out to meet their own objectives. Some of these include the Hydrogen Fueling Station Planning Tool developed by the Connecticut Center for Advanced Technology and a set of online EV Infrastructure Planning Tools developed by M. J. Bradley & Associates and Georgetown Climate Center in support of the Transportation and Climate Initiative. These and other tools are discussed in more detail on the "Helpful Tools for Alternative Fuel Corridor Planning" fact sheet available in the fact sheets sections of each convening's page on the <http://altfueltoolkit.org/> website.

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*FHWA's regional convenings provided a great opportunity to forge partnerships, enabling Argonne and Illinois DOT to craft collaborative, multi-State requests to nominate I-70 and I-80 as alternative fuel corridors, stretching from the East Coast to the Midwest, both of which earned designation.*

*- Marcy Rood, Clean Cities Team Lead, Energy Systems, Argonne National Laboratory*

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## Our Path Forward

Through partnership, coordination, strategic planning and the integration of policies and incentives, States around the country can work together to advance the expansion of alternative fuel corridors. At the end of each convening, partners around the room shared important learnings from the day and defined personal actions to increase Federal designation of alternative fuel corridors and expand the marketplace of AFVs (Figure 9). This section distills the comments from stakeholders into five observations on the best path forward for advancing alternative fuel corridors.



Figure 9. Stakeholders at the convening in South Carolina sharing action items and next steps. Credit: CALSTART.

- 1. Corridor Funding:** Stakeholders at each convening emphasized the importance of funding for enhancing their alternative fuel corridor efforts. Stakeholders indicated that funding remains the number one barrier to corridor growth and vehicle adoption. Additional funding resources are needed to deploy alternative fueling stations along corridors. More funding for alternative fueling stations would complement existing efforts by State transportation agencies and could help State agencies prioritize investments where there are critical infrastructure gaps and support market development opportunities for increased AFV adoption. Additionally, resources are needed for State transportation agencies to post signage along designated alternative fuel corridors to increase visibility and awareness on existing and available fueling stations.
- 2. Regional Coordination:** Ongoing engagement and outreach with regional partnerships can ensure coordination, alignment of corridor priorities, and technical exchange. By bringing together multiple partners across disciplines and perspectives, partners can effectively evaluate barriers, understand needs and put forward actions that improve stronger coordination of priorities and resources. Corridor partnerships should include a variety of partners such as energy, environment, and State transportation agencies, MPOs and COGs, Clean Cities Coalitions, utilities, fleet-users, manufacturers, infrastructure providers, trade associations, and environmental and economic development organizations. Working with the U.S. Environmental Protection Agency's Diesel Collaboratives, such as the Northeast, Southeast, and West Coast Collaboratives, is an excellent way

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*FHWA's Alternative Fuel Corridor Program has allowed Utah Clean Cities to coalesce partners from across the Intermountain West Region around initiatives to remove barriers to infrastructure deployment, promote economic development, and increase consumer awareness of alternative fuels. Through initiatives such as [CorridorWest \(CORWest\)](#), we are bringing States together to develop solutions that close key gaps along corridors. Participating in the convening helped us reinvigorate our partnerships, clarify roles and responsibilities, and inform our initiatives with best practices and lessons learned from across the region.*

*-Tammie Bostick, Utah Clean Cities*

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to leverage and invite participation from diverse stakeholder groups that have like-minded interests in advancing alternative fuels and clean corridors. Another important coordination strategy is the inclusion of alternative fuel corridors within MPO regional freight and transportation plans.

