Arizona Interstate 10 Alternative Fuels Corridor Deployment Plan

for Electric Vehicle Charging and Compressed Natural Gas Fueling

November 2020

Partners:

VALLEY OF THE SUN CLEAN CITIES COALITION

ADOT | Arizona Department of Transportation

PAG Pima Association of Governments

Funded by: U.S. Department of Transportation Federal Highway Administration
Led by: Pima Association of Governments
Partners: Arizona Department of Transportation, Valley of the Sun Clean Cities Coalition

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About PAG: Pima Association of Governments is the metropolitan planning organization for the greater Tucson region, an association of local, state and tribal governments that works to build consensus among its members and the public on regional planning for transportation, water quality, air quality and economic vitality.

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LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
AC	Alternating Current
ACC	Arizona Corporation Commission
AFC	Alternative Fuels Corridor
AFCD	Alternative Fuels Data Center
AFV	Alternative Fuel Vehicle
ADEQ	Arizona Department of Environmental Quality
ADOA	Arizona Department of Administration
ADOT	Arizona Department of Transportation
AEPC	Arizona Electric Power Cooperative
AGO	ArcGIS Online
AIIC	Arizona Interstate/Infrastructure Collaborative
API	Application Programming Interface
APS	Arizona Public Service
ASU	Arizona State University
ATA	Arizona Trucking Association
ATIA	America's Transportation Infrastructure Act
BEV	Battery Electric Vehicle
CCS	Combined Charging System
CHAdeMO	CHArge de MOve
CMAQ	Congestion Mitigation and Air Quality
CNG	Compressed Natural Gas
CO	Carbon Monoxide
DC	Direct Current
DCFC	Direct Current Fast Charge
EERE	Office of Energy Efficiency and Renewable Energy
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ESRI	Environmental Systems Research Institute
EV	Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
FAST	Fixing America's Surface Transportation
FHWA	Federal Highway Administration
GIS	Geographic Information System
GGE	Gallons Gasoline Equivalent
HEP	Office of Planning, Environment, & Realty
HIFLD	Homeland Infrastructure Foundational Level Data
HOV	High Occupancy Vehicle
I-10	Interstate 10
ICCT	International Council on Clean Transportation
ICE	Internal Combustion Engine
INVEST	Investing in a New Vision for the Environment and Surface Transportation
ISTEA	Intermodal Surface Transportation Efficiency Act
MOU	Memorandum of Understanding

MOVES	Motor Vehicle Emission Simulator
MUTCD	Manual on Uniform Traffic Control Devices
NAAQS	National Ambient Air Quality Standards
NADA	National Automobile Dealers Association
NASEO	National Association of State Energy Officials
NATSO	National Association of Truck Stop Owners
NEV	Neighborhood Electric Vehicle
NGV	Natural Gas Vehicle
NHS	National Highway System
NOx	Nitrogen Oxides
NREL	National Renewable Energy Laboratory
PAG	Pima Association of Governments
PEV	Plugin Electric Vehicle
PHEV	Plugin Hybrid Electric Vehicle
PM2.5	Fine Particulate Matter ≤ 2.5 micrometers
PM10	Coarse Particulate Matter ≤ 10 micrometers
REV	Regional Electric Vehicle
RPM	Range Per Minute
SAE	Society of Automotive Engineers
SRP	Salt River Project
SSVEC	Sulphur Springs Valley Electric Cooperative
SWG	Southwest Gas Corporation
TA	TravelCenters of America
TE	Transportation Electrification
TEP	Tucson Electric Power Company
US	United States
USDOT	U.S. Department of Transportation
VOC	Volatile Organic Compound
VSCCC	Valley of the Sun Clean Cities Coalition
ZEV	Zero Emission Vehicle

EXECUTIVE SUMMARY

This document details a plan for deployment of electric vehicle (EV) fast charging stations and compressed natural gas (CNG) fueling facilities at selected locations along the Interstate 10 (I-10) corridor in Arizona. The Federal Highway Administration (FHWA) Alternative Fuels Corridor (AFC) program requires no greater than 50 miles between EV Direct Current Fast Charge (DCFC) charging stations and 150 miles between CNG fueling facilities, and a maximum distance of five miles from the National Highway System (NHS) corridors to obtain Corridor Ready designation.

Gaps exist along I-10 in Arizona between Phoenix and the Arizona/California border and between Tucson and the Arizona/New Mexico border where DCFC stations are greater than 50 miles apart. Analysis of these gaps resulted in the determination that DCFC stations are required in Salome and Tonopah to close the gap between Blythe, CA, and Buckeye and in Willcox and San Simon to close the gap between Benson and Lordsburg, NM, to qualify for Corridor Ready designation by FHWA. Two truck stop travel centers were selected in Willcox, San Simon and Salome and one in Tonopah for consideration as potential site hosts for EV charging.

Distance gaps also exist along I-10 in Arizona between Tucson and the Arizona/New Mexico border, where CNG fueling facilities are greater than 150 miles apart. Analysis of this gap resulted in the determination that one CNG fueling facility is required in either Willcox or San Simon to close the gap between Tucson and Deming, NM. Two truck stop travel centers were selected in both Willcox and San Simon for consideration as potential site hosts for CNG fueling.

Figures ES-1 and ES-2 show the Arizona I-10 EV charging and CNG Corridor Pending and Corridor Ready segments, along with the existing and selected potential site host locations.

Figure ES-1 **Arizona I-10 EV Charging Corridor Pending and Corridor Ready Existing and Potential Site Locations**

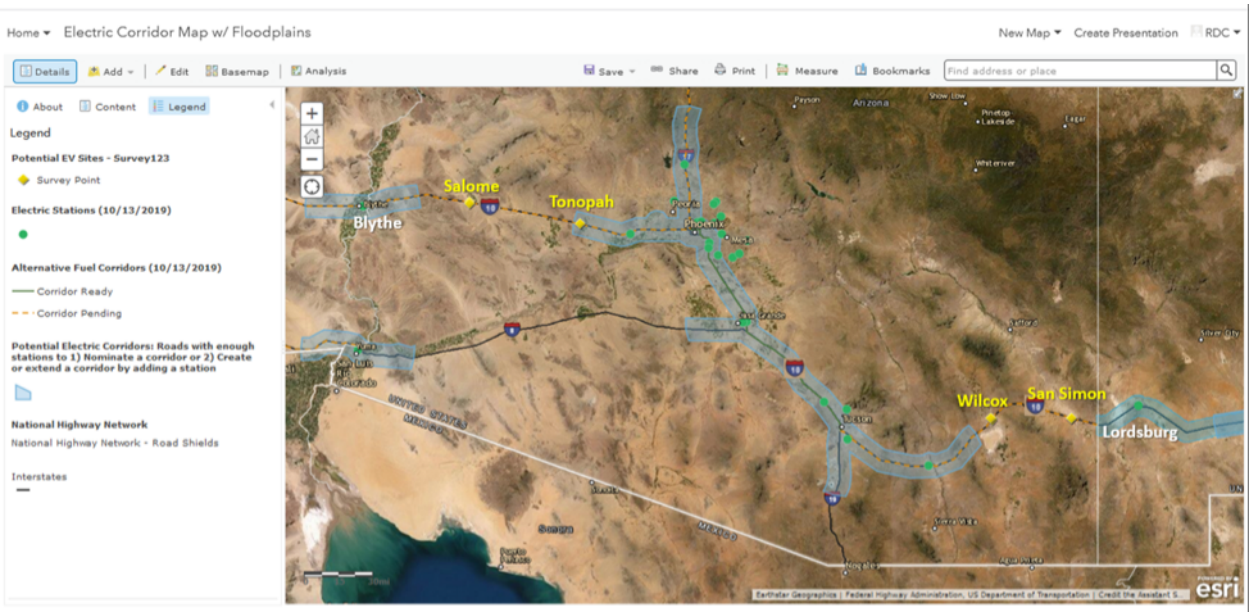
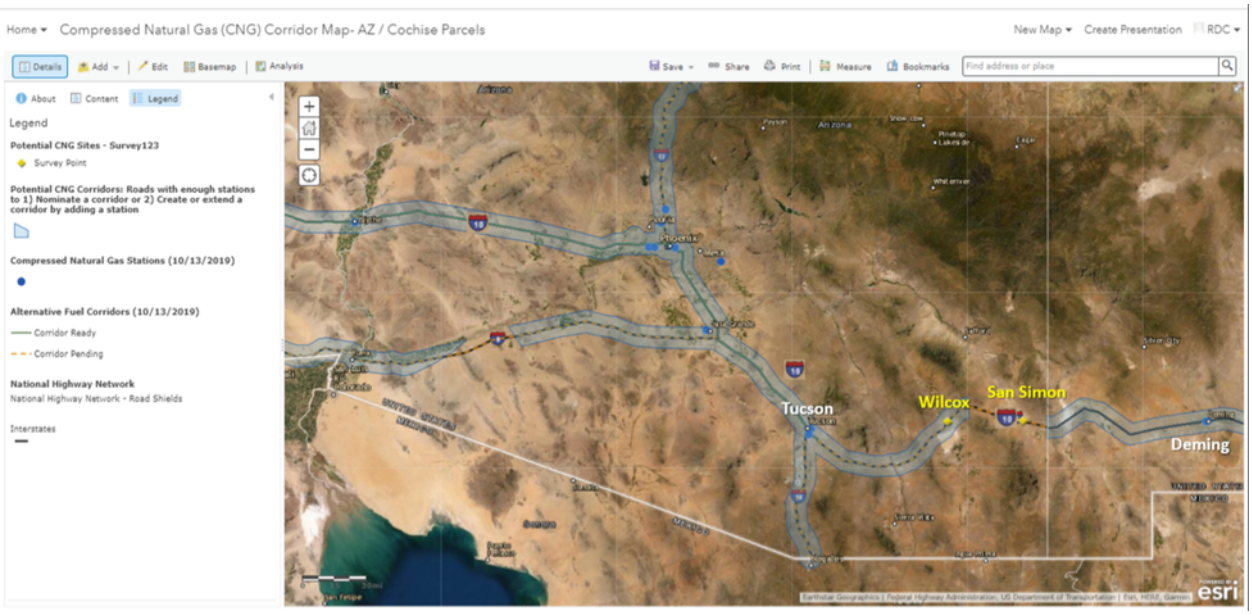


