

# Alternative Fuel Corridors and Signage

- Speakers:
  - **Diane Turchetta**, Transportation Specialist, U.S. DOT Federal Highway Administration
  - **Casey Langford, Ph.D.**, Planning Manager, Long Range Planning Division, Tennessee Department of Transportation

BEGIN

ALTERNATIVE  
FUELS  
CORRIDOR



# Alternative Fuel Corridors

NATIONAL GOVERNORS ASSOCIATION

TRANSPORTATION ELECTRIFICATION WORKSHOP

MARCH 11 & 12, 2019

NASHVILLE, TN

DIANE TURCHETTA | U.S. DEPARTMENT OF TRANSPORTATION

# National Alternative Fuel Corridors



To improve the mobility of alternative fuel vehicles, the U.S. Department of Transportation (DOT) has designated national corridors in strategic locations along major highways for:

- ▶ Plug-in electric vehicle charging
- ▶ Hydrogen fueling
- ▶ Propane (LPG) fueling
- ▶ Natural gas (CNG, LNG) fueling

# Benefits of a National System

## ALTERNATIVE FUELS CORRIDOR

- Allows for inter-city, regional, and national travel using clean-burning fuels
- Addresses range anxiety
- Integrates with existing transportation planning processes
- Accelerates public interest and awareness of alternative fuel availability

# Corridor-Ready Criteria

EV	CNG	LNG	Hydrogen	Propane
DCFC only	150 miles between stations	200 miles between stations	100 miles between stations	150 miles between stations
50 miles between stations	5 miles from highway			5 miles from highway
5 miles from highway	Public stations only	5 miles from highway	5 miles from highway	Public stations only
Public stations only (no Tesla)	Fast fill, 3,600 psi	Public stations only	Public stations only	Primary stations only



# Highway Signage

## ➤ MUTCD Memorandum – Signing for Designated Corridors

- ✓ Provides guidance to State DOTs
- ✓ First corridor signs installed on I-94 and I-26
- ✓ FHWA developed FAQs to address commonly asked questions (see AFC website)

I-94 (Minnesota)



I-26 (South Carolina)

# Combined Results

## Rounds 1&2

- Designations....
  - ✓ **58** nominations
  - ✓ Includes portions/segments of **84** Interstates, along with **43** US highways/state roads
  - ✓ Comprise **44 states plus D.C.**
  - ✓ Covers **over 100,000** miles of the National Highway System (all fuels combined)

# FY 2018 Request for Nominations

- Round 3 request for nominations - October 2018
- Distributed through FHWA Division Offices
- Nominations due the end of January 2019
- Designations made in spring 2019
- No change in designation criteria
- Some changes in shapefile submissions





# Federal Highway Administration Regional Alternative Fuel Corridor Convenings

- ▶ Team to hold 5 regional convenings:
  - ▶ To Date: Midwest (MN), Southeast (SC)
  - ▶ Next Up: South Central (TX) Northeast/Mid-Atlantic (RI) and REV West (Salt Lake City)
- ▶ Strengthen coordination b/w states, public and private partners
- ▶ Evaluate regional priorities & needs, programs, and resources to expand corridors
- ▶ Identify critical infrastructure gaps
- ▶ Discuss a regional strategy to promote clean vehicle adoption and corridor growth
- ▶ Foster partnership development

## 2 Regional Convenings to Date

**Midwest AFC**  
St. Paul, MN  
June 12, 2018



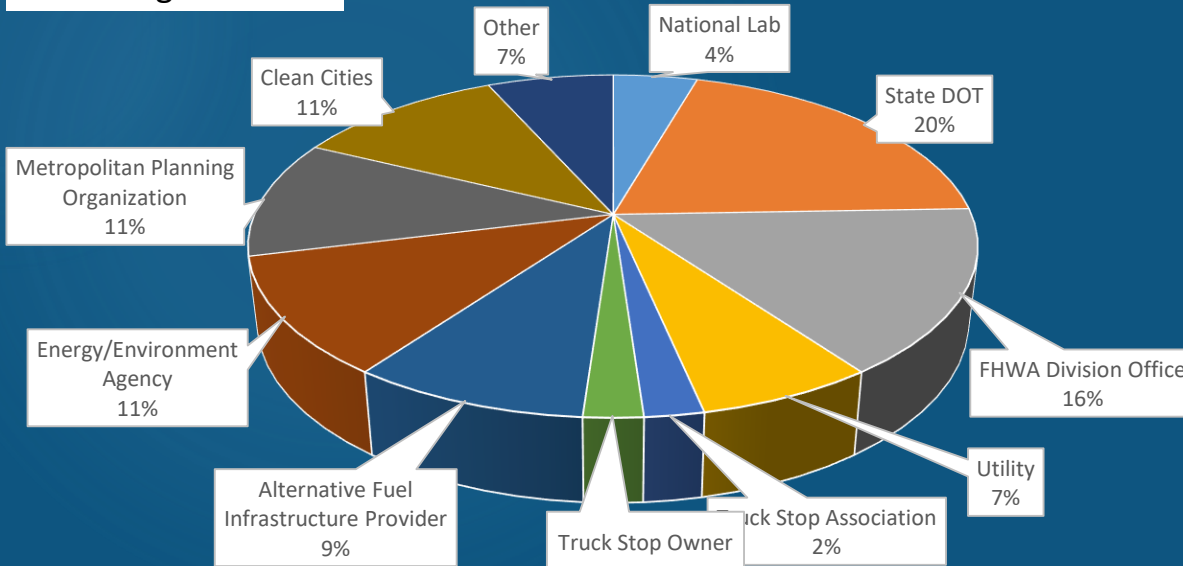
**Southeast AFC**  
Charleston, SC  
September 25, 2018

# Convening Results

## MIDWEST – St. Paul, MN (June 12, 2018)

- ▶ 9 States: ND, SD, MN, WI, MI, OH, IL, IN, IA
- ▶ 52 stakeholders
- ▶ Fuels of Interest: EV, CNG and H2
- ▶ # of Designated Corridors: 26 (SD none)