- 3. Elevate Value Proposition:** Advancing an educational campaign amongst decision-makers, government, and industry (dealers and fleets) can highlight the benefits, business case, and availability of alternative fuel technologies and infrastructure. To elevate the value proposition of alternative fuel corridors, partners need to develop and implement an effective educational campaign strategy that reaches multiple audiences. The value proposition must present the economic, environmental, and social benefits of alternative fuels to meet both public and private interests. An effective educational campaign strategy includes strong messaging and branding, public engagement activities such as outreach events (workshops, ride and drives, symposiums, etc.), online websites and tools, a consistent and relevant social media plan, and educational fact sheets that present information that is clear and digestible to the viewer. Clean Cities Coalitions and trade and industry associations are experienced and useful partners to help facilitate meaningful outreach. Working through schools, educational institutions, and local business chambers are effective methods of reaching communities.
- 4. Encourage Vehicle Incentives:** Providing voucher incentives for light-, medium- and heavy-duty AFVs (rural, urban, and freight transportation) is an effective incentive in the face of high cost. The zero- and near-zero emission truck and bus market is rapidly growing, offering several technology options for fleets. While having a higher upfront purchase price, zero to near-zero emission trucks and buses are proving to have a lower total cost of ownership over the life of the vehicle. Similar to the zero-emission passenger car market, incentives are needed to jump-start the zero- to near-zero emission truck and bus market to encourage fleets to purchase these advanced and cleaner vehicles. A national and State incentive program could transform this industry in the next 5-10 years, build a stronger domestic industry that provides high quality manufacturing jobs, while dramatically improving air quality along congested freight corridors. A voucher incentive program (VIP)<sup>2</sup> to incentivize clean truck and bus purchases has proven effective in large regional markets because of its streamlined 'point of sale' discount approach. In Illinois, New York, and California voucher incentives have led to the purchase of more than 7,500 battery-electric, fuel cell, hybrid, and ultra-low NOx natural gas vehicles. State and regional partners can consider pursuing the development of voucher incentive programs to move the industry forward faster and more sustainably. Making incentives for infrastructure available in parallel with vehicle incentives is important for effectively moving the market forward.
- 5. Address Barriers:** As regional corridor partnerships come together to coordinate and work together on expanding alternative fuel corridors, addressing key adoption barriers is critical to ensuring long-

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<sup>2</sup> A Voucher Incentive Program (VIP) is a streamlined process that applies the vehicle incentive at the point of purchase. Under a VIP program, the manufacturer pre-qualifies its vehicles with the entity managing the program and vendors are approved to submit voucher requests on behalf of purchasers. A voucher is redeemed to the vendor once all paperwork is submitted and the vehicle is delivered to the purchaser. Fleets greatly prefer this process over the costly and lengthy process that includes 9-12 months of proposal development and review, award selection, and contract negotiations. Fleets also prefer the VIP process over tax credits as their true monetary value usually gets lost in corporate accounting and does not impact the budgets of most fleet directors.

term success. Through approaches such as streamlining permitting processes, adjusting building codes, and addressing gaps in infrastructure along corridors in rural areas, partners can begin to overcome existing barriers. For example, the National Highway Charging Collaborative that NATSO and ChargePoint established through an MOU to deploy charging infrastructure at travel centers and fuel stops will work to address barriers associated with deploying infrastructure in rural areas. Through a focus on addressing the root causes of barriers, stakeholders can build on the momentum established during the convenings to continue to work to overcome challenges that are slowing down or preventing the adoption of alternative fuels and expanded corridor development.

## Appendix A: Convening Materials

The [Alternative Fuel Toolkit](#) website hosts all of the materials and key products of the five alternative fuel corridor convenings, with slide decks of each of the presentations, summary reports detailing key outcomes from each convening, and convening attendee lists. The website also hosts a variety of helpful resources for transportation planners interested in advancing AFVs, deploying alternative fuel infrastructure, and building out alternative fuel corridors, such as webinars, fact sheets, action guides, interactive maps, cost calculators, and more. Materials for each of the convenings can be found at the following links:

- Midwest Alternative Fuel Corridor Convening: <http://altfueltoolkit.org/midwest-alternative-fuel-corridor-convening/#materials>
- Southeast Alternative Fuel Corridor Convening: <http://altfueltoolkit.org/southeast-alternative-fuel-corridor-convening/#materials>
- South Central Alternative Fuel Corridor Convening: <http://altfueltoolkit.org/south-central-alternative-fuel-corridor-convening/#materials>
- Northeast/Mid-Atlantic Alternative Fuel Corridor Convening: <http://altfueltoolkit.org/northeast-mid-atlantic-alternative-fuel-corridor-convening/#materials>
- Intermountain Western Alternative Fuel Corridor Convening: <http://altfueltoolkit.org/intermountain-western-alternative-fuel-corridor-convening/#materials>