Figure ES-2 Arizona I-10 CNG Corridor Pending and Corridor Ready Existing and Potential Site Locations



A public-private partner advisory group was assembled to identify and evaluate the challenges, issues and barriers to deploying EV charging and CNG fueling infrastructure and to gather information related to costs and funding sources, as well as highway signage. Stakeholders included potential site hosts, electric and natural gas utilities, EV charging and CNG fueling companies, clean cities coalitions, transportation departments, various public entities and public interest groups. Tables ES-1 and ES-2 display cost estimates to install DCFC stations and a CNG compressor station at the potential sites.

Table ES-1 DCFC Charging Station Cost Estimates

Location	2 Chargers 1 50 kW CHAdeMO 1 150 kW CCS	4 Chargers 1 50 kW CHAdeMO 3 150 kW CCS	8 Chargers 1 50 kW CHAdeMO 6 150 kW CCS 1 350 kW CCS
Salome	$ 175,443	$ 349,361	$ 751,816
Tonopah	$ 188,443	$ 366,361	$ 781,816
Willcox	$ 162,543	$ 328,461	$ 716,016
San Simon	$ 162,543	$ 328,461	$ 716,016

Table ES-2 CNG Compressor Station Cost Estimates

Location	Medium Station 500-800 gge/day	Large Station 850-2,000 gge/day
Willcox/San Simon	$700,000-900,000	$1,200,000-2,000,000

1. INTRODUCTION

Pima Association of Governments (PAG), located in Pima County, Arizona, partnered with the Arizona Department of Transportation (ADOT) and Valley of the Sun Clean Cities Coalition (VSCCC) to develop a plan to deploy electric vehicle (EV) fast charging and compressed natural gas (CNG) fueling facilities at strategic locations along Interstate 10 (I-10) across Arizona. The addition of EV fast charging and CNG fueling facilities at select locations will enable passenger and commercial vehicles to cross Arizona, between the borders with California and New Mexico, using electricity and natural gas alternative fuels.

PAG received funding from the U.S. Department of Transportation Federal Highway Administration (USDOT FHWA) to complete this applied research project.

2. BACKGROUND

Section 1413 of the Fixing America's Surface Transportation (FAST) Act, signed into law on December 4, 2015, required the Secretary of Transportation to designate national EV charging, hydrogen, propane and natural gas fueling corridors. The FHWA works with other federal, state and local officials, as well as private industry, to help plan and promote an interstate network of stations that will fuel vehicles powered by clean and domestically produced alternative fuels, so commercial and passenger vehicles can reliably travel between cities, regions and across the entire nation along National Highway System (NHS) corridors.

The FHWA completed four rounds of Alternative Fuels Corridor (AFC) designations from 2016-2019. One of two designations has been assigned to each nominated highway segment:

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

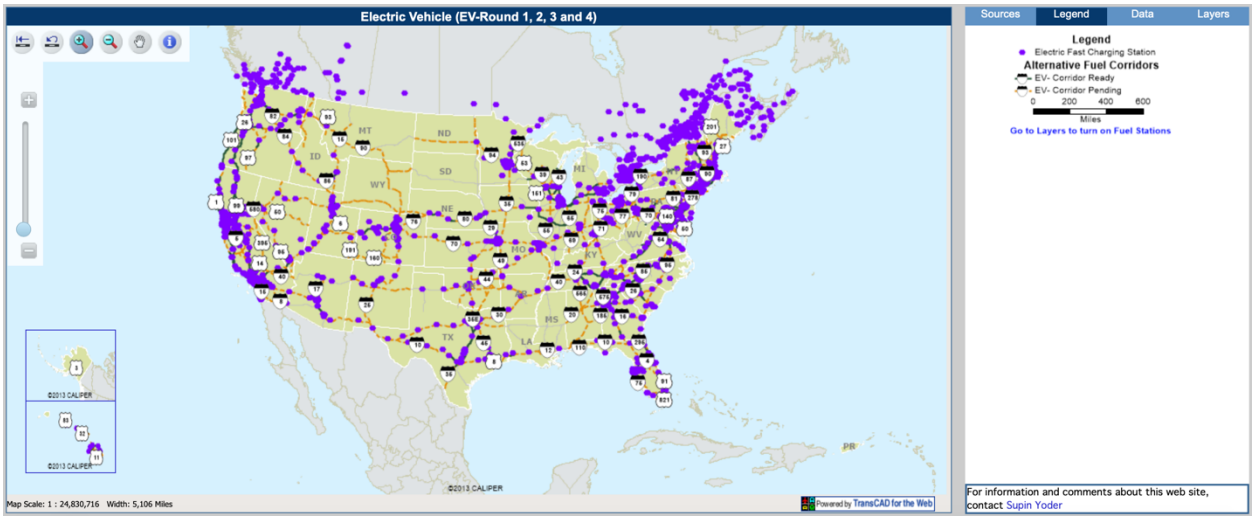
Figures 1 and 2 show the current status of nationwide AFCs for EV charging and CNG fueling for Rounds 1-4.[1]

To date, FHWA's AFC Program has included:

- 100 nominations submitted from state and local officials
- Designations on segments or entire lengths of 119 interstate corridors (including Hawaii), along with 100 US highways/state roads
- 49 states (plus the District of Columbia) designated as Corridor Ready or Corridor Pending for one or more alternative fuel types
- More than 144,000 miles of the NHS (all fuels combined)

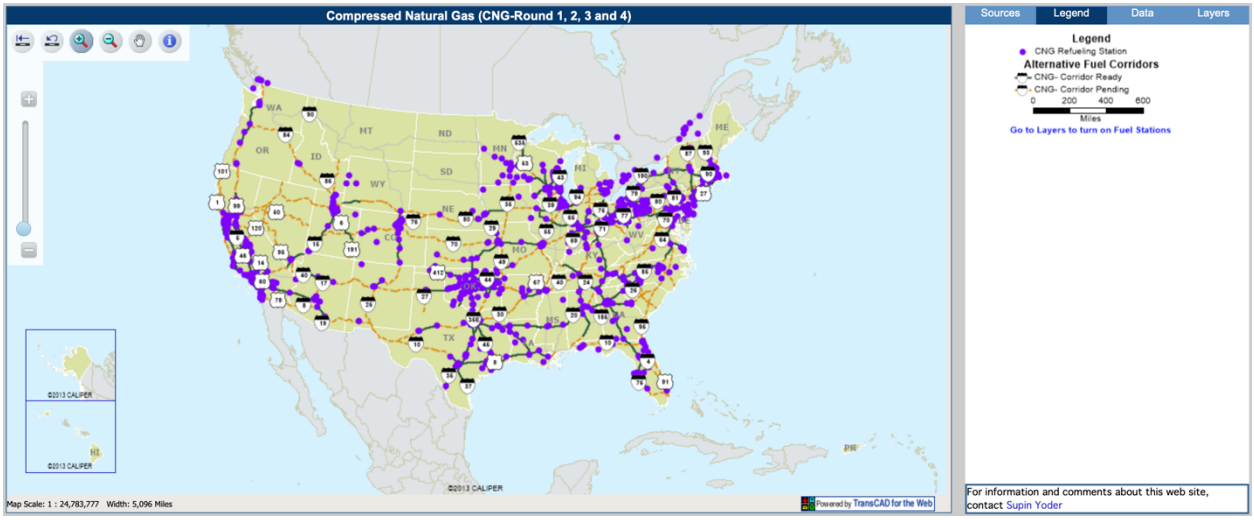
[1] FHWA HEP AFC Interactive GIS Maps https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/maps/

Figure 1 **FHWA Planning, Environment, Realty (HEP) HEPGIS EV – Rounds 1, 2, 3 and 4**



Source: https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/maps/

Figure 2 **FHWA HEPGIS CNG – Rounds 1, 2, 3 and 4**



Source: https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/maps/

The ADOT submitted an AFC nomination in Round 2 in 2017 and received FHWA approval for the following designations:

- I-10: EV Charging Corridor Pending from Arizona/California border to Phoenix and from Arizona/New Mexico border to Tucson
- I-10: EV Charging Corridor Ready from Phoenix , to Tucson
- I-10: CNG Corridor Pending from Arizona/New Mexico border to Tucson
- I-10: CNG Corridor Ready from Arizona/California border to Tucson

The FHWA solicited proposals in July 2019 for transportation agencies to assist with planning for the deployment of alternative vehicle fueling and charging facilities along interstate corridors across the nation with the goal of filling distance gaps along Corridor Pending segments and designating the

corridors as Corridor Ready as defined by the criteria established under FHWA's AFC Program. PAG submitted a grant proposal in August 2019 focused on the EV Charging and CNG Corridor Pending segments of I-10 and was selected as a grant recipient in October 2019, along with Illinois DOT, Pennsylvania DOT, Tennessee DOT and North Central Texas Council of Governments, to complete and submit an AFC Deployment Plan by November 30, 2020.