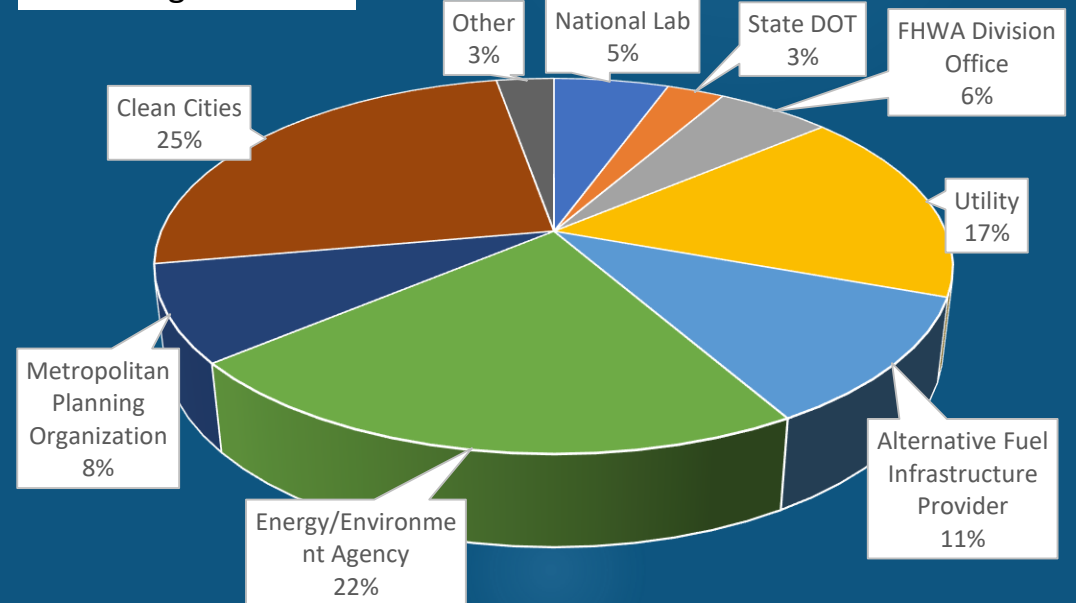
Convening Attendees



## SOUTHEAST – Charleston, SC (Sept. 25, 2018)

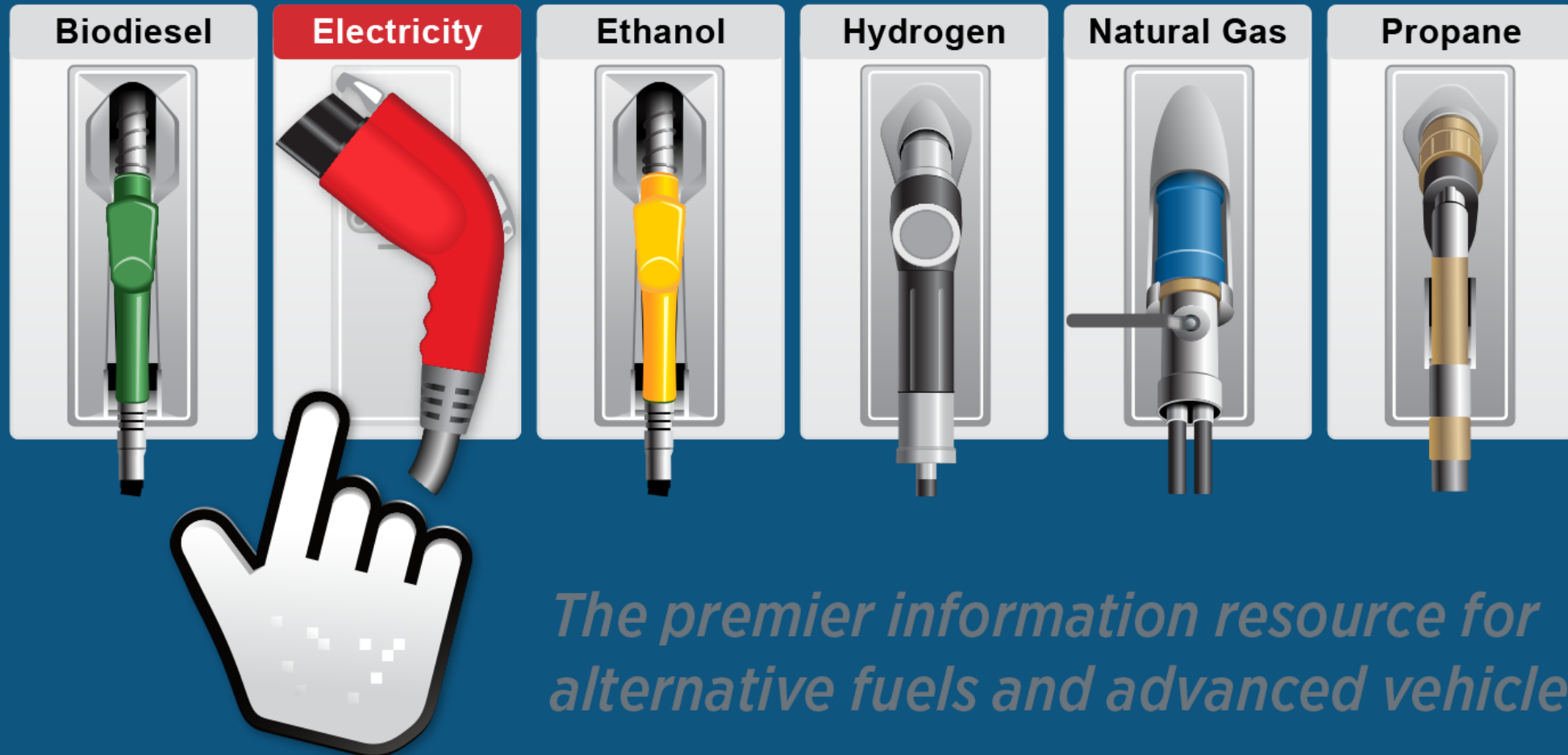
- ▶ 8 States: KY, TN, NC, SC, AL, MS, GA, & FL
- ▶ 45 stakeholders
- ▶ Fuels of Interest: EV, CNG, LNG and LPG
- ▶ # of Designated Corridors: 30 (MS none)

Convening Attendees



# Alternative Fuels Data Center

[afdc.energy.gov](http://afdc.energy.gov)

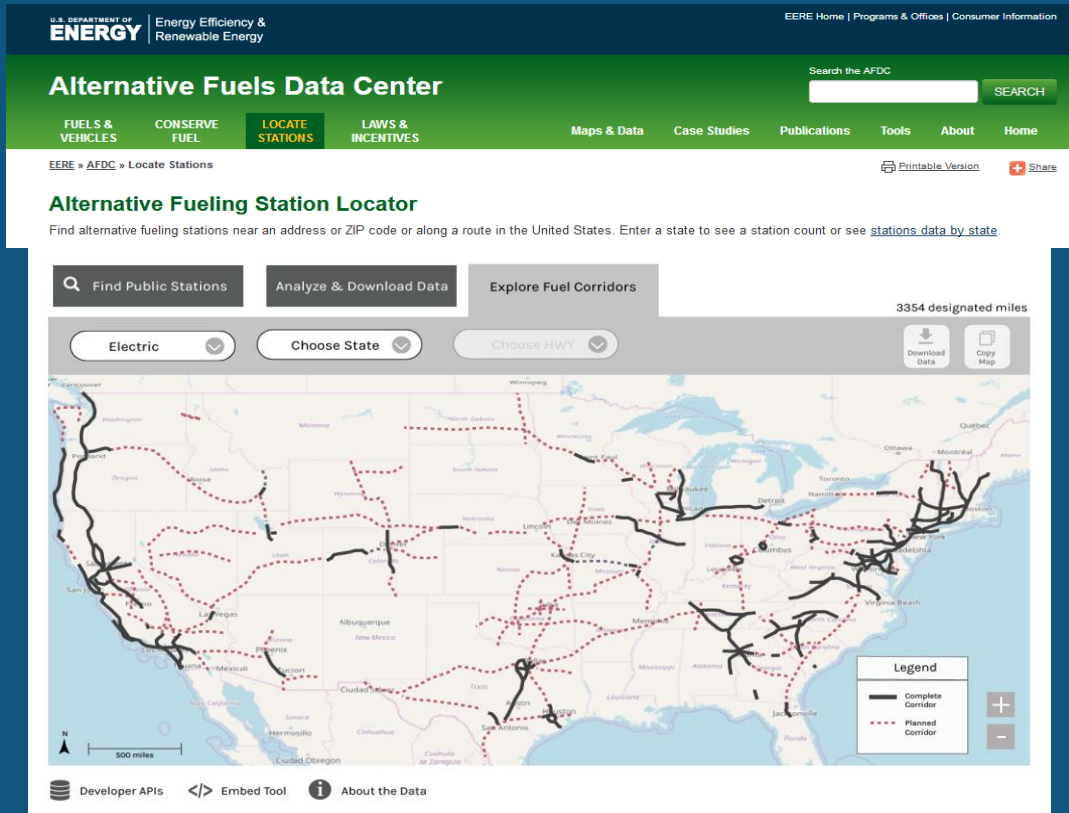


*The premier information resource for  
alternative fuels and advanced vehicles*



# Embeddable Application

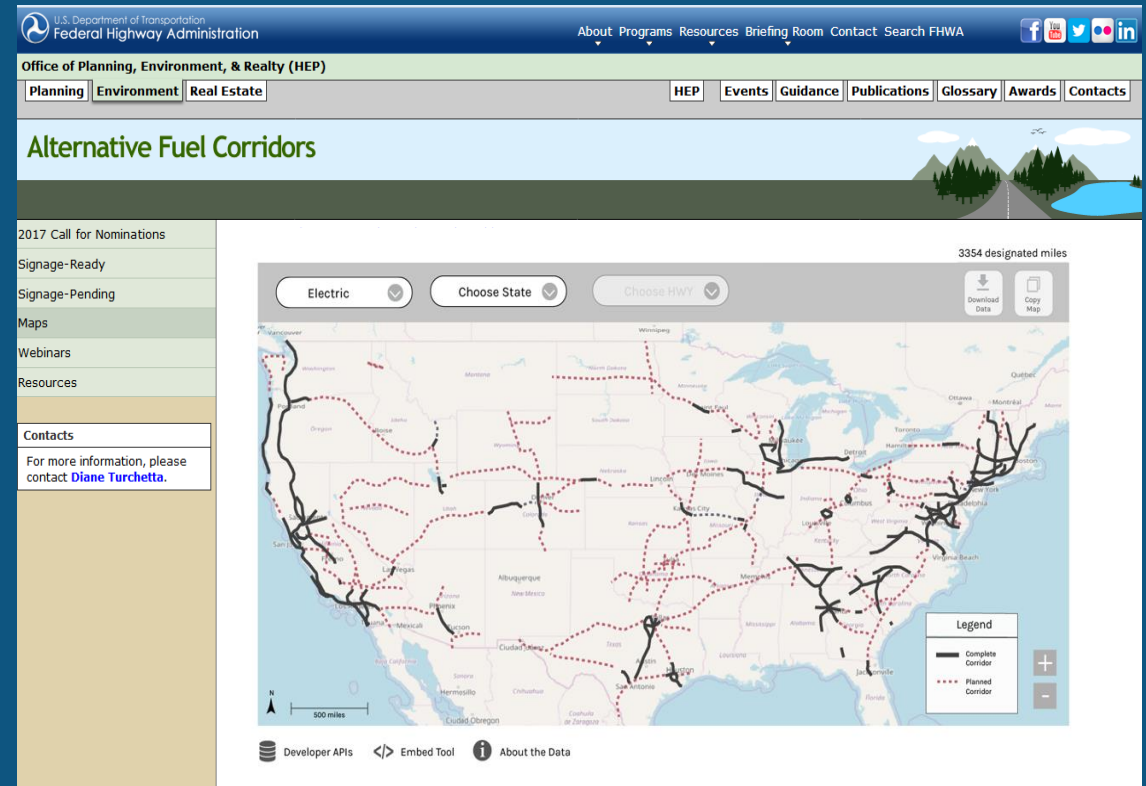
[afdc.energy.gov/corridors](https://afdc.energy.gov/corridors)



1

## Alternative Fuels Data Center

The corridor mapping tool will be available as a third tab on the Alternative Fueling Station Locator.



2

## Federal Highway Administration

The corridor mapping tool can be embedded as a standalone application on the FHWA website or any other website.

# Resources for Nominating Corridors

[afdc.energy.gov/corridors](https://afdc.energy.gov/corridors)

## Alternative Fuels Data Center

FUELS &  
VEHICLES

CONSERVE  
FUEL

LOCATE  
STATIONS

LAWS &  
INCENTIVES

Maps & Data

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### Station Data for Nominating Alternative Fuel Corridors

The table below provides station data and shapefiles by state and fuel type. These datasets include public stations with the following filters applied to meet the criteria for nominating alternative fuel corridors:

- **EV charging** – only DC fast electric vehicle (EV) charging stations, excluding Tesla
- **Hydrogen** – only retail stations (Non-retail stations may be used in corridor nominations if the stations are compliant with SAE J2601 standards and meet all of the criteria for a hydrogen corridor.)
- **Propane** – only “primary” liquefied petroleum gas (LPG) stations, which have fuel for vehicles and vehicle-specific fueling services that are consistently offered during business hours
- **CNG** – only fast-fill compressed natural gas (CNG) stations that offer a fill pressure of 3,600 psi
- **LNG** – all liquefied natural gas (LNG) stations

The data downloads are CSVs with current station data pulled automatically from the [Alternative Fueling Station Locator](#). The shapefiles are ZIP downloads with a static snapshot of the stations as of Sept. 5, 2018, including stations outside state borders within 25 miles.

