

National Electric Vehicle Charging and Hydrogen, Propane, and Natural Gas Fueling Corridors

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Acronyms and Abbreviations

Alternating current	AC
Alternative Fuel Data Center	AFDC
Compressed natural gas	CNG
Direct current	DC
Department of Energy	DOE
Department of Transportation	DOT
Electric vehicle	EV
FAST Act Section 1413	Section 1413
Federal Highway Administration	FHWA
Fixing America's Surface Transportation Act	FAST Act
Fuel cell electric vehicle	FCEV
Hybrid electric vehicle	HEV
Kilogram	kg
Kilowatt-hour	kWh
Liquefied natural gas	LNG
Liquefied petroleum gas	LPG
National Highway System	NHS
National Renewable Energy Laboratory	NREL
Natural Gas	NG
Plug-in electric vehicle	PEV
Plug-in hybrid electric vehicle	PHEV
Pounds per square-inch	PSI
Society of Automotive Engineers	SAE
United States Energy Information Administration	EIA
United States Code	U.S.C.

Executive Summary

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) seeks to create a national network of alternative fueling and charging infrastructure along National Highway System (NHS) corridors. This infrastructure will improve the mobility of passenger and commercial vehicles that employ electric, hydrogen fuel cell, propane, and natural gas fueling technologies across the United States; promote energy security and enhance our economy by reducing dependence on foreign oil; and reduce emissions from the transportation sector.

For the first designation, which this report documents, FHWA identified 55 routes spanning 35 States that will serve as the basis for a national network of "alternative fuel" corridors. Some corridors are designated as "Signage Ready," meaning that there are a sufficient number of facilities on the corridor to warrant signage that alerts drivers of the availability of alternative fueling stations. Corridors that do not have sufficient alternative fuel facilities to warrant highway signage are designated as "Signage Pending." The FHWA will work with State and local agencies to assist in bringing corridors designated as Signage Pending up to the necessary standard to be designated as Signage Ready.

The FAST Act also directs FHWA to review designated corridors every 5 years to identify standardization needs and to set an aspirational goal for achieving strategic deployment of alternative fueling infrastructure by fiscal year 2020. Accordingly, the United States Department of Transportation (USDOT) has established a 2020 vision *to ensure a user-centric experience in traversing Federal alternative fuel corridors and to establish a foundation for ubiquitous alternative fuel infrastructure in the United States*. This will require a safe, reliable, effective, and high performance system that aligns with USDOT's vision for the NHS.

The FHWA will coordinate with Federal, State, and local efforts as well as with the private sector to support the strategic deployment of alternative fueling infrastructure. The FHWA will also continue to support the current designated alternative fuel corridors and establish a process for rolling corridor designations in order to meet the 2020 aspirational goals.

1 Introduction

1.1 Background

Section 1413 of the Fixing America's Surface Transportation (FAST) Act, signed into law on December 4, 2015, requires the Secretary of Transportation to designate national electric vehicle (EV) charging, hydrogen, propane, and natural gas fueling corridors. (23 United States Code [U.S.C.] 151). In accordance with the Act,¹ corridor designations must identify near- and long-term needs for, and locations of, charging and fueling infrastructure for passenger and commercial vehicles that use electric charging, hydrogen fuel cell, propane, and natural gas fueling technologies across the United States.

Section 1413 also requires FHWA to solicit nominations for corridors from State and local officials² and involve a range of stakeholders.³ Within 5 years of establishing the corridors and every 5 years thereafter, USDOT must update and redesignate the corridors.⁴ During the designation and redesignation of the corridors, FHWA must also issue a report that identifies (1) EV charging infrastructure, hydrogen fueling infrastructure, propane fueling infrastructure, and natural gas fueling infrastructure and, (2) standardization needs for electricity providers, industrial gas providers, natural gas providers, infrastructure providers, vehicle manufacturers, electricity purchases, and natural gas purchases.⁵ The report must also establish aspirational goals to achieve strategic deployment of EV charging infrastructure, hydrogen fueling infrastructure, propane fueling infrastructure, and natural gas fueling infrastructure in those corridors by the end of fiscal year 2020. This report fulfills the reporting requirement for the first alternative fuel corridor designation.

1.2 Overview of EV Charging, Hydrogen, Propane, and Natural Gas Fueling Technologies

The designated alternative fuel corridors will support a national network of alternative fueling and charging infrastructure. The corridors include five alternative fuels and technologies:

- **EV charging:** Electric-drive vehicles use electricity as a primary power source or to improve the efficiency of conventional vehicle operations. Plug-in electric drive vehicles (PEVs) receive energy by plugging into an off-board power source. PEVs include both plug-in hybrid electric vehicles (PHEVs) and all-electric vehicles. PHEVs can travel 10-40 miles on battery power alone before switching to gasoline. EVs can typically travel 70-100 miles on a single charge, though some models can go over 200 miles.⁶ Similar to conventional vehicles, the efficiency and driving range of EVs varies based on driving styles and conditions. There are several

¹ 23 U.S.C. 151(a)

² 23 U.S.C. 151(b)

³ 23 U.S.C. 151(c)

⁴ 23 U.S.C. 151(d)

⁵ 23 U.S.C. 151(e)

⁶ U.S. DOE Office of Energy Efficiency and Renewable Energy. July 2016. *At a Glance: Electric-Drive Vehicles*. www.afdc.energy.gov/uploads/publication/electric-drive_vehicles.pdf.

common charging level rates available for “EV supply equipment,” which is the equipment used to deliver electricity to a plug-in EV:⁷

- Level 1: This equipment option provides charging through a 120-volt alternating current (AC) plug. The Level 1 charging cord has a common three-prong household plug on one end to plug into a standard wall outlet. On the other end is a Society of Automotive Engineers (SAE) J1772 standard connector to plug in to the EV. Level 1 equipment is the technology typically used for home or workplace charging. Level 1 charging adds approximately two to five miles of range per hour of charging time.⁸
 - Level 2: This equipment option offers charging through a 240-volt or 208-volt AC plug. Level 2 charging equipment can be installed at a home or workplace, and is also offered at public stations and charging outlets. Level 2 charging equipment, which uses the same SAE J1772 connector as the Level 1 equipment to plug in to the EV, adds approximately 10–20 miles of range per hour of charging time.⁹
 - Direct Current (DC) Fast Charging: DC Fast Charging equipment offers charging through a 480-volt AC input that converts AC to DC off-board. This equipment offers rapid charging; a DC Fast Charge can add 50 to 70 miles of range to a light-duty EV in 20 minutes or less.¹⁰ Unlike Level 1 and 2 charging, which use the same standard connector to plug into the EV, there is no agreed-upon standard for DC Fast Charging ports. Rather, there are three types of fast charging systems: the Combined Charging System/SAE J1772 combo, the CHAdeMO, and the Tesla combo. EVs are limited to using the DC Fast Charging system that is compatible with the charge port on the vehicle.
- **Hydrogen:** Hydrogen is a gaseous alternative fuel that can be produced from domestic resources including natural gas and renewable electricity. Hydrogen fuel cell electric vehicles (FCEVs) convert hydrogen to electricity which powers an electric motor. FCEVs, which are fueled with pure hydrogen gas stored directly on the vehicle, emit only water vapor and heat. Similar to conventional vehicles, they can fuel in less than 10 minutes¹¹ and current models have a driving range greater than 300 miles. Light-duty FCEVs are beginning to enter the consumer market in regions of the United States, mostly notably in California.¹² The State is also leading the nation in developing publicly accessible hydrogen fueling stations. A similar network of stations is under development in the Northeast.
 - **Propane:** Also known as liquefied petroleum gas (LPG), propane has been used as a transportation fuel in light-, medium-, and heavy-duty vehicles for decades. There are two types of propane vehicles: dedicated and bi-fuel. Dedicated propane vehicles are designed to run only on propane, while bi-fuel propane vehicles have two separate fueling systems that enable the vehicle to use either propane or gasoline. Buyers can either purchase propane

⁷ Note, not all EVs are capable of charging at each level of charging. There are also other charging levels available, such as inductive charging, but these are not as common.

⁸ U.S. DOE Office of Energy Efficiency and Renewable Energy. *Developing Infrastructure to Charge Plug-In Electric Vehicles*. www.afdc.energy.gov/fuels/electricity_infrastructure.html.

⁹ Ibid.

¹⁰ Ibid.

¹¹ Hydrogen is most often dispensed at 10,000 pounds per square inch (PSI), however some legacy stations operate at lower pressures. Fill times will take longer at lower pressures.

¹² DOE Alternative Fuels Data Center. Hydrogen Basics. www.afdc.energy.gov/fuels/hydrogen_basics.html.