3. FHWA CRITERIA

3.1 EV CHARGING

The FHWA's current criteria for EV Charging Corridor Ready NHS segments:

- Public Direct Current Fast Charge (DCFC) stations
- No greater than a 50-mile distance between one station and the next on the corridor
- No greater than five mile distance off the highway
- J1772 Combined Charging System (CCS) and CHAdeMO connectors required at each DCFC site. Tesla stations use a proprietary network that is not publicly accessible to non-Tesla vehicles and are, therefore, not included.

DCFC

DC charging for electric vehicles allows for higher charging speeds, as DC current can be supplied directly to the electric vehicle's DC battery at higher power levels than alternating current (AC) charging, which must be converted to DC through a vehicle's on-board charger. AC Level 1 (120 volts or normal household current) and 2 (208-240 volts or an electric dryer power equivalent) charging typically supply between four and 25 miles of range per hour (RPH), depending on the kW acceptance rate of a vehicle's on-board charger and amperage level of the supply power. DCFC (3-phase 480 volts AC input), sometimes referred to as Level 3 DC charging, can supply between 100-2000 miles RPH, depending on the kW power level of the EV charger and the maximum charge rate of the specific EV. EVs that utilize DCFC are commonly referred to as Plugin Electric Vehicles (PEVs), which are subcategorized as Plugin Hybrid Electric Vehicles (PHEVs) and Battery Electric Vehicles (BEVs). For the purposes of this report, the term EV is synonymous with PEV.

CHAdeMO

CHArge de MOve, a DCFC standard first developed in Japan for the Japanese market, is used in the United States for EVs such as the Nissan Leaf and Mitsubishi Outlander PHEV.

CCS

CCS is a DCFC protocol certified by SAE International (formerly Society of Automotive Engineers) and used by automobile manufacturers that support CCS, including BMW, Daimler, FCA (Chrysler and Fiat), Ford, Jaguar, General Motors (Cadillac and Chevrolet), Honda, Hyundai, Kia, Mazda and Volkswagen Group. The "combined" term designates the CCS capability to incorporate the level 2 (J1772 standard) plug and DC fast charging connector into the same larger plug. CCS Combo 1 (CCS1) connector is used in the US while CCS Combo 2 (CCS2) is used in Europe.

The majority of electric vehicle manufacturers use CCS, and several that have previously used CHAdeMO are releasing new models that use CCS, such as Nissan with the announcement of the 300-mile range Ariya to be released in 2021.[2]

[2] Nissan https://www.nissanusa.com/ariya.html

Tesla offers a CHAdeMO charging adapter compatible with the Model S, Model 3, Model X and Model Y and introduced a CCS2 adaptor in European market in 2019; future availability of a Tesla CCS2 charging adaptor for the United States is uncertain.[3,4]

Table 1 shows the approximate miles of range per minute (RPM) charging rate at EV charger power levels of 50, 150 and 350 kW and the corresponding charge times for 100-, 240- and 300-mile range EVs.[5] The maximum power level and charging rate will vary by EV model.

Table 1 DCFC Charging Levels and Miles Range Per Minute

CHARGING LEVEL	Miles Range Replenished
50 kW	2-3 miles/minute; charges 100-mile range EV to 80% in 30 minutes
150 kW	6-9 miles/minute; charges 240-mile range EV to 80% in 30 minutes
350 kW	12-20 miles/minute; charges 300-mile range EV to 80% in 30 minutes

Source: https://www.epri.com/research/products/3002009442

A limited number of PHEV models have been manufactured with CHAdeMO fast charging capability; however, the smaller batteries and shorter electric-only range of PHEVs compared to BEVs generally results in gas-only fueling during highway travel.

The average range of model year 2020 light-duty BEVs was 255 miles, increased from 73 miles average range for model year 2011. The average electric range of model year 2020 PHEVs (parallel) has decreased to 22 miles compared to 35 miles for model year 2011.[6]

3.2 CNG FUELING

FHWA's current criteria for CNG Corridor Pending NHS segments:

- Public CNG fueling stations
- No greater than 150 mile distance between one station and the next on the corridor
- No greater than five mile distance off the highway
- 3,600 psi fast-fill CNG fueling

CNG is used in light-, medium- and heavy-duty applications. A CNG-powered vehicle gets about the same fuel economy as a conventional gasoline vehicle on a gallon gasoline equivalent (gge) basis. One gge equals about 126 standard cubic feet and 5.66 pounds of CNG.

CNG stations can be fast-fill, time-fill, or a combination of both. The type of station needed is dependent on the application. Typically, retail stations use fast-fill, and fleets that have central

[3] Tesla Product CHAdeMO Adapter https://shop.tesla.com/product/chademo-adapter
[4] Tesla EU Charging Connecters https://www.tesla.com/en_EU/support/charging-connectors
[5] EPRI Consumer Guide to Electric Vehicle Charging https://www.epri.com/research/products/3002009442
[6] EERE Find Electric Vehicle Models https://www.energy.gov/eere/electricvehicles/find-electric-vehicle-models

refueling and the ability to fill overnight use time-fill. All public fueling stations offer a fast-fill option although some systems are rated at 3,000 psi versus 3,600 psi.

Unlike gasoline or diesel stations, CNG stations are not "one size fits all." Building a CNG station for a retail application or a fleet requires calculating the right combination of pressure and storage needed for the types of vehicles being fueled.

Drivers fueling light-duty vehicles at a fast-fill station experience similar fill times to a conventional gasoline fueling station; less than five minutes for a 20-gallon-equivalent tank. Large truck and bus stations will fill at twice that rate.[7]

[7] AFDC Natural Gas https://afdc.energy.gov/fuels/natural_gas.html

4. REV WEST COLLABORATION

In October 2017, Arizona joined Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming (Signatory States) in signing the Regional Electric Vehicle (REV) West memorandum of understanding (MOU) to create an Intermountain West EV Corridor that will make it possible to seamlessly drive an EV across the Signatory States' major transportation corridors.[8]

In December 2019, the Signatory States signed a revised REV West MOU to update their EV corridor goals based on progress to date. Signatory States are committed to:

- Educate consumers and fleet owners to raise EV awareness, reduce range anxiety and increase EV adoption
- Coordinate on EV charging station locations to achieve a consistent user experience across Signatory StatesUse and promote the REV West Voluntary Minimum Standards for EV DCFC charging stations and explore opportunities for implementing the standards in Signatory States
- Identify and develop opportunities to incorporate EV charging stations into planning and development processes such as building codes, metering policies and renewable energy generation projects
- Encourage EV manufacturers to stock and market a wide variety of EVs within the Signatory States
- Identify, respond to, and collaborate on funding opportunities to support the development of the plan
- Support the build-out of DCFC stations along EV corridors through investments, partnerships and other mechanisms[9,10,11]

The National Association of State Energy Officials (NASEO) is facilitating support to the Signatory States as they implement activities outlined in the MOU, including creating best practices and procedures to enhance EV adoption, coordinating on EV charging station locations, creating voluntary minimum standards and leveraging economies of scale.

The Signatory States maintain a coordination group composed of senior leadership from each state who meet on a quarterly basis and report on the above actions. For more information, see the REV West website.[12] This deployment plan takes into consideration the REV West Voluntary Minimum Standards for EV DCFC charging station siting as follows:

- Public access 24 hours a day, each day of the year;
- ADA compliance with wheelchair accessibility;
- Access to drinking fountains, bathrooms, and food or vending;
- Security cameras, adequate lighting and an emergency shelter;
- Within walking distance of full-service amenities such as local restaurants, retail shopping or tourist attractions.

[8] NASEO REV West MOU https://www.naseo.org/Data/Sites/1/revwest_mou.pdf
[9] NASEO Updated REV West MOU https://www.naseo.org/Data/Sites/1/revwest_mou_2019_final.pdf
[10] NASEO Voluntary Minimum Station Standards https://www.naseo.org/Data/Sites/1/revwest_volminimumstandards.pdf
[11] AFDC REV West Plan https://afdc.energy.gov/laws/11881
[12] NASEO REV West https://www.naseo.org/issues/transportation/rev-west

5. APPROACH AND METHODS

The goals of this project are to develop a corridor deployment plan and facilitate installation of EV charging and CNG fueling facilities with the support of public-private partnerships. The sections of focus along I-10 were the EV Charging Corridor Pending segment between the Arizona/California border and Phoenix , and the EV Charging and CNG Corridor Pending segments between the Arizona/New Mexico border and Tucson. The following steps were taken to achieve these goals:

Step 1: Identify and verify existing EV charging stations and CNG fueling sites located along the EV Charging and CNG Corridor Pending segments of I-10 that meet current FHWA criteria. Existing EV charging and CNG fueling locations are shown in Figures 3 and 4.