Learn more about corridor designations from the [Federal Highway Administration](#).

































### Explore Potential Corridors

Use the prototype mapping tool to explore potential corridors by fuel:

- [EV charging](#)
- [Hydrogen](#)
- [Propane](#)
- [CNG](#)
- [LNG](#)

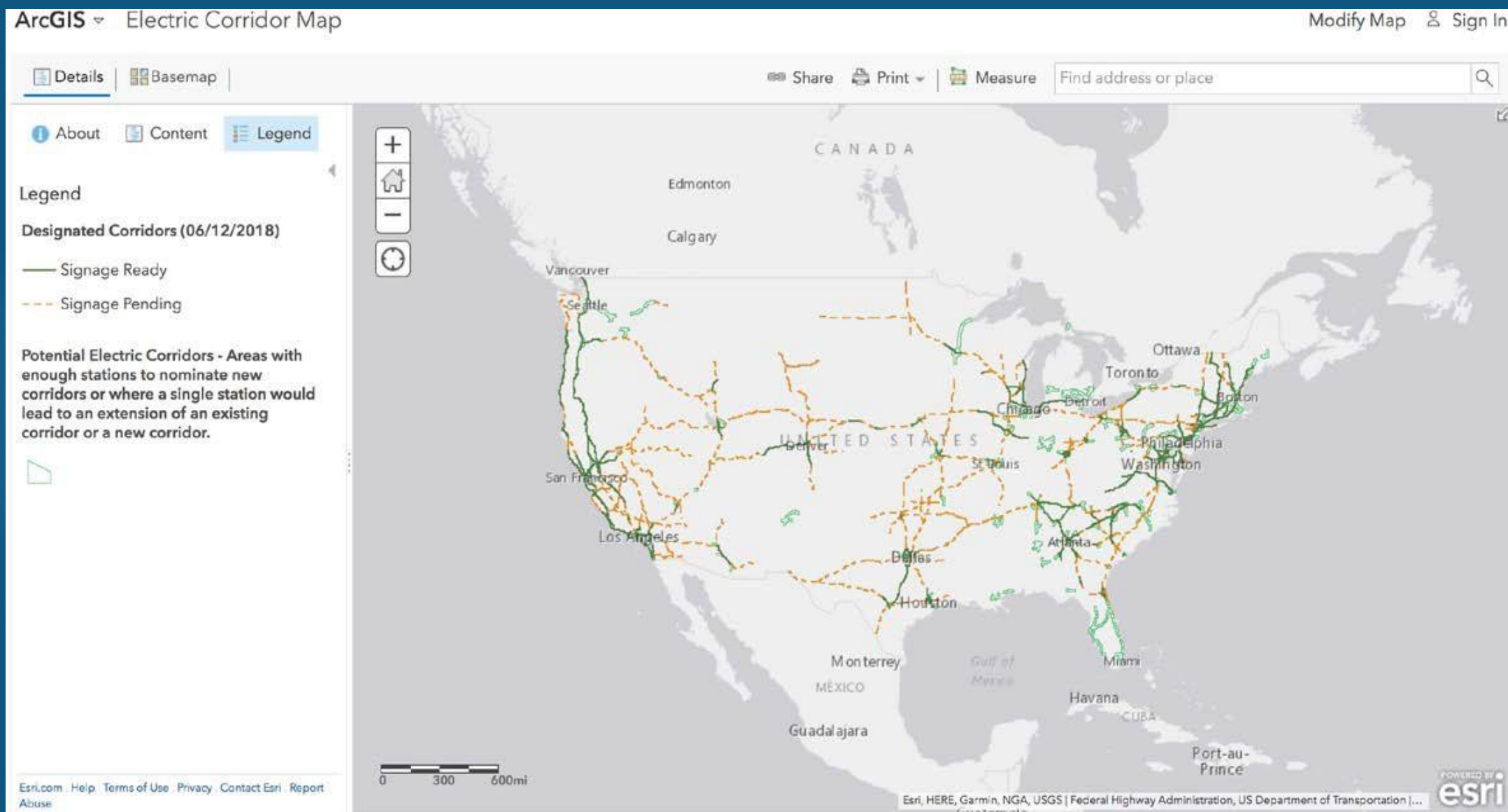
### Stations by State and Fuel Type

State	EV Charging	Hydrogen	Propane	CNG	LNG
Alabama	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>
Alaska	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>
Arizona	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>
Arkansas	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>
California	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>
Colorado	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>
Connecticut	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>	 <a href="#">data</a>   <a href="#">shapefile</a>

- Shapefiles
- Interactive maps
- CSV downloads

# Interactive Map

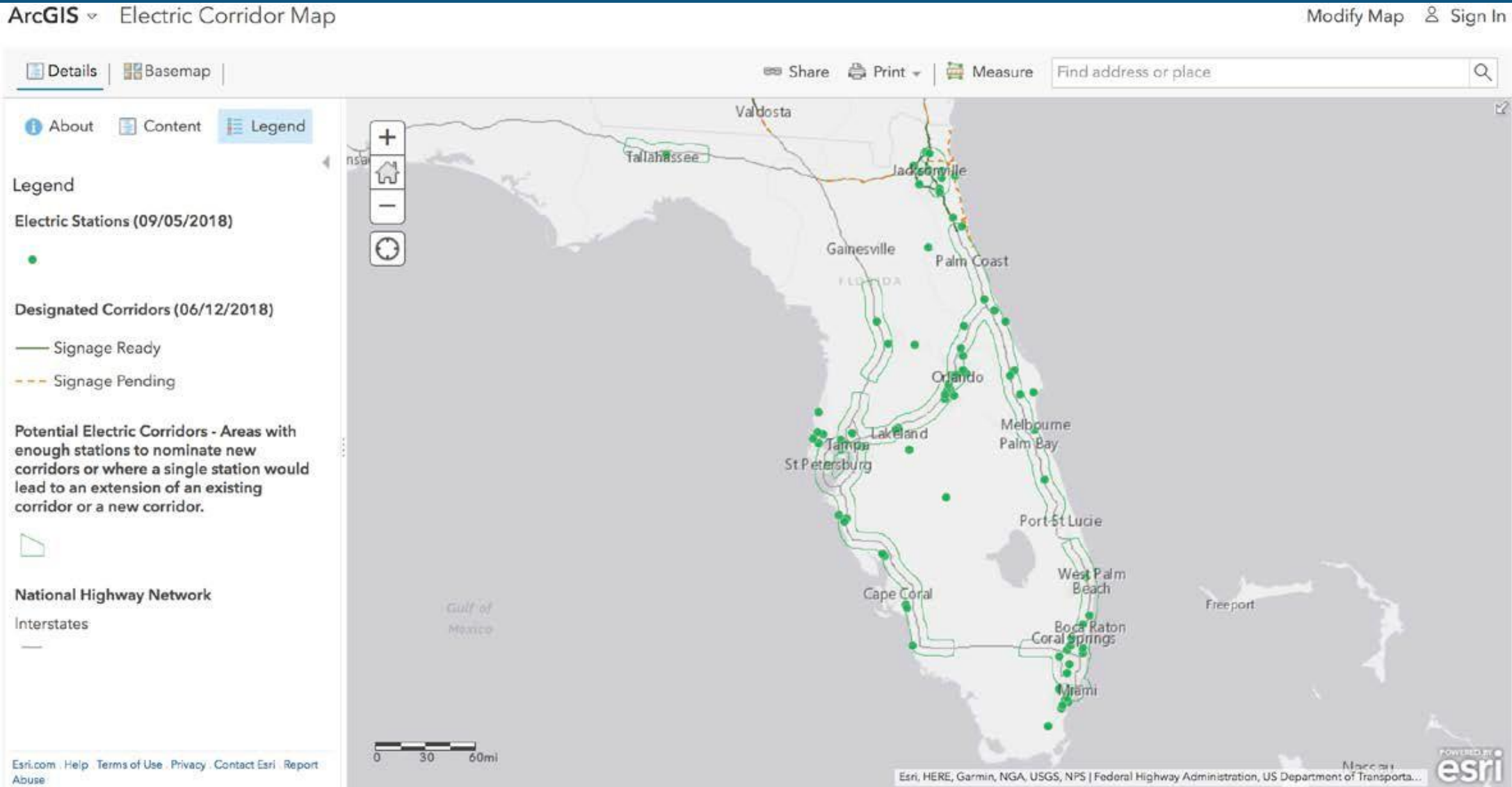
[afdc.energy.gov/corridors](https://afdc.energy.gov/corridors)





# Stations Layer - FL

[afdc.energy.gov/corridors](https://afdc.energy.gov/corridors)



# Future of AFC Program

- Request for Nominations on an annual basis under life of FAST Act
- Possible inclusion in the next transportation reauthorization bill or other legislation
- Enhanced coordination efforts with Clean Cities Program/NREL
- Enhanced collaboration with stakeholders including industry



# For More Information

## DOT Alternative Fuel Corridor Team Contact Information

### **Diane Turchetta**

U.S. Department of Transportation  
Federal Highway Administration

202-493-0158

[diane.turchetta@dot.gov](mailto:diane.turchetta@dot.gov)

### **Mike Scarpino**

U.S. Department of Transportation  
Volpe Center

617-494-3373

[michael.scarpino@dot.gov](mailto:michael.scarpino@dot.gov)

### **Stephen Costa**

U.S. Department of Transportation  
Volpe Center

617-494-3852

[stephen.costa@dot.gov](mailto:stephen.costa@dot.gov)

## Resources

FHWA Alternative Fuel Corridor website:

[http://www.fhwa.dot.gov/environment/alternative\\_fuel\\_corridors/](http://www.fhwa.dot.gov/environment/alternative_fuel_corridors/)

MUTCD Memorandum – Signing for Designated Alternative Fuel Corridors:

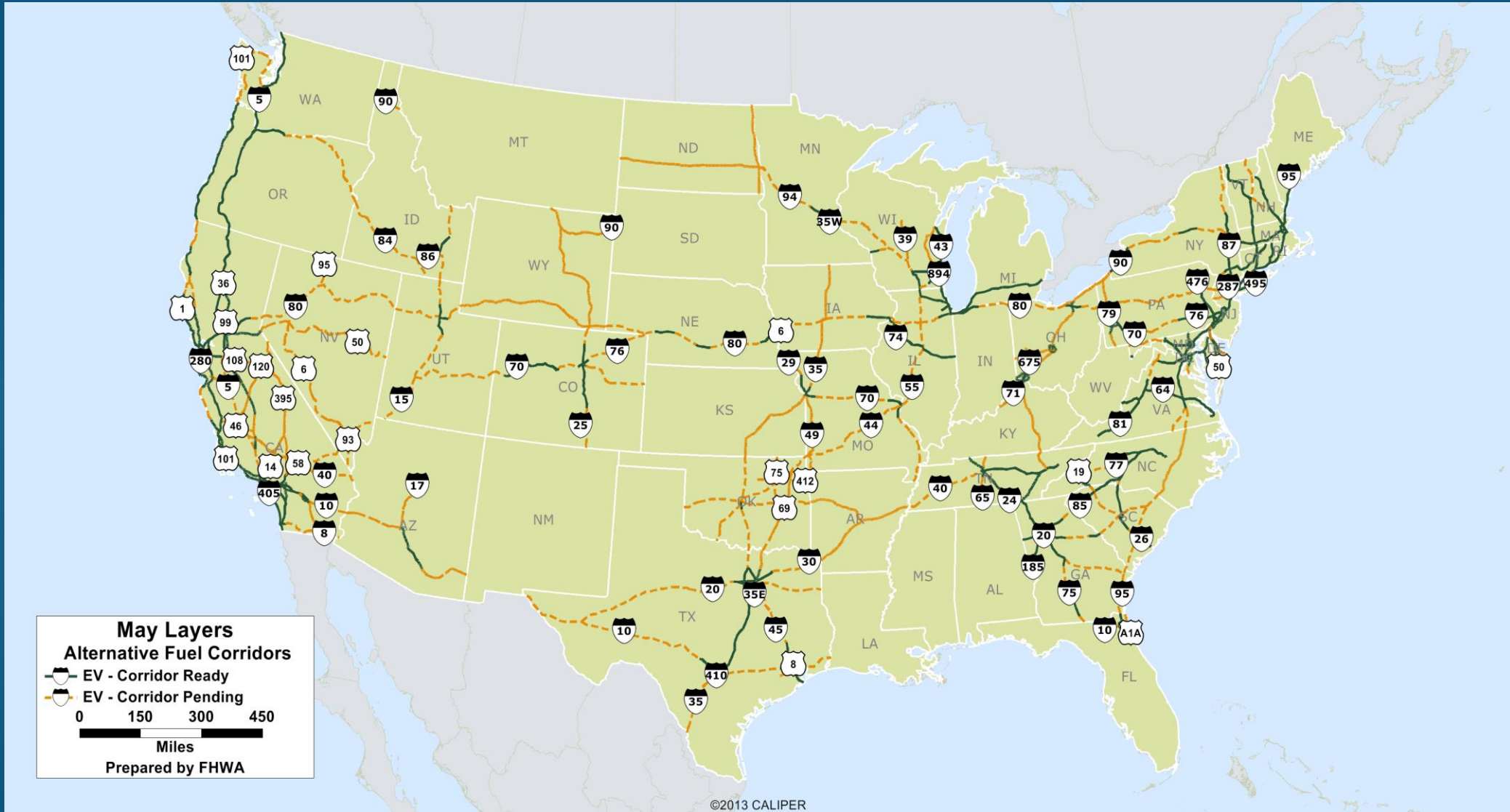
[https://mutcd.fhwa.dot.gov/resources/policy/alt\\_fuel\\_corridors/index.htm](https://mutcd.fhwa.dot.gov/resources/policy/alt_fuel_corridors/index.htm)

DOE/NREL Alternative Fueling Station Locator:

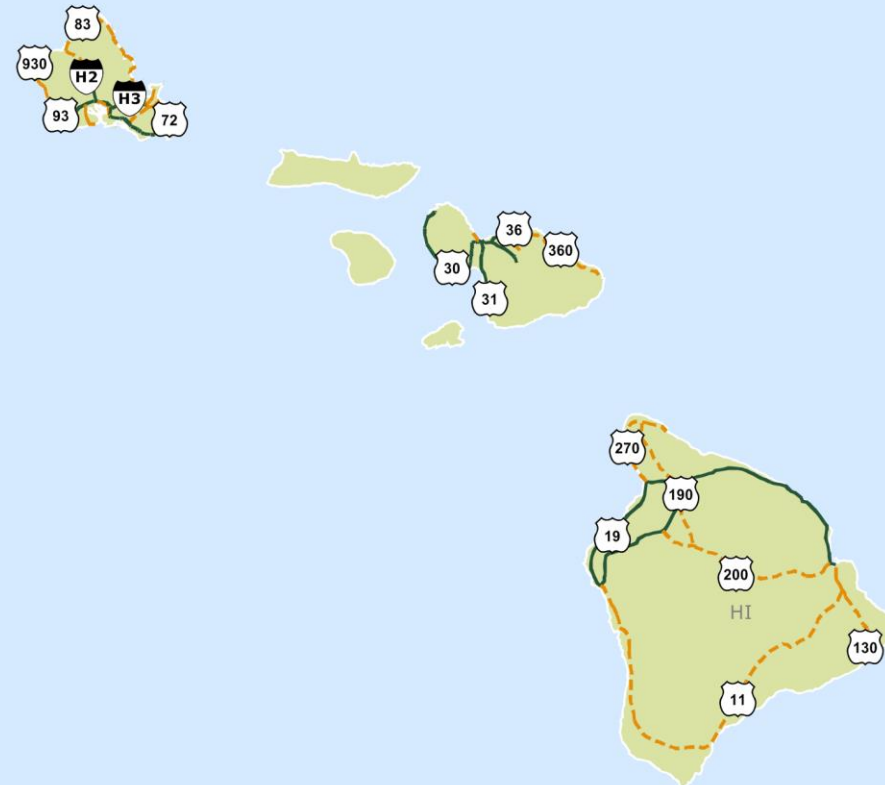
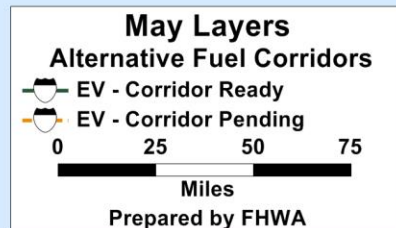
<https://www.afdc.energy.gov/locator/stations/>



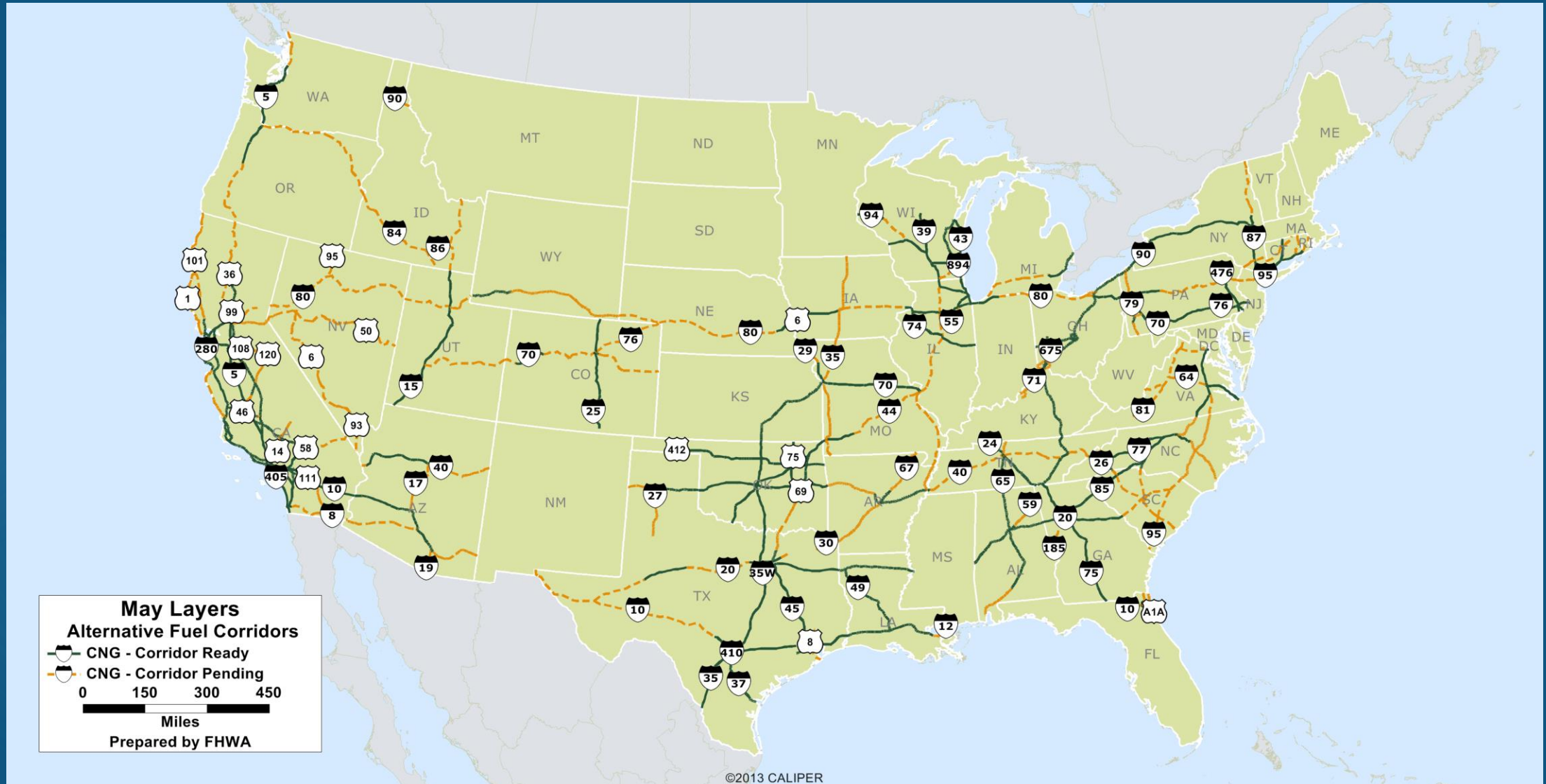
# Rounds 1 & 2 EV Map – Corridor Ready and Pending