California Air Resources Board. July 2016. Hydrogen Fuel Cell Electric Vehicle Deployment and Hydrogen Fuel Station Network Development. www.arb.ca.gov/msprog/zevprog/ab8/ab8_report_2016.pdf.

vehicles from an original equipment manufacturer (OEM) or convert existing vehicles to propane. Fueling a propane vehicle is much like fueling a conventional vehicle, thus propane fueling infrastructure is very similar to that of gasoline and diesel. The fuel is stored onsite, typically in aboveground tanks.¹³

- **Natural gas:** Natural gas has long been used to power vehicles. There are three types of natural gas vehicles: dedicated vehicles that run only on natural gas, bi-fuel vehicles that can run on either natural gas or gasoline-diesel, and dual-fuel vehicles that use natural gas with some diesel fuel for ignition assistance.¹⁴ Natural gas is stored onboard a vehicle as compressed natural gas (CNG) or liquefied natural gas (LNG). CNG is used in light-, medium-, and heavy-duty applications, while LNG is typically used in medium- and heavy-duty vehicles. A CNG fuel system transfers natural gas from the tank to the engine while reducing the fuel pressure to meet the operating requirements of the engine's fuel management system. LNG engines operate similarly; the LNG is converted to a gas before it is injected into the engine. CNG vehicles are fueled with easy-to-use, pressurized dispensers and can often be filled in a similar amount of time as a conventional vehicles. Modern dispensers operate at 3,600 psi, but legacy stations often operate at lower pressures, which increases fill times and reduces range. LNG stations deliver liquid fuel similar to gasoline and diesel. However, because of the extremely low temperature of LNG, special procedures, training, and protective equipment are required for vehicle fueling.¹⁵

1.3 Status of Alternative Fueling Infrastructure

Generally, the availability of retail fueling stations poses a significant barrier to the adoption of alternative fuel vehicles, particularly in household markets.¹⁶ EV Level 2 charging stations and outlets currently represent the most widespread alternative fueling infrastructure type, with stations and/or outlets available in all 50 States. Public propane stations are also available in all 50 States, although the total number of stations is significantly lower than EV stations. Public fueling infrastructure for natural gas and hydrogen vehicles is more limited; nearly all of the hydrogen stations are located in California with a smaller Northeast station network scheduled to open in 2017. Table 1 summarizes the total number of public alternative fueling stations nationwide by fuel type.

TABLE 1: TOTAL PUBLIC ALTERNATIVE FUELING STATION COUNTS NATIONWIDE
Source: DOE Alternative Fuels Data Center. Data current as of November 16, 2016.

¹³ DOE. May 2016. Propane Basics. www.afdc.energy.gov/uploads/publication/propane_basics.pdf.

¹⁴ DOE. June 2016. Natural Gas Basics. www.afdc.energy.gov/uploads/publication/natural_gas_basics.pdf.

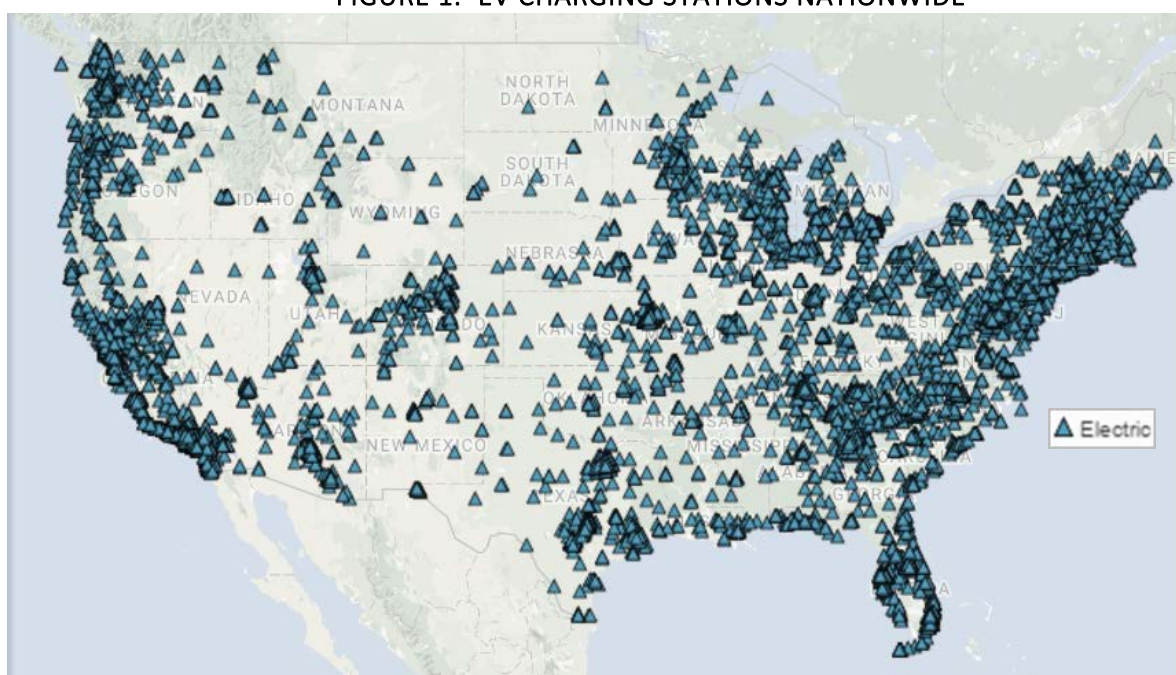
¹⁵ Ibid.

¹⁶ Melaina, M. et al. November 2012. Consumer Convenience and the Availability of Retails Stations as a Market Barrier for Alternative Fuel Vehicles. <http://www.nrel.gov/docs/fy13osti/56898.pdf>.

Fuel/Technology	Stations
EV Level 1	1,503
EV Level 2	13,175
EV DC Fast Charging	1,939
Propane	437 ¹⁷
CNG	956
LNG	83
Hydrogen	31

The following maps generated from the Department of Energy's (DOE) Alternative Fueling Station Locator provide information on the distribution of fueling stations by State as of November 16, 2016.¹⁸

FIGURE 1. EV CHARGING STATIONS NATIONWIDE



¹⁷ Excludes stations with limited vehicle-specific fueling capabilities, i.e., stations that have fuel available for use in vehicles, but no vehicle services or vehicle fuel-specific pricing available.

¹⁸ See www.afdc.energy.gov/locator/stations/. According to DOE, stations are verified at least once a year to determine whether they are still operational and providing the fuel specified. Mapped data are updated on an ongoing basis. Stations that are no longer operational or no longer provide alternative fuel are removed from the data as they are identified.

A map of the United States showing the distribution of propane stations. The map is color-coded by state, with a legend indicating that purple dots represent propane stations. The distribution is dense in the Northeast, Midwest, and West Coast, and sparser in the Great Plains and Mountain West regions.

A map of the United States showing the distribution of CNG stations. The map is color-coded by state, with a legend indicating that orange squares represent CNG stations. The distribution is dense in the Northeast, Midwest, and South, and sparse in the West.

Figure 4: LNG FUELING STATIONS NATIONWIDE



FIGURE 5: HYDROGEN STATIONS NATIONWIDE



Projections by the United States Energy Information Administration (EIA), based on current laws and regulations and known market, demographic, and technological trends, indicate that sales of alternative fueled vehicles are likely to grow significantly by 2040.¹⁹ A 2014 National Renewable Energy Laboratory (NREL) study evaluated the existing and potential market strength of common alternative fuels, including electricity, CNG, and propane.²⁰ The analysis identified locations that have the greatest potential for successful deployment of alternative fuels across the country. Of all the fuels analyzed, evidence suggested that CNG was promising in the greatest number of States, largely due to the fact that freight traffic provides potential demand for many far-reaching corridor markets, and that CNG sources are geographically widespread. The NREL analysis identified strong market potential for specific fuel types in the following areas:

- *EVs*: The market for EVs are currently strongest along the West Coast, in the Northeast, and in Hawaii, followed by isolated urban areas throughout the nation and linked urban areas in the Great Lakes region, Florida, North Carolina, Arizona, and Nevada;
- *Propane vehicles*: The propane market is fragmented, with a high frequency of strong markets in Indiana, Connecticut, California, Illinois, Washington, Pennsylvania, Texas, West Virginia, Ohio, and Mississippi; and
- *CNG vehicles*: Connecticut, New York, Oklahoma, Rhode Island, California, Pennsylvania, Utah, Massachusetts, West Virginia, Ohio, and Washington currently have strong markets for CNG vehicles.

¹⁹ EIA. September 2016. Annual Energy Outlook 2016. www.eia.gov/forecasts/aeo/section_marketrends.cfm.

²⁰ NREL. November 2014. Geography of Existing and Potential Alternative Fuel Markets in the United States. www.afdc.energy.gov/uploads/publication/geography_alt_fuel_markets.pdf.

2 Alternative Fuel Corridor Designations

The FHWA's goal is to create and expand a national network of alternative fueling and charging infrastructure along National Highway System (NHS)²¹ corridors, thereby improving the mobility of passenger and commercial vehicles that employ electric, hydrogen fuel cell, propane, and natural gas fueling technologies across the United States.²² This section describes the alternative fuel corridor designation process and the corridor designations made.

2.1 Corridor Designation Process

In accordance with 23 U.S.C. 151, FHWA involved a range of stakeholders in implementing the FAST Act Section 1413 requirements. On May 12 and 16, 2016, FHWA held two national webinars at which stakeholders were invited to provide input to FHWA on the designation process, timeline, and specific topics related to the implementation of Section 1413. Webinar discussion topics included:

- Boundaries for alternative fuel corridors (e.g., linear versus network);
- Definition of "major national highway;"
- The number of corridors to designate and the number of fuels per corridor;
- Criteria for designating corridors; and
- Possible results and outcomes of designations.