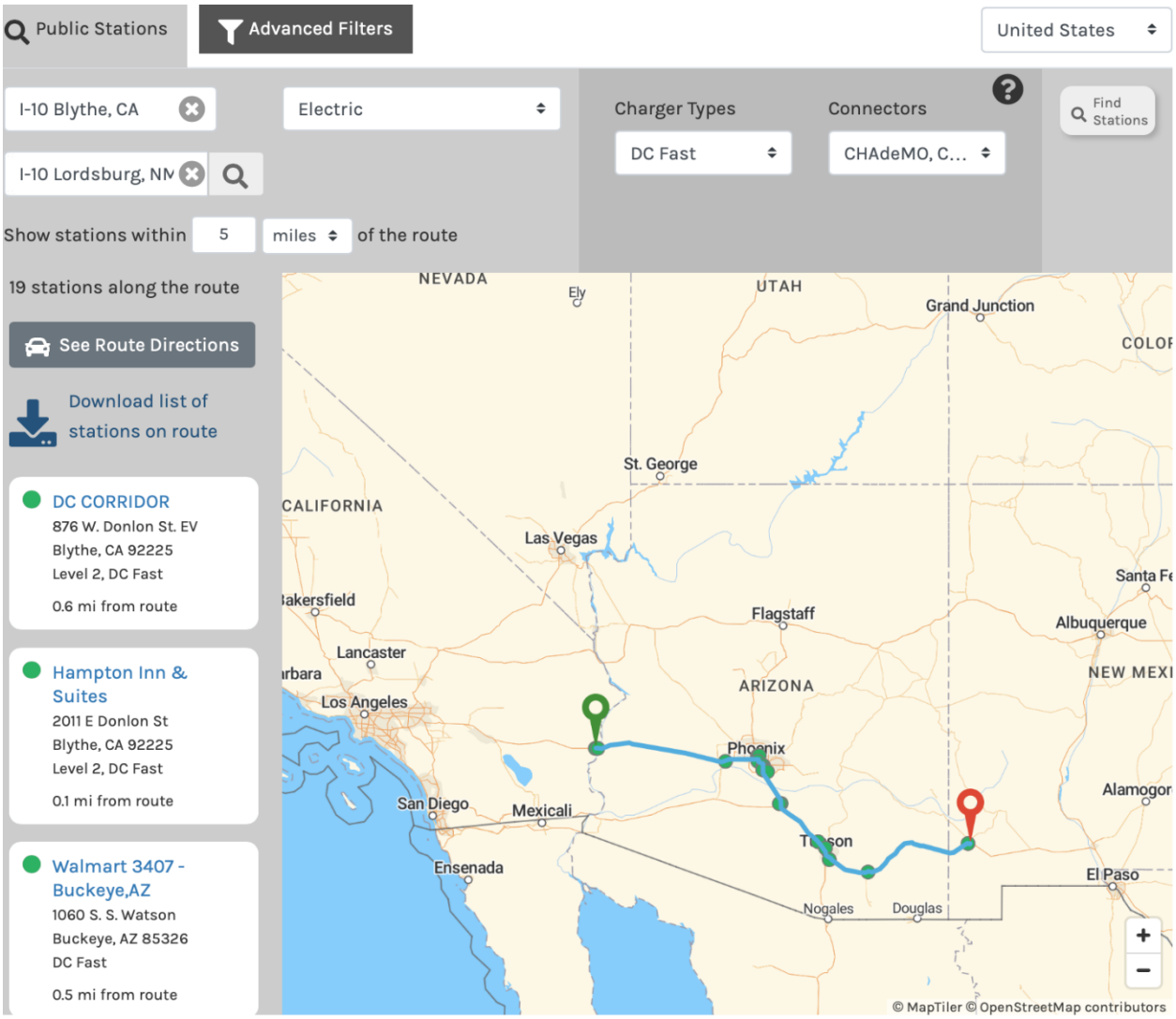
The USDOT Office of Energy Efficiency & Renewable Energy (EERE) Alternative Fuels Data Center[13] and public search tools were used as follows:

EV Charging:
https://afdc.energy.gov/fuels/electricity_locations.html#/find/nearest?fuel=ELEC;
https://www.plugshare.com;
https://openchargemap.org/site;
https://chargehub.com/en/charging-stations-map.html;
https://www.chargepoint.com;
https://www.evgo.com/charging-locations/;
https://www.electrifyamerica.com/locate-charger/

CNG Fueling:
https://afdc.energy.gov/fuels/natural_gas_locations.html#/find/nearest?fuel=CNG;
https://maps.cngnow.com;
http://www.cnglocator.net;
https://www.cnglngstations.com;
http://www.cng4america.com/station-locator.html;
https://www.trilliumcng.com/en/find-our-fuel

[13] AFDC Alternative Fuels and Advanced Vehicles https://afdc.energy.gov/fuels/

Figure 3 **Existing DCFC EV Charging Locations**



Source: https://afdc.energy.gov/fuels/electricity_stations.html

Step 2: Identify and evaluate gaps greater than 50 miles for EV charging and 150 miles for CNG fueling, using ArcGIS web maps and publicly available mapping products. Evaluate the minimum number of new facility locations required to close the distance gaps through use of GIS web maps.

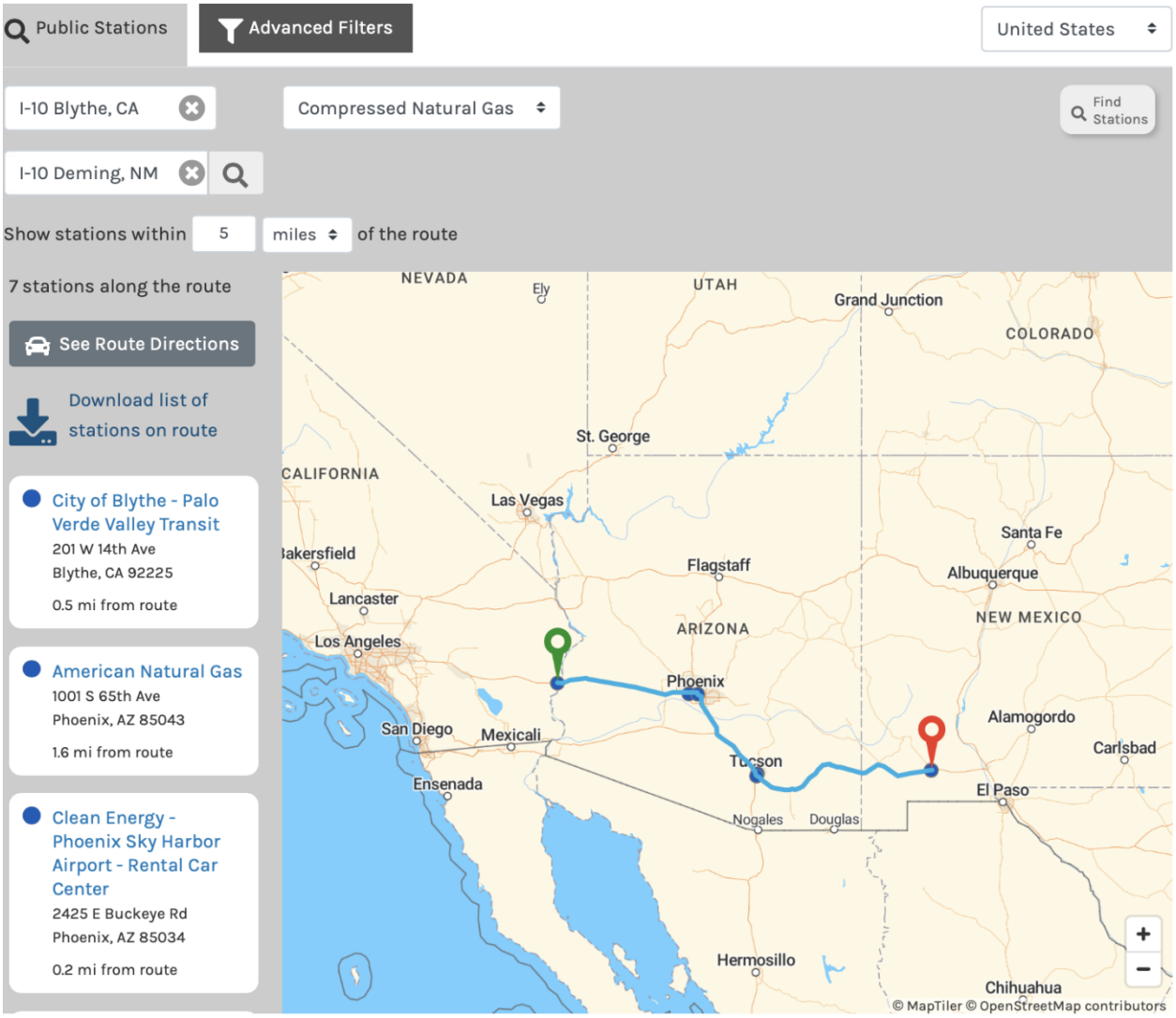
Step 3: Select areas where additional facilities are required to fill the distance gaps and identify potential locations along those highway exits, using ArcGIS web map data layers to determine site suitability selection for installation of infrastructure combined with mapping resource tools such as Google Earth, Bing and Pictometry. Further evaluate potential facility locations by conducting field site visits using Environmental Systems Research Institute's (Esri's) Survey123 application to confirm FHWA criteria and REV West voluntary minimum standard attributes.

Step 4: Gather contact information for the prospective facility owners/operators, utilities and other stakeholders.

Step 5: Form public-private collaborative advisory group, invite stakeholders and set quarterly meetings to gather input.

Step 6: Develop plan using stakeholder advisory group input and partner resources.

Figure 4 **Existing CNG Fueling Locations**



Source: https://afdc.energy.gov/fuels/natural_gas_stations.html

6. SITING ANALYSIS

Siting analysis for this exercise leveraged publicly available information resources and FHWA siting criteria to narrow the focus of potential sites as described in the methodology above. The resulting list of existing and potential EV charging and CNG fueling locations along the Corridor Pending segments of I-10 are shown in Tables 2-4.