# Rounds 1 & 2 EV Map for HI - Corridor Ready and Pending

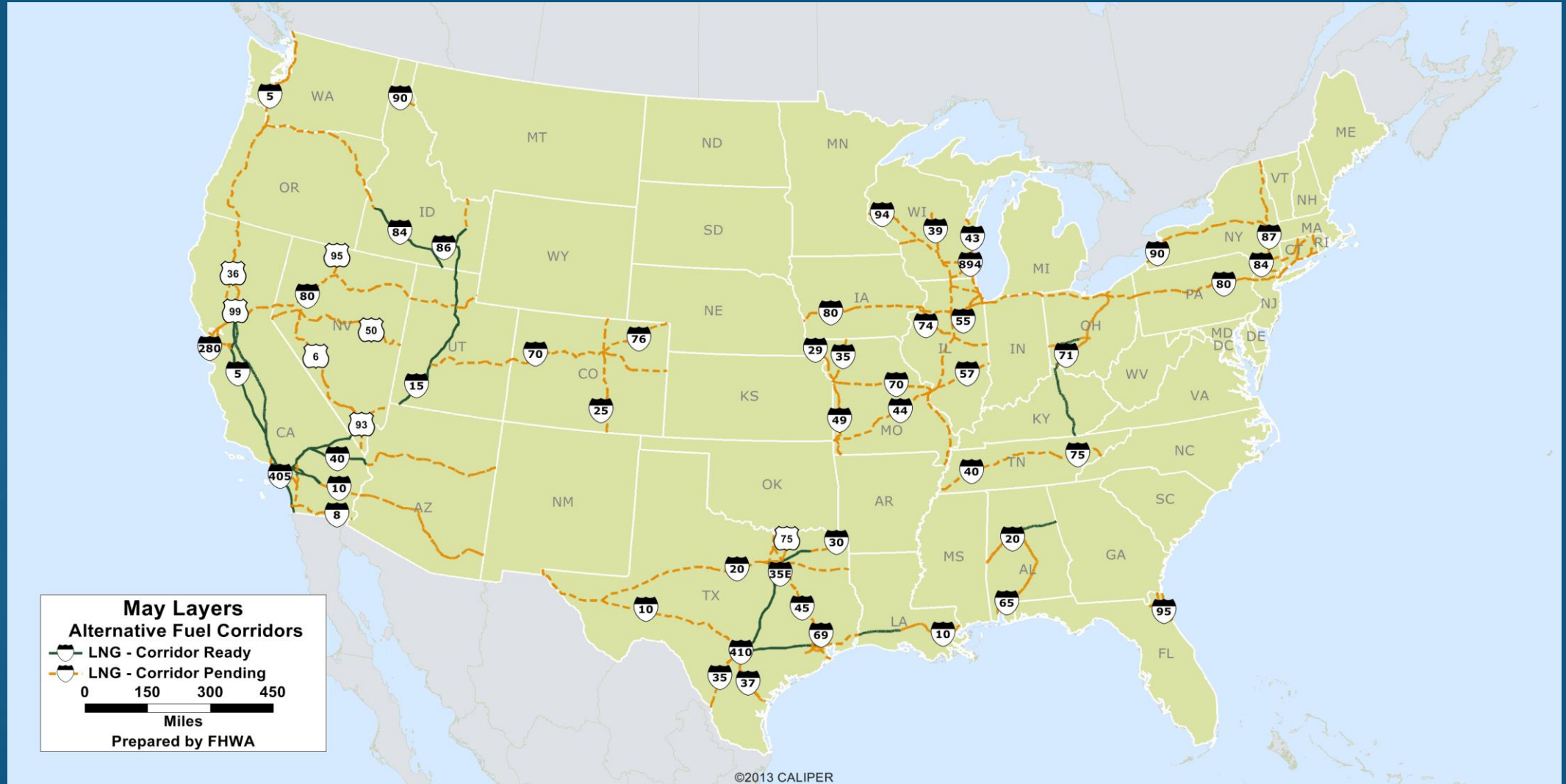


# Rounds 1 & 2 CNG Map – Corridor Ready and Pending

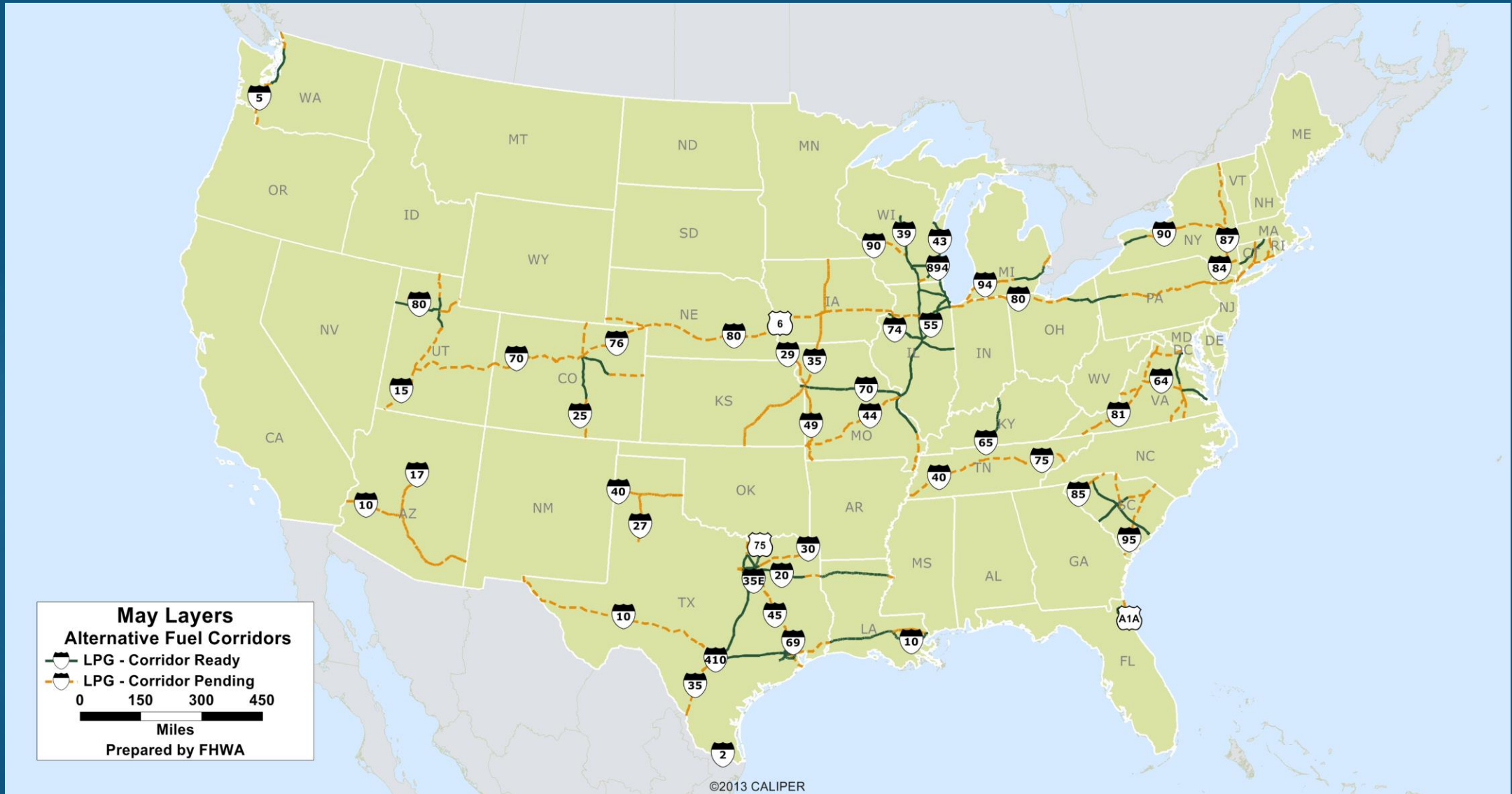




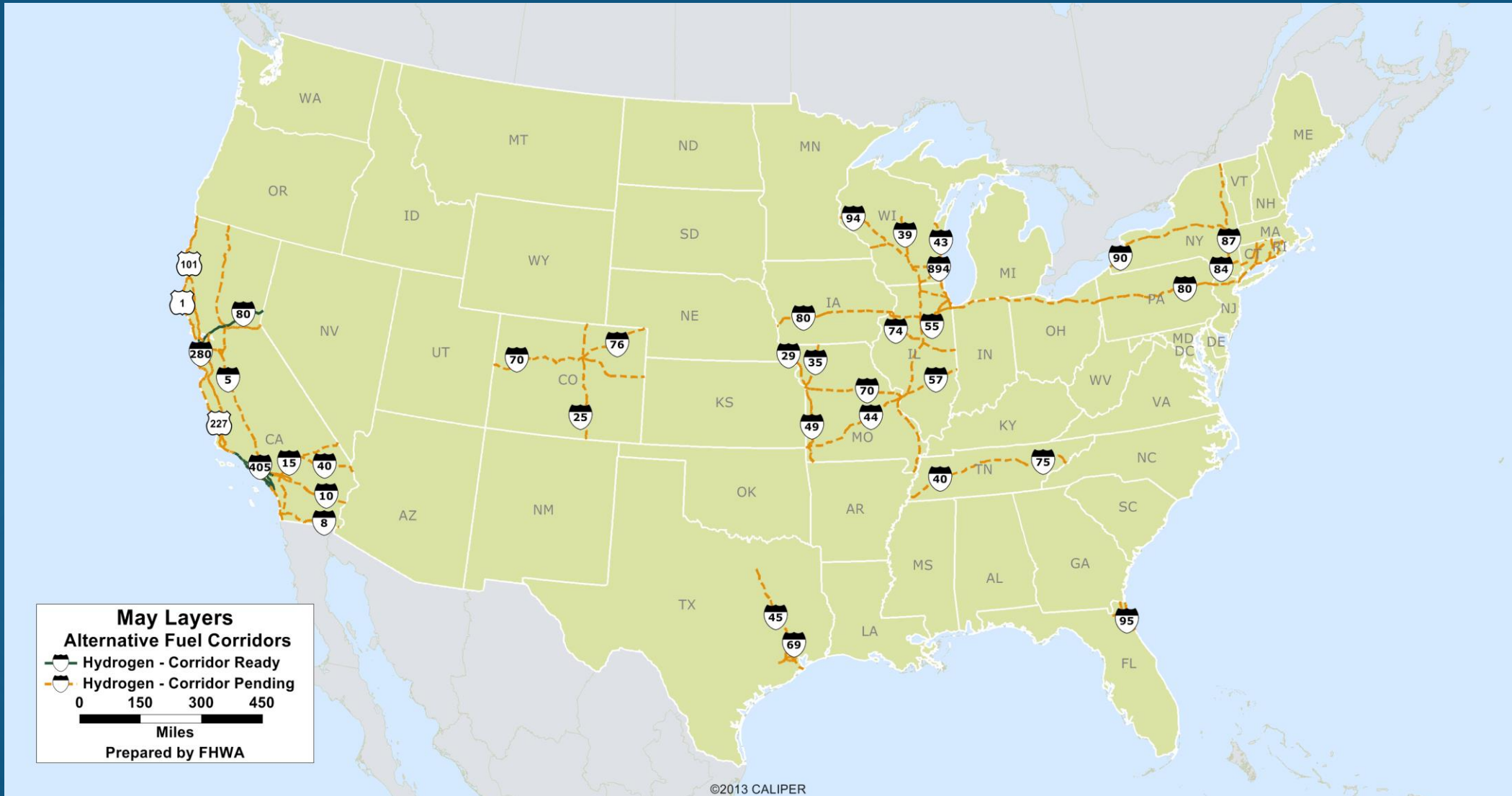
# Rounds 1 & 2 LNG Map – Corridor Ready and Pending



# Rounds 1 & 2 LPG Map – Corridor Ready and Pending



# Rounds 1 & 2 HYD Map – Corridor Ready and Pending





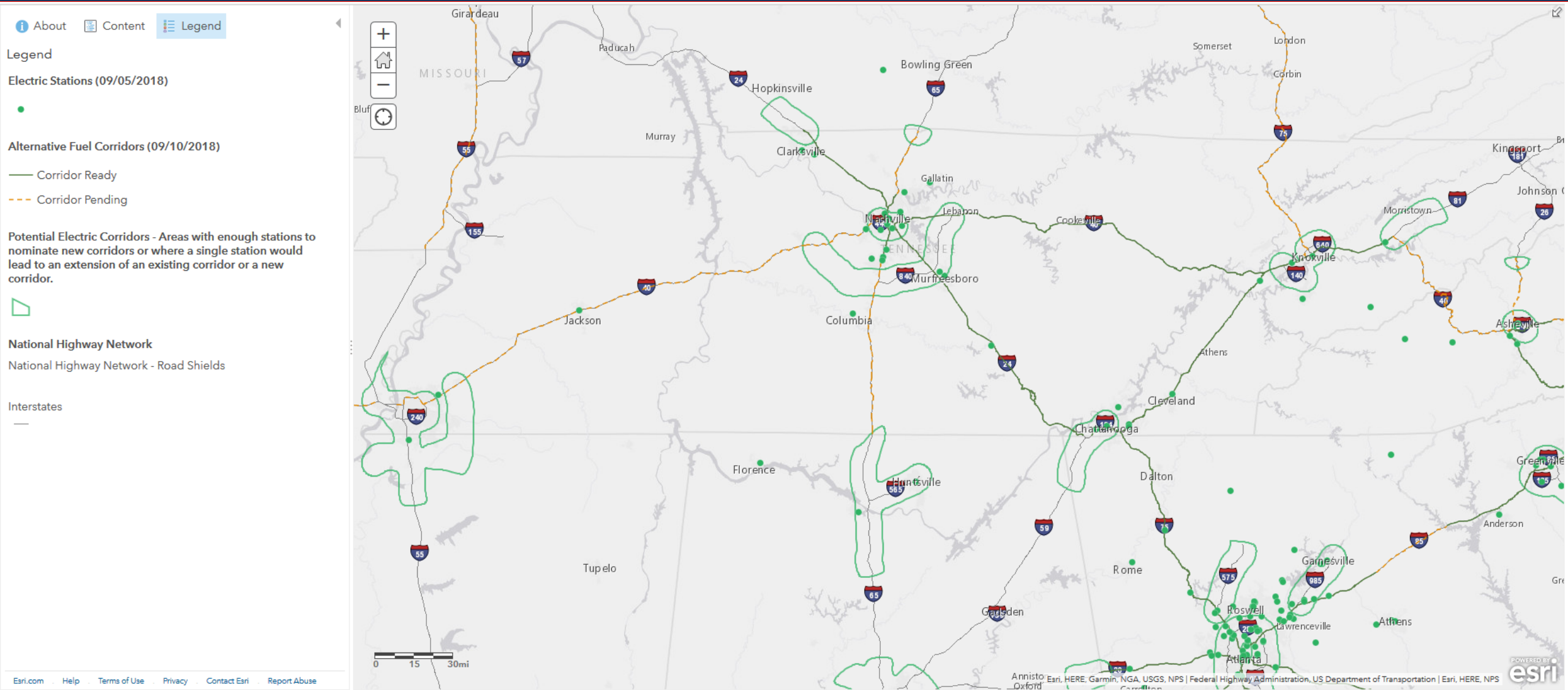
# **Alternative Fuel Corridors in Tennessee: Partnerships and Programs**

Casey Langford, Ph.D.  
TDOT Long Range Planning Division

March 12, 2019



# Tennessee Alternative Fuel Corridors



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# Tennessee Alternative Fuel Corridors - Ready

- **I-40** – Electric vehicles (EV) - Dandridge to Nashville
- **I-24** - EV entire length
- **I-24** - Compressed natural gas (CNG) entire length