The FHWA coordinated with the DOE's Clean Cities Program to publicize the webinars to its associated network of coalitions and stakeholders. At least 375 stakeholders participated in the two webinars.²³ The FHWA then compiled and reviewed input received during the webinars in order to prepare a corridor nomination solicitation for publication in the Federal Register. The webinar presentations, chat pod transcripts, and recordings are available at www.fhwa.dot.gov/environment/alternative_fuel_corridors/.

On July 22, 2016, FHWA published a Federal Register Notice²⁴ inviting nominations from State and local officials to assist in making alternative fuel corridor designations. The comment period was open for 30 days. The FHWA received 34 responses, which included 55 corridor nominations. Based on stakeholder input, FHWA decided to limit this first designation cycle to NHS Interstates as well as several major State roads and highways, such as US 101 on the West Coast and US 50 on the East Coast. The FHWA also limited the first designation cycle to those corridors nominated by stakeholders.

The FHWA then worked with DOE and NREL to map all public EV charging, hydrogen, propane, and CNG and LNG stations located within five miles of the nominated corridors found on the NHS.

²¹ See the following FHWA Web site for definitions and descriptions of the NHS: http://www.fhwa.dot.gov/planning/national_highway_system.

²² 81 FR 47852 (July 22, 2016), available at www.federalregister.gov/documents/2016/07/22/2016-17132/fixing-americas-surface-transportation-act-designation-of-alternative-fuel-corridors.

²³ Instances where multiple viewers of one webinar stream occurred were assumed to be one stakeholder in this overall count.

²⁴ 81 FR 47852 (July 22, 2016), available at www.federalregister.gov/documents/2016/07/22/2016-17132/fixing-americas-surface-transportation-act-designation-of-alternative-fuel-corridors.

With the help of FHWA GIS experts, road segments were identified where alternative fueling infrastructure currently has high coverage, as well as where significant gaps, as defined by distance between stations, currently exist. One of two designations were then assigned to each nominated highway segment: (1) “Signage Ready,” meaning that there are a sufficient number of facilities on the corridor to warrant signage alerting drivers of the availability of alternative fueling stations, or (2) “Signage Pending,” meaning that the corridor does not have sufficient alternative fuel facilities to warrant highway signage at this time. Table 2 describes the distance criteria used in making the corridor designations.

Table 2. Signage Ready and Signage Pending infrastructure coverage criteria

Fuel/ Technology	Signage Ready NHS Segment has...	Signage Pending NHS Segment has...
EV Charging	Public DC Fast Charging or Level 2 chargers no greater than 50 miles between one station and the next on the corridor	Public DC Fast Charging or Level 2 chargers separated by more than 50 miles
Hydrogen	Public hydrogen stations no greater than 100 miles between one station and the next on the corridor	Public hydrogen stations separated by more than 100 miles
Propane	Public, primary propane stations no greater than 150 miles between one station and the next on the corridor	Public, primary propane stations separated by more than 150 miles
CNG	Public, fast fill, 3,600 psi CNG stations no greater than 150 miles between one station and the next on the corridor	Public, fast fill, 3,600 psi CNG stations separated by more than 150 miles
LNG	Public LNG stations no greater than 200 miles between one station and the next on the corridor	Public LNG stations separated by more than 200 miles

The Signage Ready and Signage Pending criteria for each fuel type was developed based on information from several resources, including (1) input provided by stakeholders during the two national webinars; (2) common proposed distances between stations on nominated corridors; (3) discussions with the DOE and NREL personnel with experience related to siting of alternative fuel infrastructure; (4) input from industry trade associations; and (5) alternative fuel vehicle technical capabilities.

The FHWA determined that for EV Charging, only publicly accessible Level 2 and DC Fast Charging sites would be considered. For propane stations, FHWA determined that only “primary” stations (i.e., those stations that offer vehicle-specific fueling capabilities and fuel priced specifically for use in vehicles) would be considered when determining infrastructure coverage along a nominated corridor.

The FHWA relied on DOE’s Alternative Fuel Station Locator²⁵ and NREL’s TransAtlas²⁶ to verify the location of and distance between existing alternative fueling stations along a nominated corridor to designate highway segments as “Signage Ready” or “Signage Pending.”

2.2 Designated Alternative Fuel Corridors

For the first designation, FHWA identified 55 corridors spanning 35 States that serve as the basis for a national network of alternative fuel corridors. Fuel-specific maps that highlight the “Signage Ready” and “Signage Pending” corridors are available in Appendices A through E. Appendices F through J include fuel-specific tables listing the designated corridors by lead agency.

²⁵ Available at www.afdc.energy.gov/locator/stations/.

²⁶ Available at <https://maps.nrel.gov/transatlas/#/?activeLayers=lyQBvX&baseLayer=groad&mapCenter=40.21244%2C-91.625976&zoomLevel=4>.

3 Aspirational Goals & Standardization Needs

Section 1413 of the FAST Act directs USDOT to review designated corridors every 5 years. It also requires USDOT to identify aspirational goals for achieving strategic deployment of EV charging and hydrogen, natural gas, and propane fueling infrastructure by fiscal year 2020,²⁷ and to identify standardization needs for electricity providers, industrial gas providers, natural gas providers, infrastructure providers, vehicle manufacturers, electricity purchasers, and natural gas purchasers.²⁸ These requirements recognize the need for continued efforts and further expansion of fueling infrastructure beyond USDOT's initial designations. Accordingly, this section discusses standardization needs and puts forth USDOT's vision for a strategic deployment of alternative fueling infrastructure that can enhance the viability of alternative fuels to increasingly meet the nation's transportation needs.

2020 Aspirational Goal for National Alternative Fuel Corridors

To ensure a user-centric experience in traversing Federal alternative fuel corridors and to establish a foundation for ubiquitous alternative fuel infrastructure in the United States. This will require a reliable, consistent, and high performance system that aligns with the USDOT's vision for the NHS and is augmented with effective coordination, outreach, and education.

The NHS is the centerpiece of a safe, modern, and efficient transportation system that enables coast-to-coast travel across the United States. The NHS includes the Interstate Highway System as well as other roads important to the nation's economy, defense, and mobility. The NHS was developed by USDOT in cooperation with the States, local officials, and metropolitan planning organizations (MPOs).²⁹ This world-class system, which has developed over many years, continues to evolve through a concerted effort across all levels of government. The consistent user experience that the NHS provides serves as a framework with which to align the aspirations for alternative fueling infrastructure, especially since FHWA and DOE's Clean Cities program has shown that the experience of the driver is paramount to deploying alternative fuel vehicles and infrastructure.

The principles of consistency and convenience, reliability and performance, and coordination outline the critical objectives upon which the 2016 USDOT Alternative Fuel Corridor designations can grow in order to better meet drivers' needs and improve the mobility of passenger and commercial vehicles that employ electric, hydrogen fuel cell, propane, and natural gas fueling technologies across the United States. Each of these principles is discussed below.

3.1 Consistency and Convenience

Significant effort has gone into ensuring a consistent experience in using the NHS, regardless of where in the United States travel takes place. This consistency provides for more uniform expectations among drivers when they plan trips of all distances. The current state of alternative fueling infrastructure presents a more fragmented experience that can differ from fuel type to fuel type and

²⁷ 23 U.S.C 151(e)(2)

²⁸ 23 U.S.C 151(e)(1)

²⁹ See http://www.fhwa.dot.gov/planning/national_highway_system/.

from fueling station to fueling station.³⁰ While a number of these differences are inherent to the fuel itself, there are also common elements that can be advanced through a national vision for alternative fuel corridors, including:

- Dedicated roadway signage;
- Consistent marketing of alternative fuels;
- An open and common payment platform;
- Standardization of nozzles and connectors; and
- Convenience amenities.

3.1.1 Dedicated Roadway Signage

The availability of dedicated roadway signs to indicate the availability of alternative fuels has been discussed as a key need to increase awareness of station availability and ease “range anxiety” among drivers.^{31,32} Standardized signage has been developed to be used on alternative fuel corridors that complies with the provisions of the national Manual on Uniform Traffic Control Devices (MUTCD). This signage will alert drivers that they are traveling along an alternative fuel corridor and that appropriate services are available within five miles of the road. Deployment of these signs along corridors will be a key step to alerting drivers on fueling availability as a more comprehensive network is built out. It will also be crucial that these signs accurately represent the availability of alternative fuels at any given time as well as the starting and ending points of a given alternative fuel corridor. Maintenance of these signs and corridors will likely need to continue on a regular basis into the future. The dynamic nature of these corridors may also suggest the need for additional or supplemental ways to communicate alternative fuel station availability to drivers, such as through mobile device apps and in-vehicle information systems.³³

3.1.2 Consistent Marketing of Alternative Fuels

Gasoline and diesel are typically dispensed in gallons, providing a baseline for consumers when purchasing these fuels at retail stations. Despite performance differences between these fuels, a common unit of measurement allows for a consistent benchmark of prices as well as greater transparency to consumers. Often alternative fuels are marketed and labeled in gasoline or diesel gallon equivalents, which link the various properties and performance characteristics of alternative fuels back to their gasoline or diesel counterparts. In that sense a gasoline gallon equivalent of an alternative fuel provides the same amount of energy as a gallon of gasoline, providing a common baseline for consumers to use.

³⁰ Fleming, Charles. “How will I charge my electric vehicle? And where? And how much will it cost?” Los Angeles Times. September 26, 2016. <http://www.latimes.com/business/autos/la-fi-hy-agenda-ev-charging-20160920-snap-story.html>.