Table 2 EV Charging Stations; I-10 California to Phoenix EV Charging Corridor Pending Segment

Site	Location	I-10 Exit #	Network	Status
Denny's/DC CORRIDOR	Blythe, CA	239	ChargePoint	Existing
Hampton Inn & Suites	Blythe, CA	239	EV Connect	Existing
Love's #286	Quartzsite, AZ	17	Electrify America	Pending
Pilot #1212	Salome, AZ	45	N/A	Potential
Pilot #1215	Salome, AZ	45	N/A	Potential
Pilot #1180	Tonopah, AZ	94	N/A	Potential
Walmart #3407	Buckeye, AZ	117	Electrify America	Existing

Table 3 EV Charging Stations; I-10 Tucson to New Mexico EV Charging Corridor Pending Segment

Site	Location	I-10 Exit #	Network	Status
Baggin's Sandwiches	Tucson, AZ	267	EVgo	Existing
Walmart #3807	Benson, AZ	303	Electrify America	Existing
TA #226	Willcox, AZ	340	N/A	Potential
Willcox Truck Plaza	Willcox, AZ	340	N/A	Potential
Pilot #1269	San Simon, AZ	378	N/A	Potential
4K Truck Stop	San Simon, AZ	378	N/A	Potential
Chevron	Lordsburg, NM	20A	Electrify America	Existing

Once the potential sites were selected, site visits and direct conversations with project partners took place. Due to the scarcity of options along these remaining gaps, the narrowing down process was straightforward once siting criteria was applied.

Two tools were developed with a goal of broader adoption in mind. These tools were built within the Esri suite of services leveraging existing open data sources and analytical resources made available through the National Renewable Energy Laboratory (NREL) application programming interface (API).

Table 4 CNG Fueling Stations; I-10 Tucson to New Mexico CNG Corridor Pending Segment

Site	Location	I-10 Exit #	Status
Clean Energy	Tucson, AZ	263	Existing
Trillium – Golden Eagle	Tucson, AZ	263	Existing
TA #226	Willcox, AZ	340	Potential
Willcox Truck Plaza	Willcox, AZ	340	Potential
Pilot #1269	San Simon, AZ	378	Potential
4K Truck Stop	San Simon, AZ	378	Potential
City of Deming	Deming, NM	81	Existing

The first tool integrates the siting requirements into an Esri Survey123 form to facilitate data collection and reporting. The second tool is an enhancement to the station route distance tool to support route distance analysis of potential sites using U.S. Department of Energy (USDOE) web services.

6.1 ARCGIS SURVEY123

Survey123 Application – Potential Alternative Fuel Site Survey Tool

The Esri ArcGIS Survey123 application was selected because Esri products are the industry standard. It is an easy-to-use form-centric data collection application, and any organization with ArcGIS Enterprise has free access to it.[14]

To collect and report site data, an Esri Survey123 form was developed. Once collected, data are published to ArcGIS and then available on ArcGIS Online (AGO) or through an organization's Esri Portal account. The process of collecting data in the field for each site is straightforward. The Survey123 form is completed, and the data are available for subsequent editing, analysis and reporting using Esri's AGO or the subscribing organization's portal. Data can be collected using the form on a phone, tablet or with a web browser.

[14] ESRI ArcGIS Survey123 https://survey123.arcgis.com

Once in the field, the custom form in the Survey123 app can be completed. In addition to collecting the required site details, additional data about the collection process is also gathered. The form includes fields for site name and address, the standards and amenities available there, as well as photos and the latitude and longitude (XY) of the site. Additional fields include date and time of the collection as well as data collector name, email address and signature.

With an Esri login to AGO or your Portal, once data are input, they are available to view, analyze, edit and map. Figures 5-9 show the customized Survey123 Form, My Surveys detail and Map Viewer with Feature Report option and Edit Mode.