- **I-75** - EV Knoxville to Tennessee/Georgia border
- **I-75** - CNG entire length
- **I-65** - EV Madison to Franklin
- **I-65** - CNG Nashville to Tennessee/Alabama border
- **Partners** - TDOT, TDEC, TN Clean Fuels, TVA, ORNL, ChargePoint and others



# Alt Fuel Corridor Designations

Electric (DC Fast Charging) Stations along I-24



CNG Stations along I-24

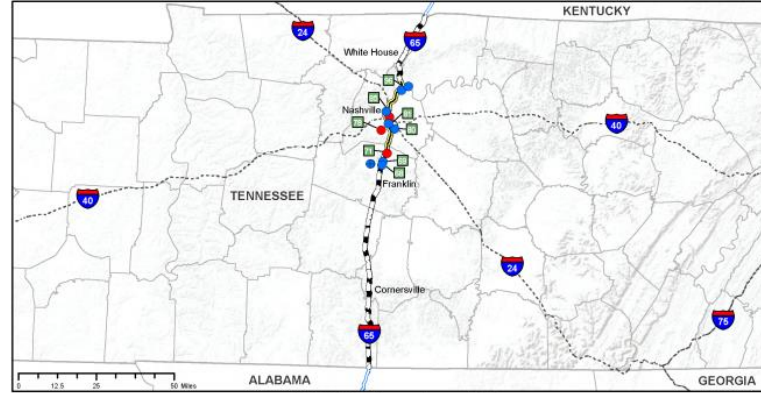


**Sources:**  
 US Department of Energy - Alternate Fuel Station Locator,  
 Tennessee Department of Transportation,  
 Tennessee Department of Environment and Conservation,  
 East Tennessee Clean Fuel Coalition

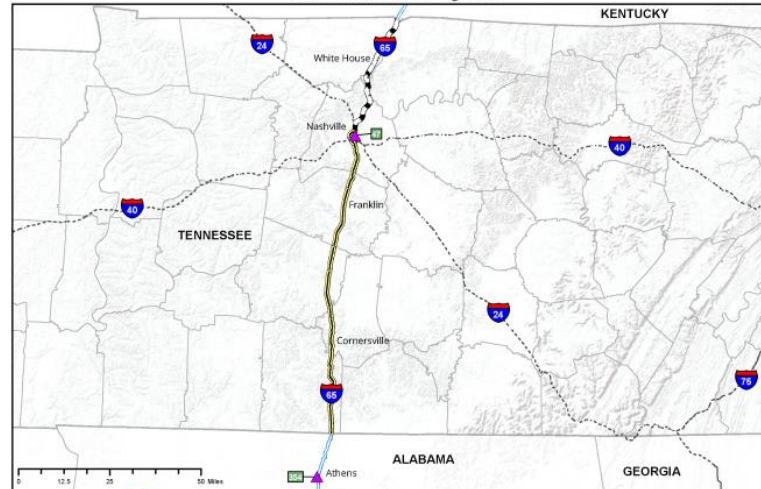
**Legend**

- ⊕ Out of Service Fast Charging Stations
- CHAdeMO only
- CHAdeMO & CCS combo
- ▲ CNG Stations
- ⚡ Interstate
- ⚡ Interstate 24
- ⚡ Signage Pending
- ⚡ Signage Ready
- ⚡ Exits