³¹ “Access to alternative transportation fuel stations varies across the lower 48 states.” April 30, 2012. The U.S. Department of Energy, Energy Information Administration. <http://www.eia.gov/todayinenergy/detail.php?id=6050>.

³² U.S. Department of Energy. January 2014. A Guide to the Lessons Learned from the Clean Cities Community EV Readiness Project. http://www.afdc.energy.gov/uploads/publication/guide_ev_projects.pdf.

³³ U.S. DOT, FHWA. January 2015. Feasibility and Implications of Electric Vehicle (EV) Deployment and Infrastructure Development http://www.fhwa.dot.gov/environment/climate_change/mitigation/publications/ev_deployment/fhwahep15021.pdf.

³³ Tazewell, Anne, et. al. “Alternative Fuel Road Signage Policies & Programs in Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia.” July 24, 2014. <https://nccleantech.ncsu.edu/wp-content/uploads/Road-Signage-Policies-and-Procedures.pdf>.

Gasoline and diesel gallon equivalents is increasingly a preferred measure for alternative fuels as the private sector has realized the utility of simplicity in marketing these fuels to the public. Notably, the National Conference on Weights and Measures has recently approved the sale of natural gas in diesel gallon equivalence.³⁴ Propane is also marketed in gallons. Hydrogen is sold in kilograms based on dispenser standards established by the National Conference on Weights and Measures.³⁵ Electricity lacks a single common marketing metric when used for transportation purposes. In traditional power-sector applications, it is often marketed in kilowatt-hours (kWh). When used in electric charging, it can be sold in kWh, per full charge, or based upon charging time. Each of these approaches may reflect the actual cost of charging.³⁶ However, this inconsistency can create an overly complex consumer experience. While neither USDOT nor FHWA is responsible for prescribing pricing mechanisms or standards for dispensing fuel, a continued dialogue for streamlining how these fuels are marketed may provide a consistent, transparent experience for drivers.

3.1.3 An Open and Common Payment Platform

Similar to the variety of approaches in marketing alternative fuels, the mechanisms of accepted payments can vary widely across current infrastructure providers. Unlike most gasoline and diesel fueling stations, alternative fuel payment services may be unique to an infrastructure provider and require opt-in participation in order to use the service (often at no cost, but occasionally with membership fees). The practical implication is that a driver on a given designated alternative fuel corridor may presume access to all fueling facilities located along the corridor but then mistakenly find themselves unable to access some facilities. Some States, notably California, have established a more formal framework for interoperability which enables subscription and membership-based services while allowing for non-members to utilize public EV charging infrastructure; this model may be appropriate for other alternative fuels. California has also taken the lead to create an open payment platform for hydrogen that is being replicated by station developers in the Northeast.

The requirement for an open payment platform was not factored into the initial alternative fuel corridor designations, but USDOT plans to continue seeking ways to foster an open system along designated corridors.

3.1.4 Standardization of Connectors and Nozzles

To facilitate the widespread adoption of alternative fuel vehicles, standard vehicle models and infrastructure should be encouraged. Some alternative fuel technology developers have converged on a single set of standards that promote interoperability among vehicles and refueling infrastructure; others, such as those for plug-in EVs, have not.³⁷ Incompatible fueling/charging infrastructure reduces the effectiveness of an alternative fuel corridor and limits public accessibility. Any nationally-designated corridor system should promote interoperability and open access, including coordination with standard-setting entities that have jurisdiction and technical insight into the needed technical protocols.

³⁴ "Weights and Measures Adopts Diesel Gallon Equivalent for CNG." The Association for Convenience and Fuel Retailing. August 5, 2016. <http://www.nacsonline.com/Media/Daily/Pages/ND0805162.aspx#.WFdLgLGZO8U>.

³⁵ "Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality." 95th National Conference on Weights and Measures, Inc. July 2010. <http://www.nist.gov/pml/wmd/pubs/hb130.cfm>.

³⁶ Berman, Brad. "The Ultimate Guide to Electric Car Charging Networks". <http://www.pluginCars.com/ultimate-guide-electric-car-charging-networks-126530.html>.

³⁷ Csere, Csaba. "Electric-Car Makers' Quest: One Plug to Charge Them All." Aug. 26, 2011. The New York Times. <http://www.nytimes.com/2011/08/28/automobiles/electric-car-makers-quest-one-plug-to-charge-them-all.html>.

Charging or fueling facilities that require a specific and limited vehicle make and model were not included in initial corridor designations. The USDOT plans to continue this practice in future designations, seeking to promote convergence toward a system that provides fair and equal access to all drivers.

FIGURE 6: ALTERNATIVE FUELING AND RECHARGING NOZZLES



Source: DOE's Alternative Fuels Data Center

3.1.5 Convenience and Amenities

The initial alternative fuel corridor designations consider current alternative fueling stations within five miles of a major highway without additional consideration of facilities such as restrooms, access that complies with Americans with Disabilities Act requirements, or height and fueling capacity requirements for large vehicles, such as semi-trucks. Future designations by USDOT may seek to reduce the distance threshold between the highway and alternative fueling stations (less than five miles).

3.2 Reliability and Performance

The NHS provides a reliable experience for travelers that allows for uninterrupted and flexible travel. The FHWA should ensure that travelers can safely and quickly navigate between destinations, make adjustments as appropriate, and have up-to-date information available to them in advance of and during their trip along alternative fuel corridors.

3.2.1 Availability of Alternative Fueling Stations

The USDOT's "Signage Ready" alternative fuel corridor designations were made based upon existing vehicle technical capabilities, namely range and refueling/recharging time to enable medium- and long-distance travel using alternative fuels. Beyond technical or analytical approaches to determining station availability, research has shown that consumers place a high premium on the peace of mind of having the availability of alternative fueling stations more closely resemble the current network of gasoline fueling stations.³⁸ Previous surveys have indicated a perceived alternative fuel vehicle cost

³⁸ Greene, D.L., 1998. "Survey evidence on the importance of fuel availability to choice of alternative fuels and vehicles". *Energy Studies Review*. 8(3): p. 215-231 and Melaina, M.W., C. Welch, R. Baumgartner, and E. Rambo (2008). *Consumer preferences for*

penalty of between \$7,000 and \$9,000 when there is a lack of fueling infrastructure along Interstates that connect urban areas.³⁹ This suggests the need to move beyond what is technically feasible by increasing the density of fueling and charging stations to provide increased confidence to consumers. Over time, USDOT may adjust the current spacing requirements among alternative fueling station locations along “Signage Ready” corridors based on the current state of vehicle technology.

3.2.2 Type of Corridors Alternative Fueling Stations

It is not immediately clear that future alternative fueling infrastructure will need to resemble today’s gasoline and diesel fueling station infrastructure.⁴⁰ Alternative fuels present opportunities for a fueling infrastructure that more closely aligns with the specific needs of the end-user as fuel types and uses diversify. As an example, in the case of electricity, the flexibility of charging at home or the workplace or of charging fleets onsite present a higher likelihood that a vehicle will leave its traditional dwelling place with a “full tank.” This is often not the case for conventionally-fueled vehicles. Similarly, not all alternative fuels have uniform requirements for station specifications, nor will there be immediately viable opportunities for all vehicles sizes and types. These distinctions are important to reinforce that there is not a single protocol or metric for alternative fueling station placement along designated corridors, and that all fuels may not be appropriate along all corridors. The optimal mix and availability of alternative fuels will be driven largely by technological capabilities and needs of the end-user. Identifying and providing the optimal mix and availability of services along “Signage Ready” alternative fuel corridors will require continued analysis and coordination among State and Federal stakeholders.

The appropriateness of these corridors will also be driven by economic and local considerations. The USDOT plans to work with stakeholders to identify targeted national interest alternative fuel corridors that promote the movement of people and/or goods and amplify local efforts near those corridors.

3.2.3 Dynamic Information on the Status of Alternative Fueling Stations

With its initial alternative fuel corridor designations, USDOT established consistent roadway signage to indicate that a given road segment is a designated corridor and list the fuels available. The USDOT recognizes that the status of alternative fueling stations along a given corridor will change with station additions, maintenance, and closures, as well as the fact that en-route information does not necessarily aid in trip planning. Accordingly, USDOT plans to work with DOE and digital mapping platforms in an effort to increase the availability of alternative fuel station data on mobile apps and tools that drivers utilize daily. This data should include attributes beyond just location information, such as real-time status, facility capabilities, and amenities.

3.2.4 Flexibility and Expandability

As with any infrastructure investment, capital investments can be significantly higher if made in retrospect rather than in advance. At the same time, there is likely to be uncertainty about the type and requirements of alternative fuel infrastructure needed, particularly as technology advances. Previous

refueling availability: results of a household survey. Annual Conference of the National Hydrogen Association, Sacramento, CA, March 31 to April 1.

³⁹ Melaina, M., Bremson, J., Solo, K., 2013. *Consumer Convenience and the Availability of Retail Stations as a Market Barrier for Alternative Fuel Vehicles.* Presented at the 31st USAEE/IAEE North American Conference Austin, Texas November 4–7, 2012.

⁴⁰ Fleming (2016) and Melaina, et. al (2013).