Figure 5 **Survey123 Form**

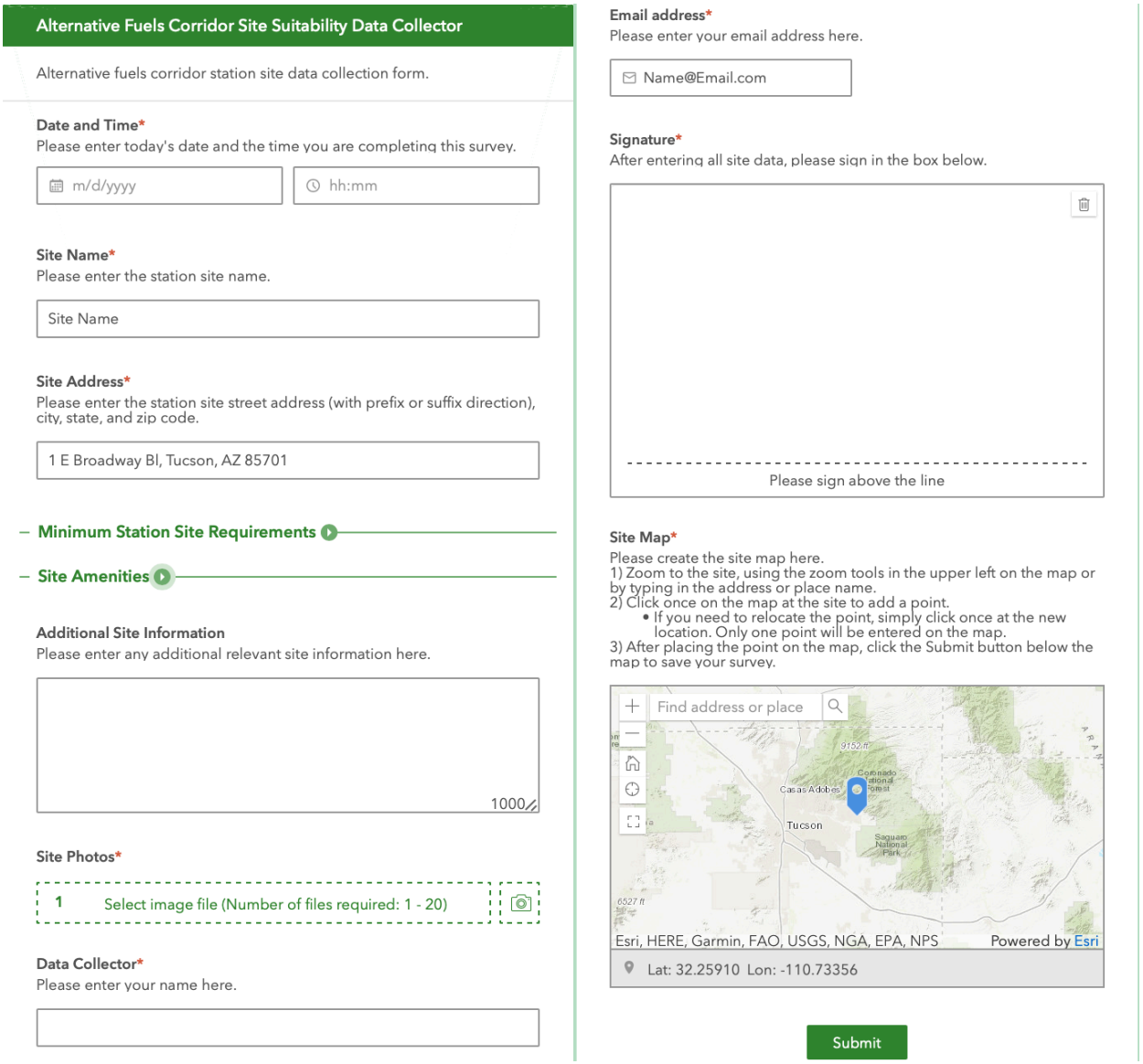


Figure 6 **Survey123 My Surveys**

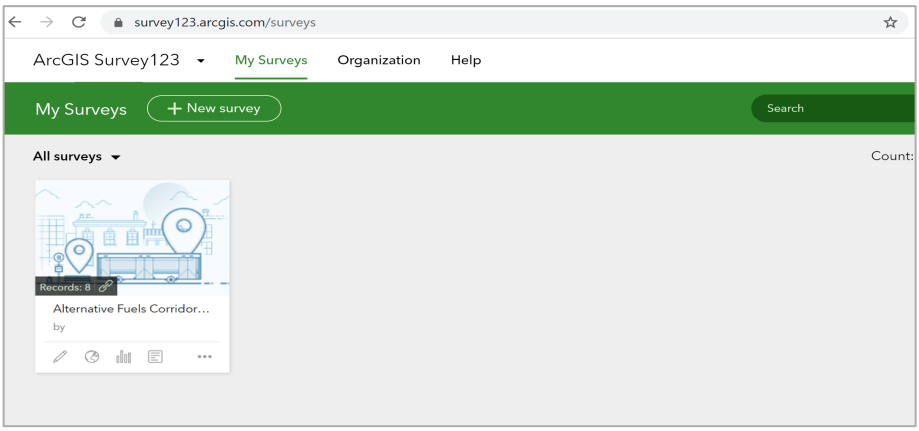


Figure 7 **Survey123 in Map Viewer**

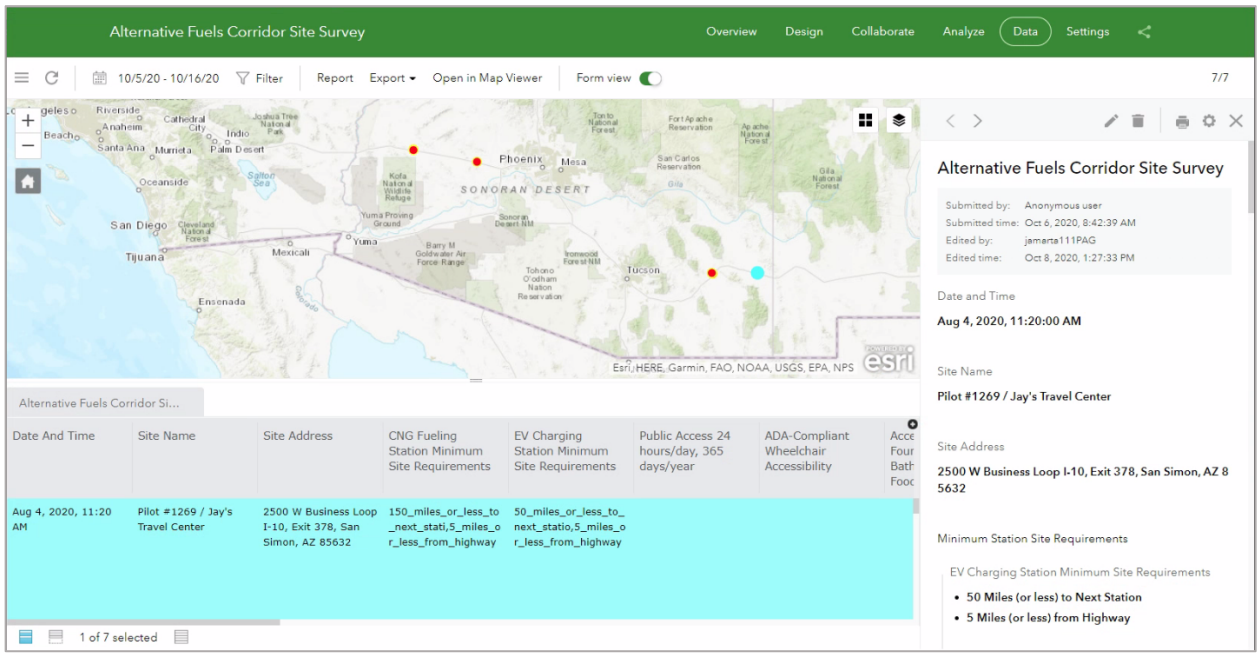


Figure 8 **Survey123 in Map Viewer Feature Report Option**

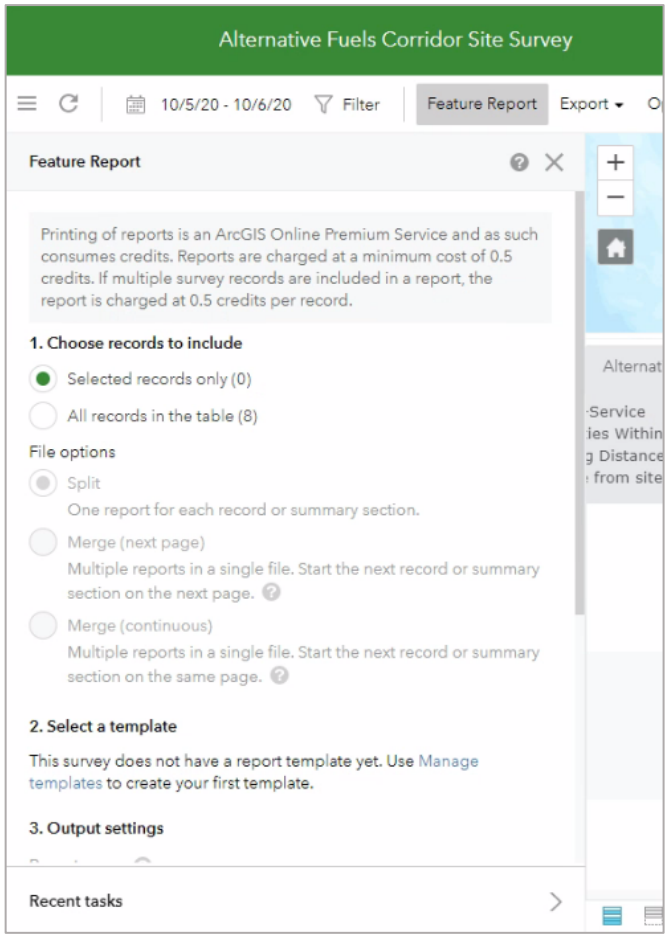
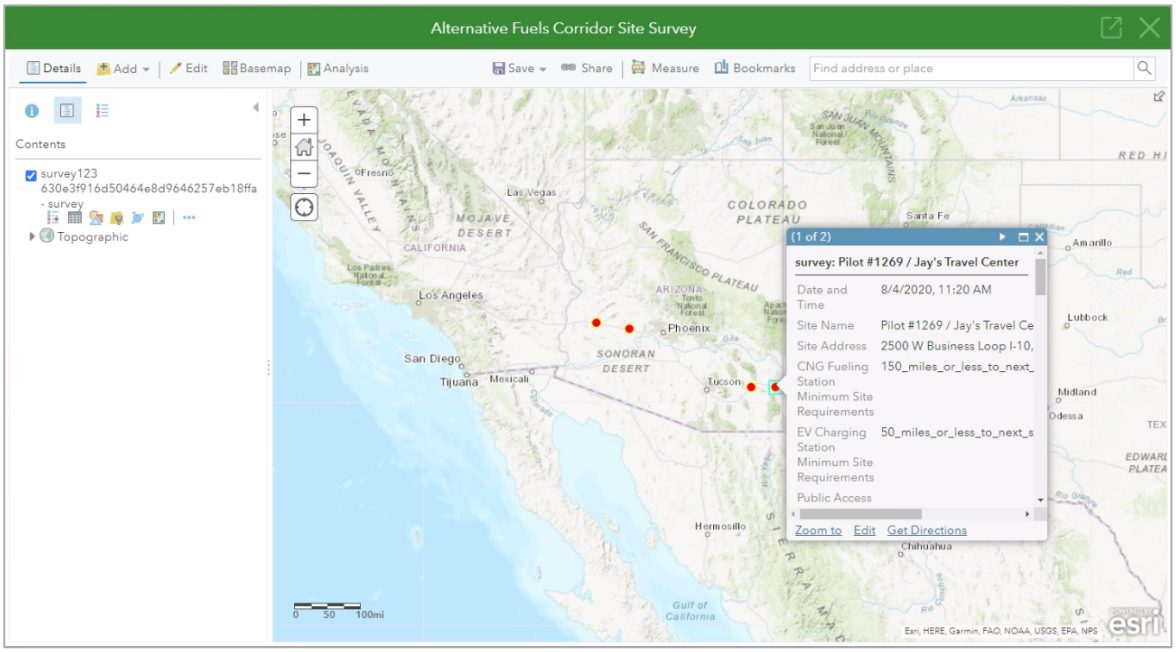


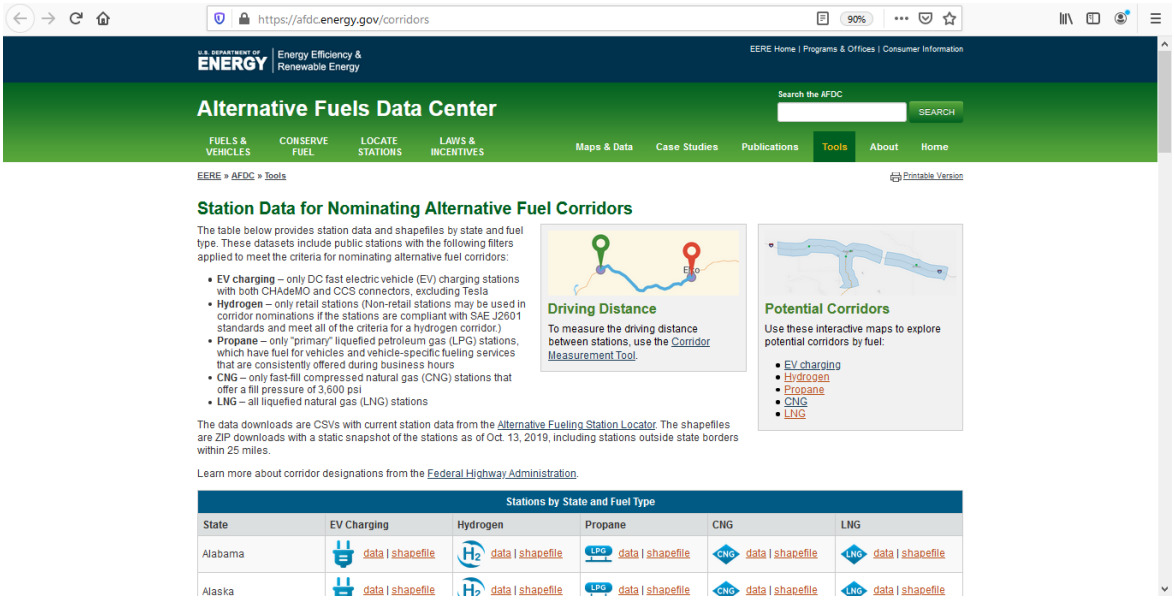
Figure 9 **Survey123 in Map Viewer Edit Mode**



6.2 ARCGIS WEB MAPS

Key information resources supporting this exercise include USDOE AFC AGO Web Maps, Homeland Infrastructure Foundational Level Data (HIFLD) open map services, custom built map services of project partner sites and La Paz and Cochise counties' open data parcel map services. This exercise focused on readily available national open data resources and demonstrated the application of leveraging local open data sources to facilitate broader adoption of this methodology in other locales.