Electric (DC Fast Charging) Stations along I-65



CNG Stations along I-65

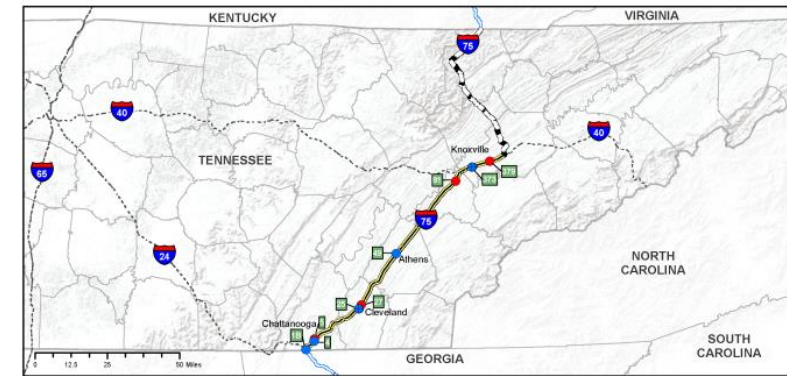


**Sources:**  
 US Department of Energy - Alternate Fuel Station Locator,  
 Tennessee Department of Transportation,  
 Tennessee Department of Environment and Conservation,  
 East Tennessee Clean Fuel Coalition

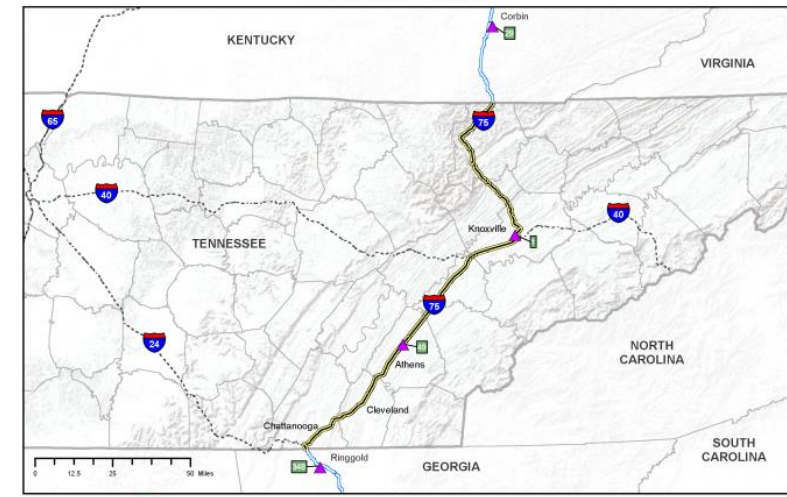
**Legend**

- ⊕ Out of Service Fast Charging Stations
- CHAdeMO only
- CHAdeMO & CCS combo
- ▲ CNG Stations
- ⚡ Interstate
- ⚡ Interstate 65
- ⚡ Signage Pending
- ⚡ Signage Ready
- ⚡ Exits

Electric (DC Fast Charging) Stations along I-75



CNG Stations along I-75



**Sources:**  
 US Department of Energy - Alternate Fuel Station Locator,  
 Tennessee Department of Transportation,  
 Tennessee Department of Environment and Conservation,  
 East Tennessee Clean Fuel Coalition

**Legend**

- ⊕ Out of Service Fast Charging Stations
- CHAdeMO only
- CHAdeMO & CCS combo
- ▲ CNG Stations
- ⚡ Interstate
- ⚡ Interstate 75
- ⚡ Signage Pending
- ⚡ Signage Ready
- ⚡ Exits

# Alternative Fuel Corridor I-26

ID	Fuel Type	Station Name	Street Address	City	Exit #	Distance off I-26 NB(EB)	Distance off I-26 SB(WB)	Level (ELEC)	Connector Type	Public/Private
1	BD	TDOT District 11	3213 N Roan St	Johnson City	19	1.4 miles	1.5 miles	N/A	N/A	Private - Govt. only
2	ELEC	Tri-Cities Nissan	3602 Bristol Hwy	Johnson City	19	2.1 miles	2.3 miles	2	J1772	Public - Call ahead
2	ELEC	Tri-Cities Nissan	3602 Bristol Hwy	Johnson City	20B/20	2.4 miles	2.6 miles	2	J1772	Public - Call ahead
3	ELEC	City of Kingsport - Parking Garage	225 W Center St	Kingsport	1	1.7 miles	2 miles	2	J1772	Public - Call ahead
4	LPG	Kingsport	2132 Netherland Inn Rd	Kingsport	1	2 miles	1.2 miles	N/A	N/A	Private - Govt. only
5	ELEC	Tri-Cities Nissan	3602 Bristol Hwy	Johnson City	19	2.1 miles	2.3 miles	2	J1772	Private
5	ELEC	Tri-Cities Nissan	3602 Bristol Hwy	Johnson City	20B/20	2.4 miles	2.6 miles	2	J1772	Private
6	E85	James H Quillen Veterans Affairs Mountain Home	Mountain Home	Mountain Home	22	2.3 miles	2.2 miles	N/A	N/A	Private
6	E85	James H Quillen Veterans Affairs Mountain Home	Mountain Home	Mountain Home	23	2.5 miles	2.4 miles	N/A	N/A	Private
7	ELEC	Rush Street Neighborhood Grill	1229 E Stone Dr	Kingsport	1	3.6 miles	3.9 miles	2	J1772	Public
8	ELEC	MeadowView Conference Resort & Convention Center	1901 Meadowview Pkwy	Kingsport	3	.5 miles	.6 miles	2	J1772	Public
9	ELEC	MeadowView Conference Resort & Convention Center - Tesla	1901 Meadowview Pkwy	Kingsport	3	.5 miles	.6 miles	2	TESLA	Public
10	ELEC	Fairfield Inn and Suites Johnson City	3078 Hamilton Place	Johnson City	19	1.8 miles	1.7 miles	2	J1772	Public
11	ELEC	City of Kingsport - Fleet Maintenance	635 Industry Dr	Kingsport	1	1.4 miles	1.5 miles	2	J1772	Private
12	ELEC	City of Kingsport - Water Sewer Department	1213 Konnarock Rd	Kingsport	4	3.2 miles	3.2 miles	2	J1772	Private
13	ELEC	Rush Street Neighborhood Grill - Tesla Destination	1229 E Stone Dr	Kingsport	1	3.6 miles	3.8 miles	2	TESLA	Public



## Tennessee AFS

- BD
- CNG
- E85
- ELEC
- LNG
- LPG

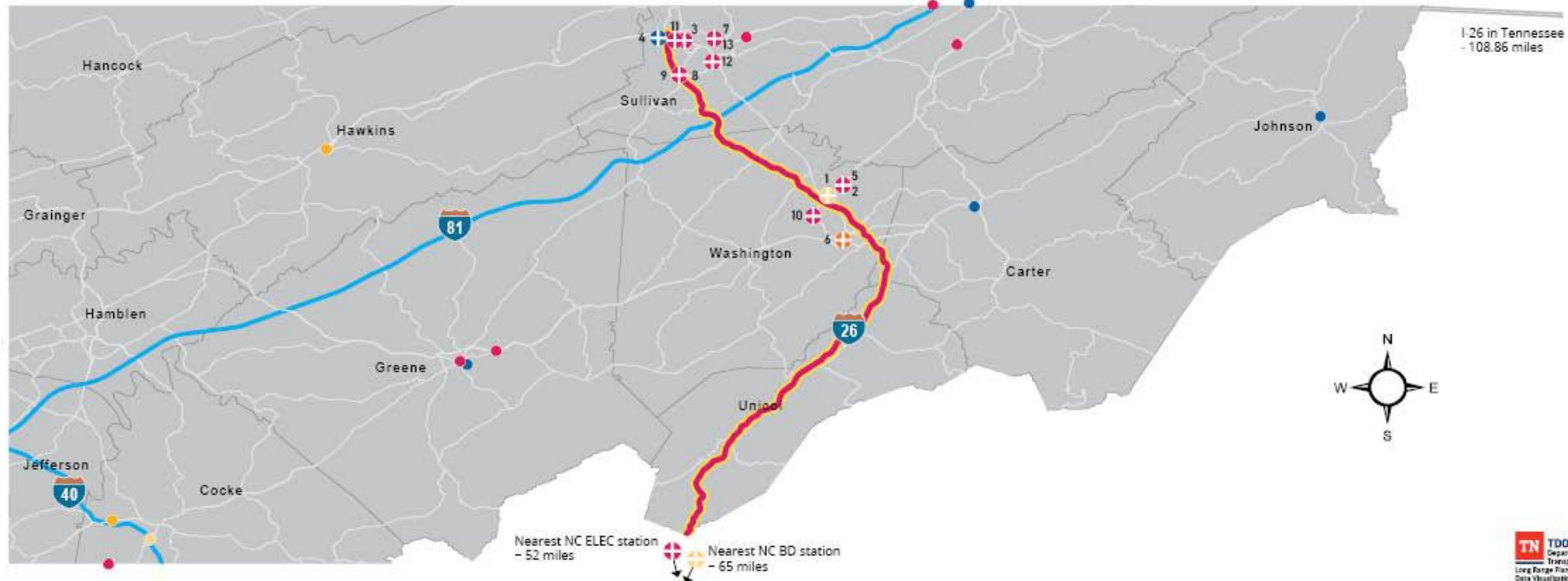
## AFS within 5 mile buffer

- BD
- E85
- ELEC
- LPG

- County Boundary
- State Boundary
- Waterbodies
- Interstate
- State Route
- I-26

## Alternative Fuel Station (AFS) Fuel Types:

- Biodiesel (BD)
- Compressed Natural Gas (CNG)
- Ethanol (E85)
- Electric (ELEC)
- Liquefied Natural Gas (LNG)
- Liquefied Petroleum Gas (LPG)