FHWA efforts have specifically identified the need for adequate electric and natural gas infrastructure along corridors to facilitate expansion of alternative fueling infrastructure.⁴¹

More broadly, the principles above are intended to provide a flexible framework that can adapt to technology, market, and policy changes. Going forward, FHWA will monitor and engage with stakeholders on developing technologies, such as wireless electric vehicle charging and battery swapping services that could transform traditional thinking about alternative fueling infrastructure.

3.3 Enhanced Coordination Among and Between the Public and Private Sectors

Coordination between Federal, State, and local governments, as well as the private sector, will be needed to further develop corridors and extend efforts into communities and urban environments to support regional growth and the use of varied fuels.⁴²

3.3.1 Shared Alternative Fuel Infrastructure Investment

As with the NHS, USDOT seeks to ensure consistency and coordinate alternative fuel infrastructure investment across jurisdictions. As with any infrastructure investment, it is in the best interest of USDOT to determine how to support infrastructure that is for public use. Most research, as well as stakeholder efforts led by FHWA, have concluded that some level of public investment is needed to build out the alternative fuel infrastructure necessary to establish a system that fosters public confidence.⁴³ A continued dialogue regarding private- and public-sector share of investment in alternative fueling infrastructure will be important as future infrastructure investment decisions are made and more work is done to determine societal benefits of alternative fuel infrastructure. This partnership between USDOT and DOE presents an opportunity to establish unique business models and public-private partnerships, and to unify principles to ensure a robust and enduring investment in alternative fueling infrastructure. With regard to EV charging infrastructure in particular, public and private investment decisions should be made in a way that takes into account the public interest focusing on where public charging infrastructure is needed and should support a competitive market and innovation.

3.3.2 Shared Outreach and Education Efforts

Enhanced coordination, including public outreach and education efforts, should extend beyond providing highway signage and alternative fueling station information on resources such as the DOE's Alternative Fueling Station Locator. Both public and private stakeholders should be supportive and engaged in current and future designations. Further, USDOT and other Federal, State, and local agencies have an important role to convene, educate, and learn from this community of stakeholders.

3.3.3 Shared Standardization Efforts

The USDOT will continue the work started under the initial corridor designation process to engage with DOE, industry, and other appropriate public and private partners to address standardization

⁴¹ "Electric Vehicle Infrastructure Corridor Development Workshop: Lessons Learned from the West Coast Experience." Federal Highway Administration and Oregon Department of Transportation. July 26, 2015. http://altfueltoolkit.org/wp-content/uploads/2004/05/Portland_EV_Workshop_2015_factsheet.pdf.

⁴² Ibid.

⁴³ Ibid.

needs for each fuel type (some of which were discussed in the section above). As these markets continue to develop and mature along corridors and within communities, there will be a greater need for standardized infrastructure as well as for fuel providers, manufacturers, and purchasers.

4 Next Steps

4.1 Support for Current Designations

The initial designation of alternative fuel corridors is just one step toward the strategic deployment of alternative fueling infrastructure. The FHWA intends to support the current designated corridors, particularly by working with State and local agencies to convert “Signage Pending” corridors to “Signage Ready.” The FHWA intends to support these corridors through the following actions:

- Identifying existing barriers related to the installation of facilities;
- Assisting in the identification of potential sources of funding to install charging and fueling facilities;
- Promoting multi-State and regional cooperation and collaboration; and
- Coordinating and leveraging efforts with DOE’s Clean Cities Program.

The above actions will help State and local agencies, private industry, and other interested stakeholders to “build-out” a sustainable, reliable, and consistent alternative fuels transportation network for the 21st century.

4.2 Future Corridor Designations

The FHWA intends to support the expansion of the national network of alternative fuel corridors by establishing a process outlining the necessary steps and information for rolling corridor designations. The FHWA has created an [Alternative Fuel Corridors website](#) to provide information on the initial round of corridor designations and keep stakeholders and the public informed on future designations. In addition, a *Federal Register* Notice will be issued describing the process for rolling designations and announcing another round of nominations. The newly-established process will be developed to support and meet the 2020 aspirational goals. The USDOT will make efforts to revise and update requirements and criteria to keep pace with changing vehicle and fuel technologies and improvements.

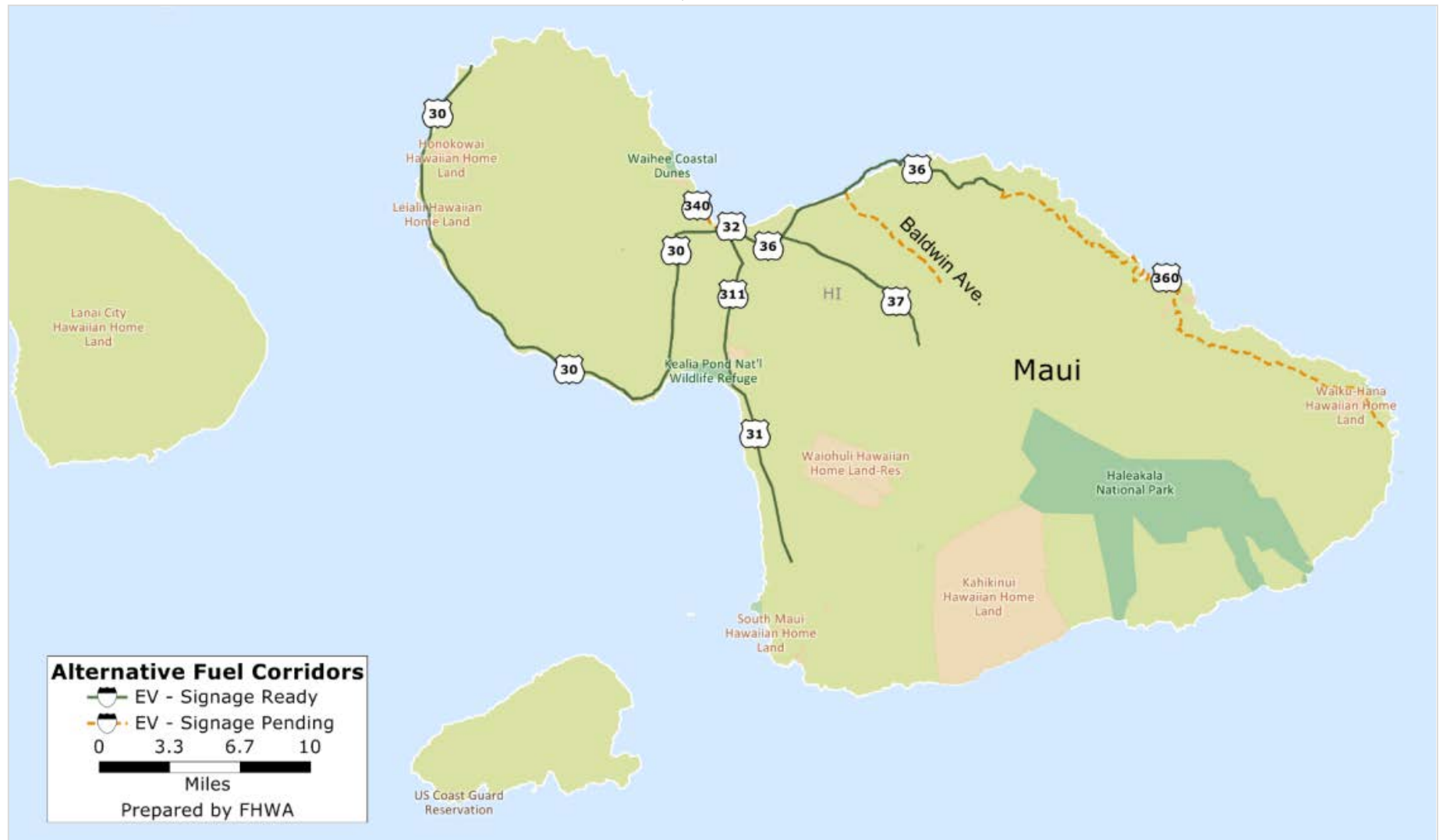
Appendix A: Map of Designated EV Corridors