Figure 10 USDOE AFDC Potential Corridor Web Maps



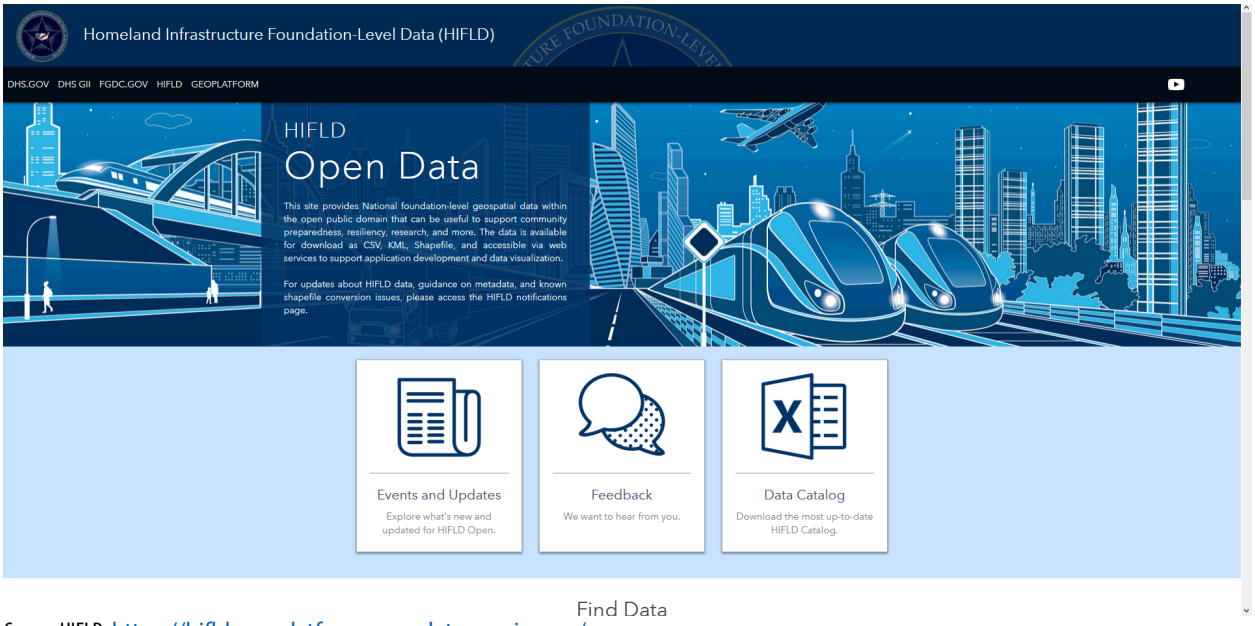
Source: AFDC, https://afdc.energy.gov/corridors

For this exercise, we added additional datasets and tools to the EV Charging and CNG Potential Corridor interactive web maps. USDOE provided these resources in a very consumable set of AGO web maps that PAG staff saved to its ArcGIS Online organizational account.[15,16] These source web maps were then customized with additional data that were pulled in from open source map service layers to add additional content to support this effort.

[15] ArcGIS Electric Corridor Map https://www.arcgis.com/home/webmap/viewer.html?webmap=376dedd75b8347b8936abd70703cdb69&extent=-158.6002,16.7349,-56.1198,56.6162

[16] ArcGIS CNG Corridor Map https://www.arcgis.com/home/webmap/viewer.html?webmap=a86a599982d8486587863262a460ccf9&extent=-158.6002,16.7349,-56.1198,56.6162

Figure 11 Homeland Infrastructure Foundation-Level Data (HIFLD) Open Map Services



Source: HIFLD, https://hifld-geoplatform.opendata.arcgis.com/

HIFLD Open Map Services:

Electric_Power_Transmission_Lines - Transmission_Lines
https://services1.arcgis.com/Hp6G80Pky0om7QvQ/ArcGIS/rest/services/Electric_Power_Transmission_Lines/FeatureServer/0

Electric_Retail_Service_Territories - Retail_Service_Territories
https://services1.arcgis.com/Hp6G80Pky0om7QvQ/arcgis/rest/services/Electric_Retail_Service_Territories/FeatureServer/0

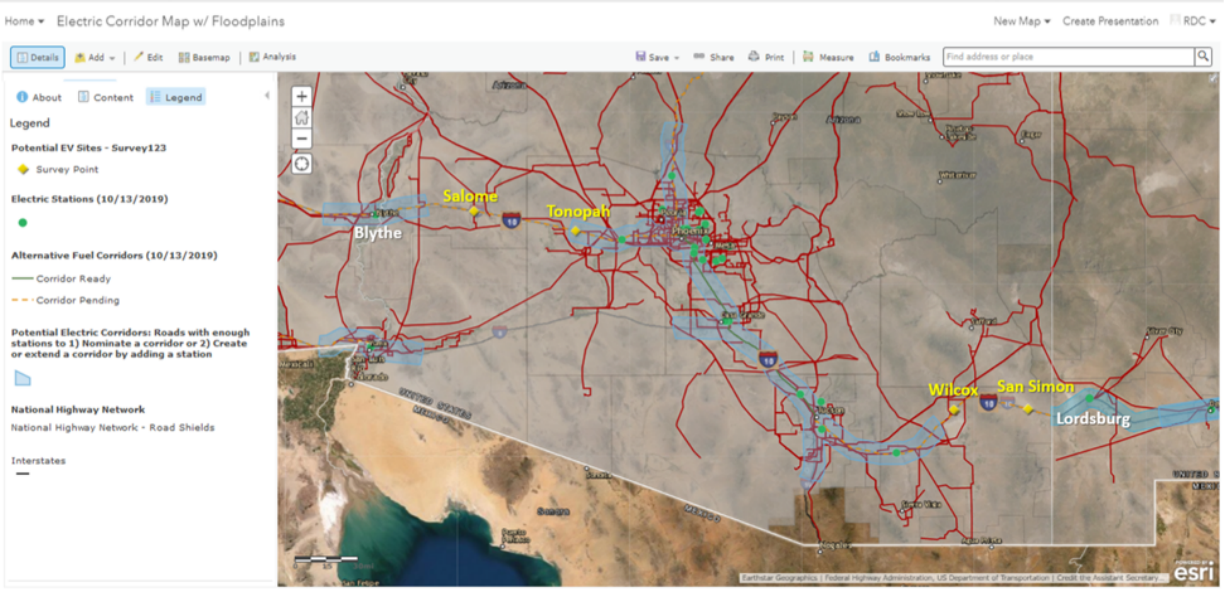
Natural_Gas_Liquid_Pipelines - Natural_Gas_Pipelines
https://services1.arcgis.com/Hp6G80Pky0om7QvQ/arcgis/rest/services/Natural_Gas_Liquid_Pipelines/FeatureServer/0

Natural_Gas_Local_Distribution_Company_Service_Territories - NG_LDC_Service_Territories
https://services1.arcgis.com/Hp6G80Pky0om7QvQ/arcgis/rest/services/Natural_Gas_Local_Distribution_Company_Service_Territories/FeatureServer/0

Local Open Map Services:

La Paz County Parcels
https://gis.lapazcountyaz.org/server/rest/services/Hosted/ParcelData08172020/FeatureServer/0
Cochise County Parcels
https://services6.arcgis.com/Yxem0VOcqSy8T6TE/arcgis/rest/services/Cad_Parcels/FeatureServer/0

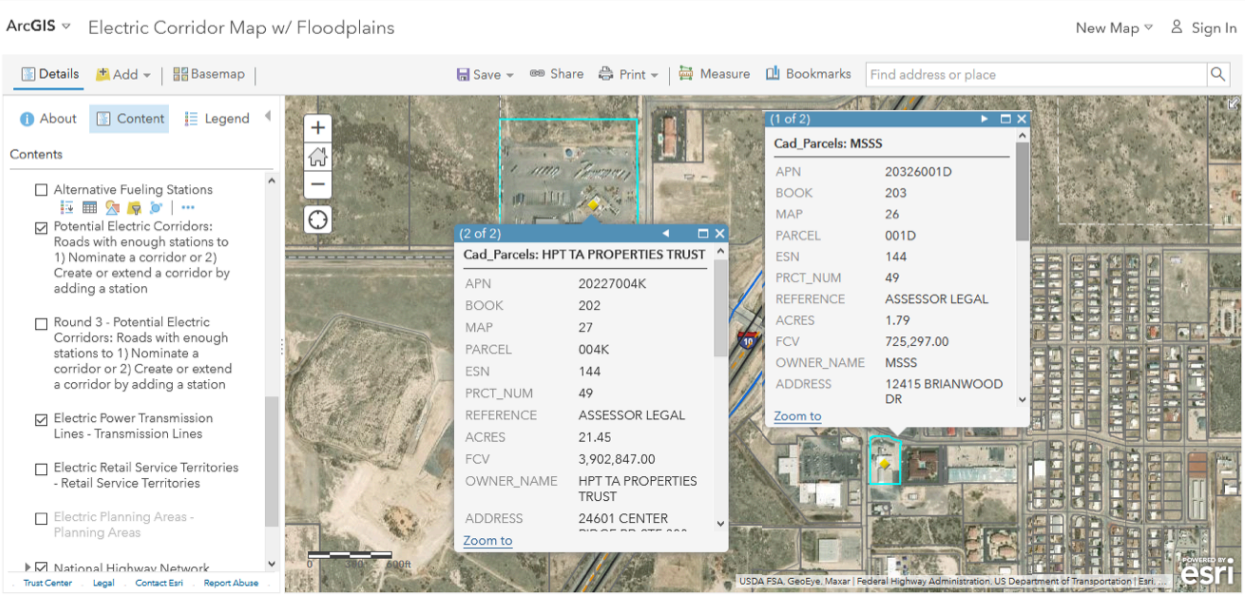
Figure 12 **USDOE AFDC EV Web Map Customized with HIFLD and Local Open Data Sources**



Willcox Potential EV Charging Site Comparison

Integrating the parcel layer supported the high-level assessment of the area available on these two potential sites shown in Figure 13: 21.45 acres vs 1.79 acres.