## Alternative Fuel Corridor I-81

ID	Fuel Type	Station Name	Street Address	City	Exit #	Distance off I-81 NB(EB)	Distance off I-81 SB(WB)	Level (ELEC)	Public/Private	Connector Type
1	LPG	U-Haul	2975 W State St	Bristol	1/1A (VA)	2 miles	2.2 miles	N/A	Public	N/A
1	LPG	U-Haul	2975 W State St	Bristol	74A	2.9 miles	3 miles	N/A	Public	N/A
2	ELEC	Wallace Nissan Oldsmobile	2733 E Stone Dr	Kingsport	59	7.3 miles	7.2 miles	Level 2	Public	J1772
3	ELEC	Bill Gatton Nissan	235 Century Blvd	Bristol	69	7.8 miles	8 miles	Level 2	Public	J1772
3	ELEC	Bill Gatton Nissan	235 Century Blvd	Bristol	1/1A (VA)	7.6 miles	7.8 miles	Level 2	Public	J1772
4	ELEC	Bill Gatton Nissan	235 Century Blvd	Bristol	69	7.8 miles	8 miles	Level 2	Private	J1772
4	ELEC	Bill Gatton Nissan	235 Century Blvd	Bristol	1/1A (VA)	7.6 miles	7.8 miles	Level 2	Private	J1772
5	ELEC	Wallace Nissan Oldsmobile	2733 E Stone Dr	Kingsport	59	7.3 miles	7.2 miles	Level 2	Private	J1772
6	ELEC	Meadowview Conference Resort and Convention Center	1901 Meadowview Pkwy	Kingsport	57B	5.5 miles	5.3 miles	Level 2	Public	J1772
7	ELEC	Meadowview Conference Resort and Convention Center	1901 Meadowview Pkwy	Kingsport	57B	5.5 miles	5.3 miles	Level 2	Public	TESLA
8	ELEC	Exxon	109 Sharon Dr.	Dandridge	4/1B	8.4 miles	4.5 miles	DC Fastcharger	Public	CHADEMO J1772COMBO
9	ELEC	City of Kingsport - Water Sewer Department	1213 Konnarock Road	Kingsport	59	4.9 miles	4.8 miles	Level 2	Private	J1772
10	ELEC	The Pinnacle - Tesla Supercharger	416 Pinnacle Pkwy	Bristol	74B	.9 miles	.7 miles	DC Fastcharger	Public	TESLA



### Tennessee AFS

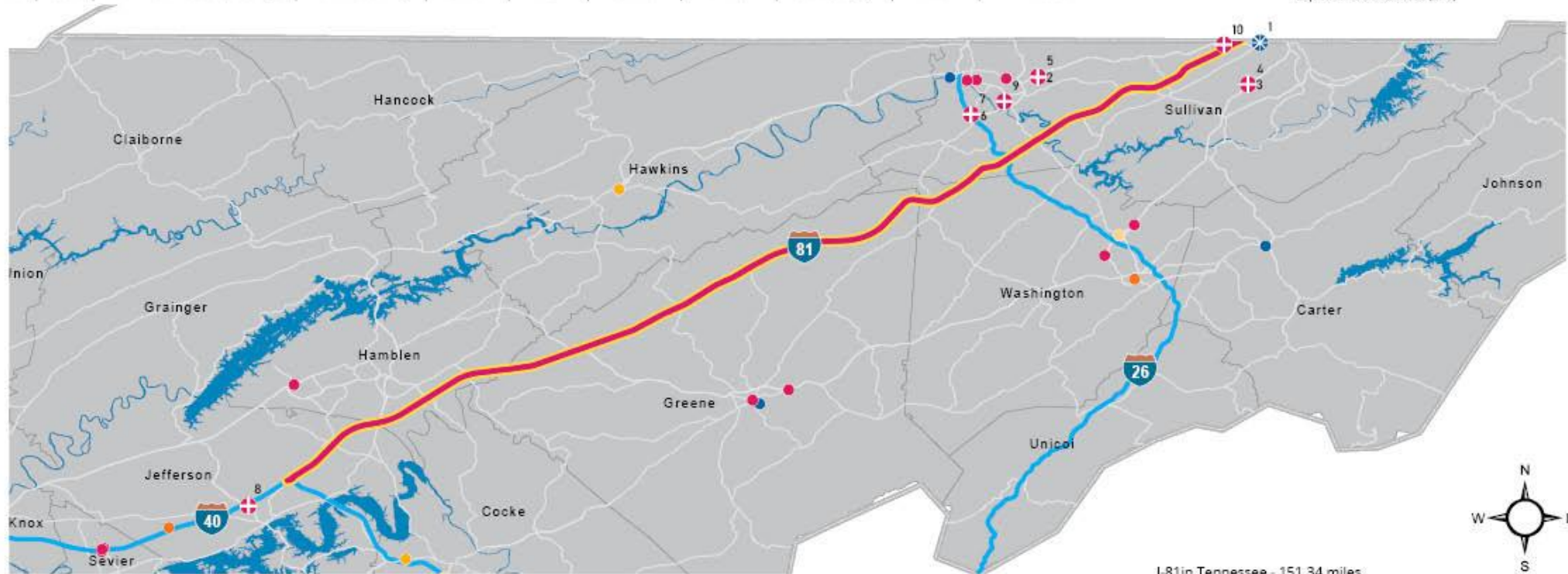
- BD
- CNG
- E85
- ELEC
- LNG
- LPG

### TN AFS within 5 mile buffer

- ELEC
- LPG

- Interstate
- State Route
- I-81
- County Boundary
- State Boundary
- Waterbodies

Alternative Fuel Station (AFS) Fuel Types:  
 Biodiesel (BD)  
 Compressed Natural Gas (CNG)  
 Ethanol (E85)  
 Electric (ELEC)  
 Liquefied Natural Gas (LNG)  
 Liquefied Petroleum Gas (LPG)



I-81 in Tennessee - 151.34 miles

# TN Alternative Fuel Initiatives

- **Present**
- **Drive Electric Tennessee** - a stakeholder collaboration to make Tennessee an electric transportation leader in SE
- Goal – Increase EVs in TN from <5,000 to 200,000 by 2028
- In 2018, a core team developed shared vision, goals and guiding principles
  - State agencies, electric utilities, cities, universities and electric vehicle OEMs
- Developing roadmap to achieve goals in 5-10 years
- Partners - TVA, TDOT, TDEC, TN Clean Fuels, others

# TN Alternative Fuel Initiatives

- **Present**
- VW Court Settlement
  - Tennessee will invest maximum 15% of NOx funds in electric charging stations
  - Electrify America charging stations (Five (5) today)
- CMAQ priority for alternative fuel infrastructure
- Interstate signage

# Lessons Learned

- **Refueling infrastructure** – maintenance of equipment essential
- **Recruiting new hosts for EV charging is a challenge**
  - Why would a property owner want to be a host?
  - Requests for proposals may not produce sufficient applicants
- **Only EV fast charging stations for corridor infrastructure**
  - Level 2 charging simply takes too long
- **Amend Randolph Sheppard Act to explicitly allow electric charging infrastructure in interstate rest areas**
- **Are there opportunities for states/U.S. to work together to reduce costs of EV fast charging infrastructure?**



# TennSmart Consortium

- In 2017, 20 public and private partners formed nonprofit to capitalize on state's status as automotive sector leader.
  - GM, Nissan and Volkswagen plus suppliers in Tennessee
  - Working together increases ability to take advantage of **intelligent mobility opportunities**
- Goals:
  - Accelerate development and use of technologies for CAVs and smart infrastructure
  - Develop technology roadmap to integrate intelligent mobility advances into long-range plans for state's transportation system

# TennSmart Focus Areas

- **Connected and automated vehicles** – Technologies for vehicle-to-vehicle and vehicle-to-grid interactions
- **Electric vehicles** – Wireless charging technologies, automate the charging process, and share energy between vehicles, buildings and the grid
- **Cybersecurity** – Technologies to validate trustworthiness of messages from vehicles and infrastructure, and address identity and privacy needs
- **Freight efficiency** – Hybrid electric heavy-duty powertrains, truck platooning technologies, automated multimodal freight delivery, and unmanned aerial systems
- **Multimodal commuting** – Mode shifts to make passenger commutes more energy efficient with technologies that increase connectivity between modes

# Founding Members of TennSmart

- TN Dept. of Transportation
- Oak Ridge Natl. Laboratory
- Bridgestone Americas
- Cummins Filtration, Inc.
- DENSO Manufacturing TN
- FedEx Corporation
- GRIDSMART Technologies, Inc.
- Local Motors
- Lyft
- Miovision
- Nissan North America
- Stantec Consulting Svcs. Inc.
- TN Dept. of Environment & Conservation
- TN Dept. of Labor & Workforce Development
- Tennessee Tech University
- Tennessee Valley Authority
- Top Five Inc.
- University of Memphis
- University of Tennessee
- Vanderbilt University

# Tennessee CAV Initiatives

- State law in 2017 authorized autonomous vehicles
- Nine states approved commercial use of driver-assisted truck platooning
  - Arkansas, Georgia, Michigan, Nevada, North Carolina, Ohio, South Carolina, **Tennessee** and Texas
  - Truck platooning authorized in TN in April 2017
  - Platooning - linking two or more vehicles in a convoy using wireless communications and sensor technology
  - Interested parties must provide a plan for the operation of the platoon to TDOT and the Department of Safety



# Thank you

## **Casey Langford, Ph.D.**

Planning Manager, Planning Data & Systems  
TDOT Long Range Planning Division  
p. 615.532.5824 | [casey.langford@tn.gov](mailto:casey.langford@tn.gov)

## **Alan Jones**

Senior Research Analyst, Research Office  
TDOT Long Range Planning Division  
p. 615.741.6832 | [alan.jones@tn.gov](mailto:alan.jones@tn.gov)