Oahu, Hawaii



Maui, Hawaii



Alternative Fuel Corridors

- Hydrogen - Signage Ready
- Hydrogen - Signage Pending

0 150 300 450
Miles

Appendix C: Map of Designated Propane Corridors



Appendix D: Map of Designated Compressed Natural Gas Corridors



Appendix E: Map of Designated Liquefied Natural Gas Corridor



Appendix F: Signage Ready Designated EV Corridors

Lead Agency	Designated EV Corridor
Atlanta Regional Commission (ARC) – Georgia	I-75: From TN border to Warner Robbins. I-75: From Tifton to Valdosta.
CA (CALTRANS, CALSTA, CEC, CARB and CPUC) <i>Includes Central Coast CA (VTCT)</i>	I-5: From OR border to Stockton and from San Fernando to Mexico border. SR-99: From Wheeler Ridge to Bakersfield, and from Tulare to Red Bluff. I-8: From San Diego to El Cajon, CA. I-10: From Santa Monica to Indio. I-15: From San Diego (@start of I-15) to Barstow. I-405: From Mission Hills (@ I-5) to Irvine (@ I-5). I-80: From San Francisco to Cisco Grove. I-205: From Tracy (@ I-580) to Tracy (@ I-5). I-580: From San Rafael (@ US 101) to Tracy (@ I-5). I-710: From Los Angeles (@ E. Valley Road) to Long Beach. I-880: From San Jose (@ I-280) to Oakland (@ I-80). I-280: from San Francisco (5 th and King St) to San Jose (@ I-680). SR-1: From Camino Capistrano (@ I-5) to San Simeon, and from Monterey to Ft. Bragg. US-101: From Los Angeles (starting @ I-10/I-5 interchange) to Ukiah and from Garberville to Trinidad. SR-60: From Los Angeles (start @ I-10/I-5 interchange) to Beaumont (end @ I-10) I-680: From Cordelia to San Jose (@ I-280).
Colorado DOT	I-25: From Pueblo to Fort Collins. I-76: From Denver to Brighton. I-70: From Denver to Golden and from Frisco to Grand Junction.
Connecticut DOT	I-95: From RI border to NY border. I-91: From MA border to New Haven. I-84: From NY border to MA border. I-395: From Waterford to MA border.
City of Detroit, Michigan <i>States included in this designation cover I-94 in MI, IN, IL</i>	I-94: From Detroit to Chicago.
Georgia DOT	I-85: From Commerce, GA to AL border.
Hawaii State Energy Office (Maui)	Hwy 30 (Proposed Maui Corridor 1): From 1 Ritz Carlton Dr., Lahaina, HI (Ritz Carlton Kapaalua) to 200 S High St, Wailuku HI (Maui County Building) Hwy 32/Hwy 36 (Proposed Maui Corridor 3): From intersection of Hwy 32/Hwy 30 to intersection of Hwy 36/Hwy 380. Hwy 31/Hwy 311 (Proposed Maui Corridor 4): From intersection of Hwy 31/Hwy 32 to 3650 Wailea Alanui Dr, Kihei, HI. Hwy 36/Hwy 37 (Proposed Maui Corridor 5): From intersection of Hwy 36/Hwy 380 to 24 Kiopaa St, Makawao, HI
Hawaii State Energy Office (Oahu)	I-H1/Hwy 72 (Proposed Oahu Corridor 1/10): From 4470 Kapolei Pkwy, Kapolei, HI to 830 W Hind Dr, Honolulu, HI.

	I-H3 (Proposed Oahu Corridor 5): From intersection with I-H1 to 45-045 Kamehameha Hwy, Kaneohe, HI. I-H2/Hwy 99 (Proposed Oahu Corridor 6/7): From intersection of I-H2/ I-H1 to 64-1550 Kamehameha Hwy, Wahiawa, HI.
Houston-Galveston Area Council, Texas	I-45: From Huntsville to Galveston. I-69: From Stafford to Humble. Beltway 8: Entire length of corridor.
Idaho DOT	I-15: From Pocatello to Idaho Falls.
Illinois DOT Mid-America (I-80) <i>States included in this designation cover I-80 in IL, IA, IN, OH, PA, NJ, NY</i>	I-80: From Manhattan to Budd Lake, NJ; from Streetsboro, OH to Elyria OH; from South Bend, IN to Joliet, IL; and, from Davenport IA to Iowa City, IA.
Illinois State Energy Office <i>States included in this designation cover I-80 in IL, WI</i>	I-90: From IN border to Sun Prairie, WI; and, from La Crosse, WI to Sparta, WI. I-94: From Sun Prairie, WI to IL/IN border. I-55: From Chicago, IL to Bloomington, IL. I-80: From IN border to Joliet, IL. I-39: From Rockford, IL to Sun Prairie, WI. I-74: From Davenport, IL to Danville, IL. I-43: From Elkhorn, WI to Green Bay.
Maryland DOT	I-95: From DE state line to VA state line. I-270: Entire length of corridor. I-70: From Baltimore to Hagerstown. US-50: From Washington, DC border to Ocean City.
Minnesota DOT <i>States included in this designation cover I-94 in MN, WI, IL, IN, MI</i>	I-94: From Detroit MI to Sun Prairie, WI and Minneapolis MN to St. Cloud MN
Missouri State Energy Office	I-29: From Kansas City to St. Joseph. I-55: From St. Louis to Festus. I-70: From St Louis to Wentzville and from Kansas City to Oak Grove. I-35: From Mission, KS to Kearney, MO
Nebraska State Energy Office	I-80: From IA border to Lincoln; from Kearney to Lexington; and from North Platte to Ogallala.
Nevada DOT	I-15: From Las Vegas to CA border in Primm.
New York State DOT	I-87: From Lake George, NY to Manhattan. I-90: From PA/NY border to Bowmansville; from Syracuse to Utica; and, from Albany to MA border. I-95: From NY/CT border to NY/NJ border. I-84: From NY/CT border to Middletown NY.
North Carolina DOT	I-40: From Raleigh to Hickory and from Black Mountain to Asheville.

	I-85: From Raleigh to Gastonia. I-30: From Greenville to west end of I-30 at I-20 junction. I-20: From Weatherford to 102 S. Beltline Rd in Dallas. I-35W: Entire length of corridor from Denton (northern end) to southern end of I-35 W at the intersection with I-35/I-35E. I-35E: Entire length of corridor from Denton (northern end) to southern end of I-35E at the intersection with I-35/I-35W. I-35: From southern intersection of I-35E/I-35W to San Antonio. I-10: From Baytown to Katy and from San Antonio to Kerrville (westbound)
North Central Texas Council of Governments, Texas	
North Florida Transportation Planning Organization	I-95: From GA border to St. Augustine I-295: Entire length of corridor
Oklahoma DOT	I-35: From Norman to Oklahoma City.
Oregon DOT	I-84: From Portland to The Dalles.
Oregon and Washington DOT	I-5: From Canadian border to CA border. US-101: From Astoria to CA border.
PA Turnpike Commission	I-76: From OH border to Hunker and from Mechanicsburg to Philadelphia. I-276: From Western start of I-76 in King of Prussia to PA/NJ border. I-476: From Wilkes-Barre to Ridley, PA (intersection with I-95).
South Carolina Energy Office	I-85: From GA border to NC border. I-77: From NC border to the end of I-77 in Columbia. I-26: From Columbia to Orangesburg and from North Charleston to Charleston.
Tennessee DOT	I-40: From Dandridge to Nashville.
Texas DOT	I-45: From Huntsville to Galveston.
Utah DOT	I-15: From Ogden to Springville. I-80: From Salt Lake City to Park City
Vermont DOT (Transportation Climate Initiative) <i>States included in this designation cover ME, NH, VT, MA, RI, CT, NY, NJ, PA, DE MD, and the District of Columbia</i>	I-95: From Augusta Maine to the DC/VA border. I-91: From Norwich, VT to New Haven, CT. I-87: From Manhattan to Lake George, NY. I-89: From Lebanon, NH to Canadian border. I-90: From Boston to Albany; from Syracuse to Utica; from Bowmansville, NY to PA/NY border. I-93: From VT border to Braintree, MA. I-84: From Middletown NY to CT/MA border. I-70: From Baltimore, MD to Hagerstown, MD.
Virginia State Energy Office	I-95: From Washington, D.C. to Petersburg VA. I-64: From VA Beach to WV border. I-81: From Harrisonburg to Marion, VA. I-66: From Strasburg to Washington D.C.

Appendix G: Signage Ready Designated Hydrogen Corridors

Lead Agency	Designated Hydrogen Corridor
CA (CALTRANS, CALSTA, CEC, CARB and CPUC)	I-5: From San Juan Capistrano to Burbank. I-405: From Los Angeles (@ Santa Monica Blvd) to Irvine (@ I-5). I-80: From San Francisco to NV border. I-710: From Los Angeles (@ E Valley Rd) to Long Beach. I-880: From San Jose (@ I-280) to Oakland (@ I-80). I-280: From San Bruno (@ I-380) to San Jose (@ I-680). SR 1: From Newport Beach to Santa Barbara. US 101: From Los Angeles (start @ I-10/I-5 interchange) to Santa Barbara and from San Jose to Mill Valley. SR 60: From Los Angeles (start @ I-10/I-5 interchange) to Diamond Bar (@ SR-57).

Appendix H: Signage Ready Designated Propane Corridors

Lead Agency	Designated Propane Corridor
Colorado DOT	I-25: From Pueblo to Denver. I-70: From Denver to Limon.
Connecticut DOT	I-84: From NY border to MA border.
Houston-Galveston Area Council	Beltway 8: Entire length of corridor. I-69: From Rosenberg to Kingwood.
Illinois DOT Mid-America (I-80) <i>States included in this designation cover I-80 in IL, IA, IN, OH, PA, NJ, NY</i>	I-80: From Clarion, PA to Columbia Station, OH and from Dolton, IL to Morris, IL.
Illinois State Energy Office <i>States included in this designation cover I-80 in IL, WI</i>	I-74: From Danville, IL to Moline, IL. I-90 and I-94: From IN border to Madison, WI. I-55: From Chicago to St. Louis. I-80: From IL/IN border to Morris, IL. I-39: From Bloomington IL to Rothschild, WI. I-43: From Howard, WI to Elkhorn, WI.
Missouri State Energy Office	I-70: From St. Louis to Kansas City. I-55: From St. Louis to Cape Girardeau.
New York State DOT	I-90: From Buffalo to West Henrietta.
North Central Texas Council of Governments, Texas	I-10: From Houston to San Antonio. I-30: From Mesquite TX to Fort Worth. I-20: From Longview to Fort Worth. I-35/I-35E/I-35W: From Denton to San Antonio.
North Florida Transportation Planning Organization	I-295: Entire length of corridor
South Carolina Energy Office	I-26: From Spartansburg, SC to Charleston, SC. I-20: From Camden, SC to GA border.
Utah DOT	I-15: From Ogden to Springville. I-80: From Salt Lake City to NV border.
Virginia State Energy Office	I-95: From Washington, D.C. to Ashland, VA. I-64: From Richmond to Chesapeake.
Washington State DOT	I-5: From Burlington, WA to Lakewood, WA.

Appendix I: Signage Ready Designated Natural Gas Corridors

Lead Agency	Designated CNG Corridor	Designated LNG Corridor
Atlanta Regional Commission, Georgia	I-75: From TN border to FL border.	
CA (CALTRANS, CALSTA, CEC, CARB and CPUC)	I-5: From Woodland to the Mexico border. SR-99: From Wheeler Ridge to Red Bluff. I-8: From San Diego to La Mesa, CA. I-10: From Santa Monica to AZ border. I-15: From San Diego to Barstow. I-405: From Mission Hills (@ I-5) to Irvine (@ I-5). I-80: From San Francisco to Auburn. I-205: From Tracy, CA (@ I-580) to Tracy, CA (@ I-5). I-580: From San Rafael (@ I-101) to Tracy (@ I-5). I-710: From Los Angeles (@ E. Valley Road) to Long Beach. I-880: From San Jose (@ I-280) to Oakland (@ I-80). I-280: From San Francisco (5th and King St) to San Jose (@ I-680). I-680: From Cordelia to San Jose (@ I-280). SR-1: From Camino Capistrano (@ I-5) to San Luis Obispo and from Castroville to San Francisco. US-101: From Los Angeles (@ I-10/I-5 interchange) to Santa Rosa. SR-60: From Los Angeles (@ I-10/I-5 interchange) to Beaumont.	I-5: From Sacramento to Mexico border. SR-99: From Wheeler Ridge to Sacramento I-10: From Los Angeles to Indio. I-15: From Ontario to NV border. I-710: From Los Angeles (@ E. Valley Road) to Long Beach. SR-60: From Los Angeles (@ I-10/I-5 interchange) to Beaumont. I-40: From Barstow to AZ border.
Colorado DOT	I-70: From Grand Junction to Glenwood Springs and from Aurora to Denver. I-25: From Trinidad to the CO/WY border.	
Connecticut DOT	I-95: From RI border to NY border. I-91: From MA border to New Haven.	
Georgia DOT	I-85: From SC border to College Park, GA.	
Houston-Galveston Area Council	I-45: From Houston, to Dallas. I-69: From Rosenberg to 15868 International Plaza Dr., Houston. Beltway 8: Entire length of corridor.	
Idaho DOT		I-84/I-86/I-15: From Nampa to Idaho Falls. I-15: From ID/UT border to the intersection with I-86 (and to Idaho Falls). I-84: From the ID/UT border to the intersection with I-86 (and to Nampa).
Illinois DOT Mid-America	I-80: From DuBois, PA to Brook Park, OH; from South Bend, IN to Davenport, IA; and, from Des Moines, IA to NE border.	

<i>States included in this designation cover I-80 in IL, IA, IN, OH, PA, NJ, NY</i>		
Illinois State Energy Office <i>States included in this designation cover I-80 in IL, WI</i>	I-74: From Iowa border to IN border. I-80: From Iowa to IN border. I-39: Rockford, IL to Wausau, WI I-43: From Green Bay WI to New Berlin, WI I-90: From La Crosse, WI to IL/IN border. I-94: From MN/WI border to Eau-Claire, WI. I-94: From Windsor, WI to IL/IN border. I-55: From Chicago to Joliet IL	
Missouri State Energy Office	I-70: From St. Louis to Kansas City. I-29: From Kansas City to St. Joseph. I-44: From Springfield to OK border.	
Nebraska State Energy Office	I-80: From Omaha to Lincoln.	
New York State DOT	I-90: From PA/NY border to MA border. I-87: From Saratoga Springs to Manhattan.	
North Carolina DOT	I-40: From Raleigh to Asheville. I-85: From Raleigh to Charlotte.	
North Central Texas Council of Governments, Texas	I-30: From Rockwall to west end of I-30 at I-20 junction. I-20: From Weatherford TX to LA border and from Sweetwater to Midland. I-35/I-35E/I-35W: from Mexico border to OK border. I-10: From LA border to Kerrville.	I-35W/I-35: From Fort Worth to San Antonio. I-35E/I-35: From Dallas to San Antonio. I-10: From Baytown to San Antonio. I-30: From Sulfur Springs to Dallas.
North Florida Transportation Planning Organization	I-95: From Jacksonville to St. Augustine. I-295: Entire length of corridor	
Oklahoma DOT	I-40, I-35 and I-44: Entire length of corridors in OK.	
Oregon DOT	I-5: From WA/OR border to Eugene, OR.	
PA Turnpike Commission	I-76: From Philadelphia to OH border I-276: Entire length of corridor. I-476: Entire length of corridor.	
South Carolina Energy Office	I-85: From the NC border to the GA border.	
Texas DOT	I-45: From Houston to Dallas.	
Utah DOT	I-15: From Idaho border to AZ border	I-15: From Idaho border to AZ border
Washington State DOT	I-5: From Everett, WA to WA/OR border.	

Appendix J: Signage Pending Designated Corridors

Lead Agency	EV Corridor	CNG Corridor	LNG Corridor	LPG Corridor	Hydrogen Corridor
North Carolina DOT	I-40: From Hickory to Black Mountain. I-85: From Gastonia to SC border.				
Connecticut DOT		I-84: From NY border to MA border. I-395: From Waterford to MA border.	I-95, I-91, I-84, I-395 : No existing LNG corridors.	I-95: From RI border to NY border. I-91: From MA border to New Haven. I-395: From Waterford to MA border.	I-95, I-91, I-84, I-395: No existing Hydrogen corridors.
Maryland DOT	I-70/I-68: From Hagerstown to WV border.				
Atlanta Regional Commission, Georgia	I-75: From Warner Robbins to Tifton; Valdosta to FL border.				
Hawaii State Energy Office (Maui)	Proposed Maui corridor segments 2, 6, and 7, and proposed corridors on Lanai and Molokai.				
Hawaii State Energy Office (Oahu)	Hwy 72 (Proposed Oahu Corridor 10): From 830 W Hind Dr, Honolulu, HI to intersection w/Hwy 61 in Kailua. Hwy 99 (Proposed Oahu Corridor 7): From 64-1550 Kamehameha Hwy, Wahiawa, HI to intersection of Hwy 99/Hwy 83. Proposed Oahu corridor segments: 2, 3, 4, 8, 9, 11, and 12.				
CA (CALSTA, CALTRANS, CEC, CARB, CPUC)	I-5: From Stockton to San Fernando SR-99: From Bakersfield to	I-5: From OR border to Woodland. I-8: From La Mesa, CA	I-15: From Ontario to San Diego. I-5: Sacramento to OR		All interstates and portions of interstates (I-5, I-8, I-10, I-15, I-40, I-80, I-205, I-

<i>Includes Central Coast CA (VTCT)</i>	Tulare. I-8: From El Cajon, CA to AZ border. 1-10: From Indio to AZ border. I-15: From Barstow to NV border. 1-40: Barstow to AZ border. I-80: From Cisco Grove to NV border. SR 1: From San Simeon to Monterey; and from Fort Bragg to Leggett. US 101: From Ukiah to Garberville; and from Trinidad to OR border.	to AZ border. I-15: From Barstow to NV border. I-80: From Auburn to NV border. SR-1: From San Luis Obispo to Castroville; San Francisco to Leggett. US 101: From Santa Rosa to OR border.	border. 1-10: From Indio to AZ border. SR-99: From Sacramento to the northern end of SR-99 at the intersection of I-5 in Red Bluff. All other interstates/ highways (I-8, I-40, I-80, I-205, I-280, I-405, I-580, I-680, I-710, I-880, US 101, SR-1, SR-60 SR-99) & portions of interstates not designated "sign ready".		280, I-405, I-580, I-680, I-710, I-880) and other highways (US 101, SR-1, SR-60 SR-99) not designated as "sign ready".
Idaho DOT	I-15: From Pocatello to UT border; and from Idaho Falls to MT border. I-84, I-86, I-90: Entire length of highway in ID.	I-15, I-84, I-86, I-90: Entire length of highway in ID.	I-84: From ID/OR border to Nampa. I-15: From Idaho Falls to ID/MT border. I-90: Entire length of highway in ID.		
Oregon DOT	I-84: From The Dalles to Idaho border.	I-5: From Eugene to CA border. I-84: Entire length of corridor.	I-5, I-84: No existing LNG corridors.		
Oregon and Washington DOT	US-101: From Astoria, OR to Canadian border.				
NCTCOG, Texas	I-30: From Greenville to AR border. I-20: From West end of I-20 at I-10 junction to Weatherford, and from 102 S. Beltline Rd., Dallas to LA border. I-35: From northern end of I-35E/I-35W to the OK border.	I-30: From Rockwall to AR border. I-20: From Weatherford to Sweetwater and from Midland to NM border. I-10: From Kerrville to	I-35W/I-35: From OK border to Fort Worth. I-35E/I-35: From OK border to Dallas. I-35: From San Antonio to Mexico border. I-10: From LA/TX	I-30: From Mesquite to AR border and from Fort Worth to west end of I-30 at I-20 junction. I-20: From LA border to Longview and from Fort Worth to west end of I-20 at I-10 junction.	

	I-35: From San Antonio to Mexico border. I-10: From LA border to Baytown, from Katy to San Antonio, and from Kerrville to Mexico border.	NM border.	border to Baytown and from San Antonio to NM/TX border. I-20: From LA/TX border to west end of I-20 at I-10 junction I-30: From AR border to Sulfur Springs and from Dallas west end of I-30 at I-20 junction.	I-35: From Denton to OK border and from San Antonio to Mexico border. I-10: From LA border to Houston and from San Antonio to NM border.	
Colorado DOT	I-76: From NE border to Brighton. I-70: From UT border to Grand Junction; Frisco to Golden; Denver to KS border. I-25: From Pueblo to NM border; Fort Collins to WY border.	I-70: From UT border to Grand Junction; from Glenwood Springs to Denver; and from Aurora to CO/KS border. I-76: From NE border to Denver.	I-70, I-76, I-25: No existing LNG corridors.	I-70: From KS border to Limon; and from Denver to UT border. I-25: From Pueblo to NM border; and from Denver to WY border. I-76: From NE border to Denver.	I-70, I-76, I-25: No existing Hydrogen corridors.
Utah DOT	I-15: From Ogden to Idaho border; and from Springville to AZ border. I-80: From Park City to WY border; and from Salt Lake City to NV border. I-70: No facilities.	I-80: From WY border to NV border. I-70: No facilities.	I-70: No facilities. I-80: No facilities	I-15: From Ogden to Idaho border. I-80: From Salt Lake City to WY border. I-70: No facilities.	
Illinois DOT Mid America <i>States included in this designation cover I-80 in IL, IA, IN, OH, PA, NJ, NY</i>	I-80: From Budd Lake, NJ to Streetsboro, OH; from Elyria, OH to South Bend, IN; from Joliet, IL to Davenport, IA; and from Iowa City, IA to IA/NE border.	I-80: From Manhattan to DuBois, PA; from Brook Park, OH to South Bend, IN; and from Davenport, IA to Des Moines, IA.	I-80: No facilities.	I-80: From Manhattan to Clarion, PA; from Columbia Station, OH to Dolton, IL; and from Morris, IL to IA/NE border.	I-80: From New York to Iowa/Nebraska border.
Tennessee DOT	I-40: From Memphis to Nashville.	I-40: No existing CNG corridor.	I-40: No existing LNG corridor.	I-40: No existing LPG corridor.	
Oklahoma DOT	I-35: From Oklahoma City to OK/KS border; and from Norman to OK/TX border. I-40: No facilities.				

	I-44: No facilities.				
Missouri State Energy Office	I-29: From St. Joseph to IA border. I-35: From Kearney to IA border. I-55: From Festus to AR border. I-70: From Wentzville to Oak Grove. I-44: No facilities. I-49: No facilities.	I-29: From St. Joseph to IA border. I-44: From Springfield to St. Louis. I-35: No facilities. I-49: No facilities. I-55: No facilities	I-70: From KC to St. Louis. I-29: No facilities. I-35: No facilities. I-44: No facilities. I-49: No facilities. I-55: No facilities	I-55: From Cape Girardeau to AR border. I-29: Entire length of highway in MO. I-35: Entire length of highway in MO. I-44: Entire length of highway in MO. I-49: Entire length of highway in MO.	I-29, I-35, I-44, I-49, I-55, I-70: No existing Hydrogen corridors.
Illinois State Energy Office <i>States included in this designation cover I-80 in IL, WI</i>	I-90: From Sun Prairie, WI to Sparta, WI. I-94: From Sun Prairie, WI to MN border. I-55: From Bloomington, IL to St. Louis. I-80: From Joilet, IL to IL/IA border. I-39: From Normal, IL to Rockford, IL; and from Sun Prairie, WI to Rothschild, WI I-43: From Beloit, WI to Elkhorn, WI.	I-43: From New Berlin, WI to Beloit WI I-94: From Windsor, WI to Eau Claire, WI. I-39: From Normal, IL to Rockford, IL I-55: From Joliet IL to IL/MO border.	I-90, I-94, I-55, I-80, I-39, I-43, I-74: No existing LNG corridors.	I-43: From Elkhorn, WI to Beloit, WI. I-90 / I-94: From Madison to WI/MN border. I-80: From Morris, IL to IA/IL border.	I-90, I-94, I-55, I-39, I-43, I-74: No existing Hydrogen corridors.
Omaha Nebraska COG <i>States included in this designation cover NE, IA</i>	US 6: Entire length of corridor from intersection of US 6 and Rt. 31 in Gretna NE to the intersection of US 6 and I-80 in Council Bluffs IA.	US 6: Entire length of corridor from intersection of US 6 and Rt. 31 in Gretna NE to the intersection of US 6 and I-80 in Council Bluffs IA.		US 6: Entire length of corridor from intersection of US 6 and Rt. 31 in Gretna NE to the intersection of US 6 and I-80 in Council Bluffs IA.	
Houston-Galveston Area Council	I-69: From northern end of I-69 to Humble and from Stafford to southern end of I-69. I-45: From northern end of I-45 in Dallas to Huntsville.	I-45: From Houston to the southern end of I-45. I-69: From 15868 International Plaza Dr, Houston to northern end of I-69.	I-45, I-69, Beltway 8: No existing LNG corridors.	I-45: From Galveston to Dallas. I-69: From Kingwood to northern end of I-69.	I-45, I-69, Beltway 8: No existing Hydrogen corridors.

Nebraska State Energy Office	I-80: From Lincoln to Kearney; from Lexington to North Platte; and from Ogallala to NE/WY border.	I-80: From Lincoln to WY border.		I-80: Entire length of highway. No existing LPG corridors.	
New York State DOT	I-90: From Bowmansville to Syracuse; and from Utica to Albany. I-87: From Lake George to Canada border. I-84: From NY/PA border to Middletown NY.	I-87: From Saratoga Springs to Canada border. I-95: From NY/CT border to NY/NJ border. I-84: From NY/CT border to NY/PA border.	I-90, I-95, I-87, I-84: No existing LNG corridors.	I-90: From West Henrietta to the NY/MA border. I-95, I-87, I-84: No existing LPG corridors.	I-90, I-95, I-87, I-84: No existing Hydrogen corridors.
North Florida Transportation Planning Organization	I-10: From Jacksonville to Lake City. FL 105: Entire length of corridor. A1A: Entire length of corridor.	I-95: From GA border to Jacksonville. I-10: From Jacksonville to Lake City. FL 105: Entire length of corridor. A1A: Entire length of corridor.	I-95, I-10, FL 105, A1A: No existing LNG corridors.	I-95: From GA border to St. Augustine I-10: From Jacksonville to Lake City. FL 105: Entire length of corridor. A1A: Entire length of corridor.	I-95, I-10, FL 105, A1A: No existing Hydrogen corridors.
Vermont DOT-(Transportation Climate Initiative) <i>States included in this designation cover ME, NH, VT, MA, RI, CT, NY, NJ, PA, DE MD, and the District of Columbia</i>	I-91: From Norwich, VT to Canada border. I-87: From Lake George, NY to Canada border. I-89: From Lebanon, NH to Concord, NH. I-90: From Bowmansville to Syracuse; and from Utica to Albany. I-84: From Middletown NY to the NY/PA border.				
Minnesota DOT <i>States included in this designation cover I-94 in MN, WI, IL, IN, MI</i>	I-94: From Sun Prairie, WI to Minneapolis MN and St. Cloud to MN/ND border.				
South Carolina	I-26: From NC border to	I-20: Entire length of		I-20: From Florence to	

State Energy Office	Columbia; and from Orangeburg to North Charleston. I-20: From Florence to SC/GA border. I-95: From SC/NC border to SC/GA border.	corridor. I-26: Entire length of corridor. I-77: Entire length of corridor. I-95: Entire length of corridor.		Camden. I-95: Entire length of corridor. I-77: Entire length of corridor. I-85: Entire length of corridor.	
Texas DOT	I-45: From northern end of I-45 in Dallas to Huntsville.	I-45: From Houston to the southern end of I-45.		I-45: Entire length of corridor from Galveston to Dallas.	
Virginia State Energy Office	I-85: From Petersburg to VA/NC border. I-81: From MD border to Harrisonburg; and from Marion to TN border. I-95: From Petersburg to VA/NC border.	I-95: From Richmond to NC border. I-64: From Richmond to WV border. I-81: No facilities. I-66: No facilities.		I-95: From Ashland to NC border. I-64: From Richmond to WV border. I-85, I-66, I-81: No facilities.	
Georgia DOT	I-85: From Commerce to SC border.	I-85: From College Park to AL border.			
PA Turnpike Commission	I-76: From Hunker to Mechanicsburg. I-476: From Wilkes-Barre to end in Chinchilla (intersection with I-81).				
Washington State DOT		I-5: From Canada border to Everett, WA.	I-5: From Canada border to the OR border.	I-5: From Canada border to Burlington, WA; and from Lakewood WA to the OR border.	
Nevada DOT	I-15: From Las Vegas to AZ border. Proposed corridors for I-80, US-95, US-50	Proposed corridors for 1-15, I-80, US-95, US-50	Proposed corridors for 1-15, I-80, US-95, US-50		