Figure 13 **ArcGIS Web Map TA Willcox and Willcox Truck Plaza**



Potential Station Route Distance Tool

This tool was developed leveraging the NREL Developer Tools by combining the functionality of the nearest station query and the drive distance request. It is an enhancement on the currently published

Station Distance Tool as it better supports users looking at potential station sites. The current tool calculates the distance between existing stations. This enhanced tool allows the user to consume NREL data sources and analysis in the process of displaying drive distance from any potential location to NREL published station location data.

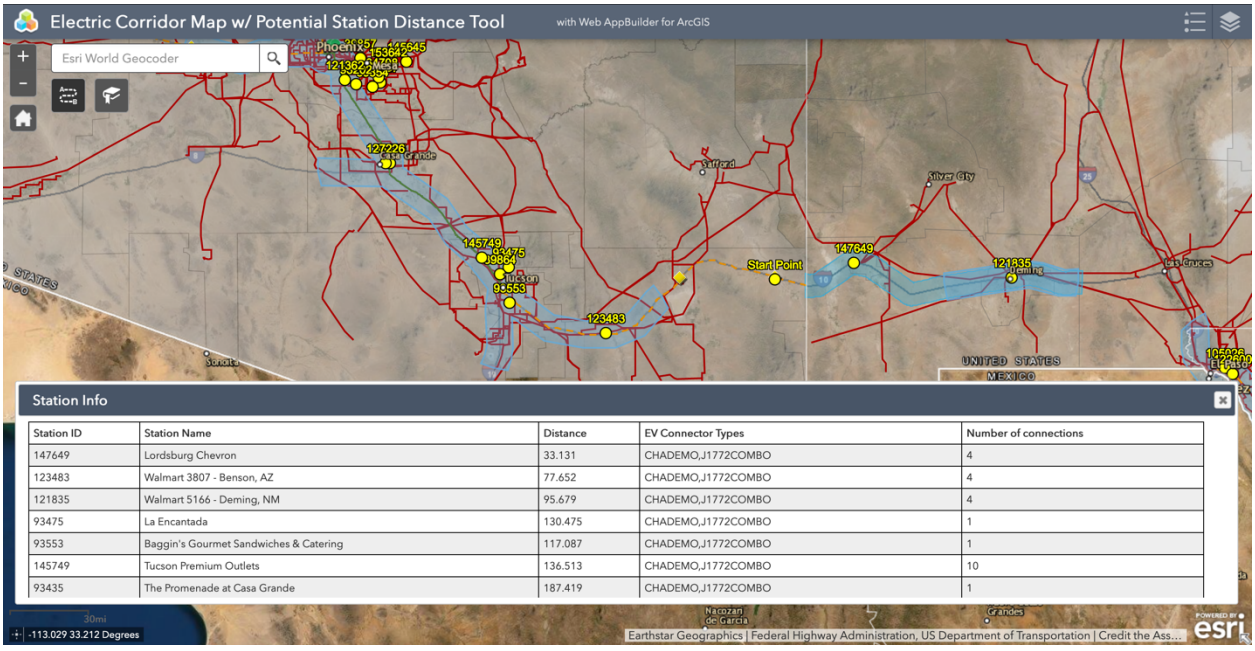
Beta functionality of this tool was built in an internal custom web map interface. It has been migrated to be deployed as an AGO Widget that can be added to an Esri Web App Builder interface that consumes the NREL published corridor web maps referenced above.

The user is asked to select a fuel type (EV or CNG), click a point on the map and is returned a table of the 20 nearest stations within 200 miles. The tool executes two API calls and passes in a query string to gather the nearest relevant EV or CNG sites for this exercise. While the initial call retrieves the data and populates a table of the 20 nearest EV or CNG sites within a 200-mile radius, the second API request evaluates the route distance from the user-generated point on the map to each EV or CNG site in the list and sorts the table based on route distance.

The user can then explore the nearest stations by clicking on the station row in the table and see the related route displayed on the map. This approach provides flexibility for the user to identify the relevant nearest station locations and distance either east/west or north/south along a corridor.

The station filters are:
Electric Vehicle Stations: Charging Level: DC Fast, Connector Type: J12772COMBO or CHADEMO; Access: Public.
CNG Vehicle Stations: PSI:3600; Access: Public.

Figure 14 EV Charging Corridor Map with Potential Station Distance Tool



Station ID	Station Name	Distance	EV Connector Types	Number of connections
147649	Lordsburg Chevron	33.131	CHADEMO,J1772COMBO	4
123483	Walmart 3807 - Benson, AZ	77.652	CHADEMO,J1772COMBO	4
121835	Walmart 5166 - Deming, NM	95.679	CHADEMO,J1772COMBO	4
93475	La Encantada	130.475	CHADEMO,J1772COMBO	1
93553	Baggin's Gourmet Sandwiches & Catering	117.087	CHADEMO,J1772COMBO	1
145749	Tucson Premium Outlets	136.513	CHADEMO,J1772COMBO	10
93435	The Promenade at Casa Grande	187.419	CHADEMO,J1772COMBO	1

Potential Willcox EV Site Nearest Station Route Distances

Figure 15 Willcox West on I-10 to Benson

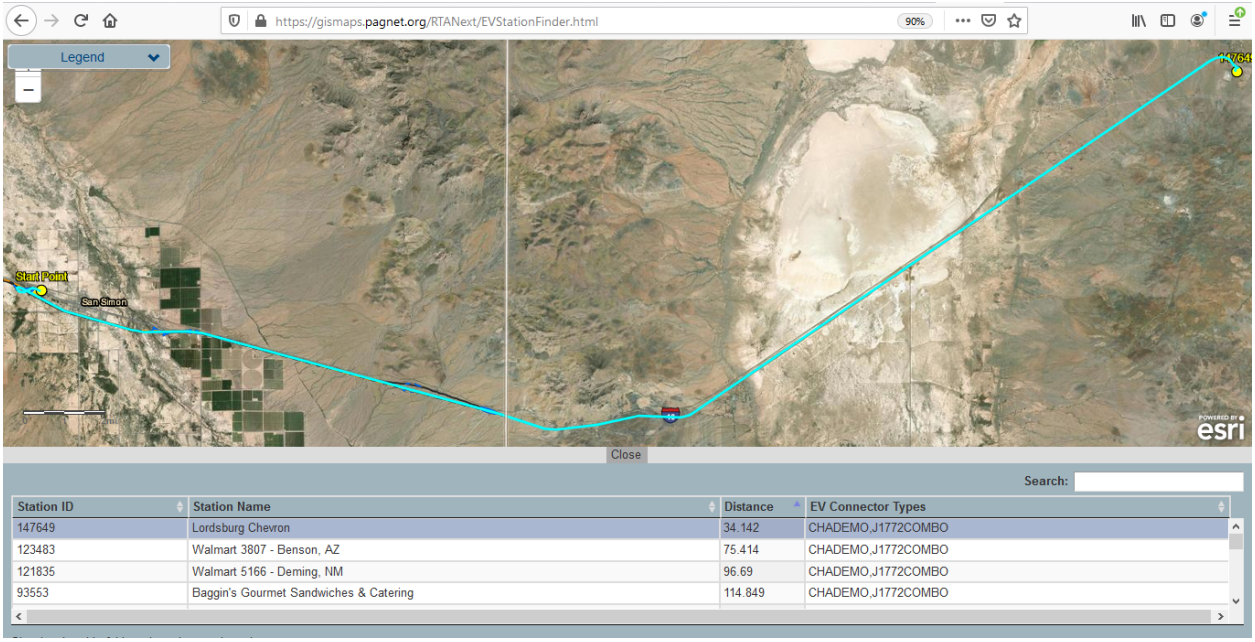
Station ID	Station Name	Distance	EV Connector Types
123483	Walmart 3807 - Benson, AZ	36.803	CHADEMO,J1772COMBO
147649	Lordsburg Chevron	71.894	CHADEMO,J1772COMBO
93553	Baggin's Gourmet Sandwiches & Catering	76.238	CHADEMO,J1772COMBO
93475	La Encantada	89.627	CHADEMO,J1772COMBO

Figure 16 Willcox East on I-10 to Lordsburg, NM

Station ID	Station Name	Distance	EV Connector Types
123483	Walmart 3807 - Benson, AZ	36.803	CHADEMO,J1772COMBO
147649	Lordsburg Chevron	71.894	CHADEMO,J1772COMBO
93553	Baggin's Gourmet Sandwiches & Catering	76.238	CHADEMO,J1772COMBO
93475	La Encantada	89.627	CHADEMO,J1772COMBO

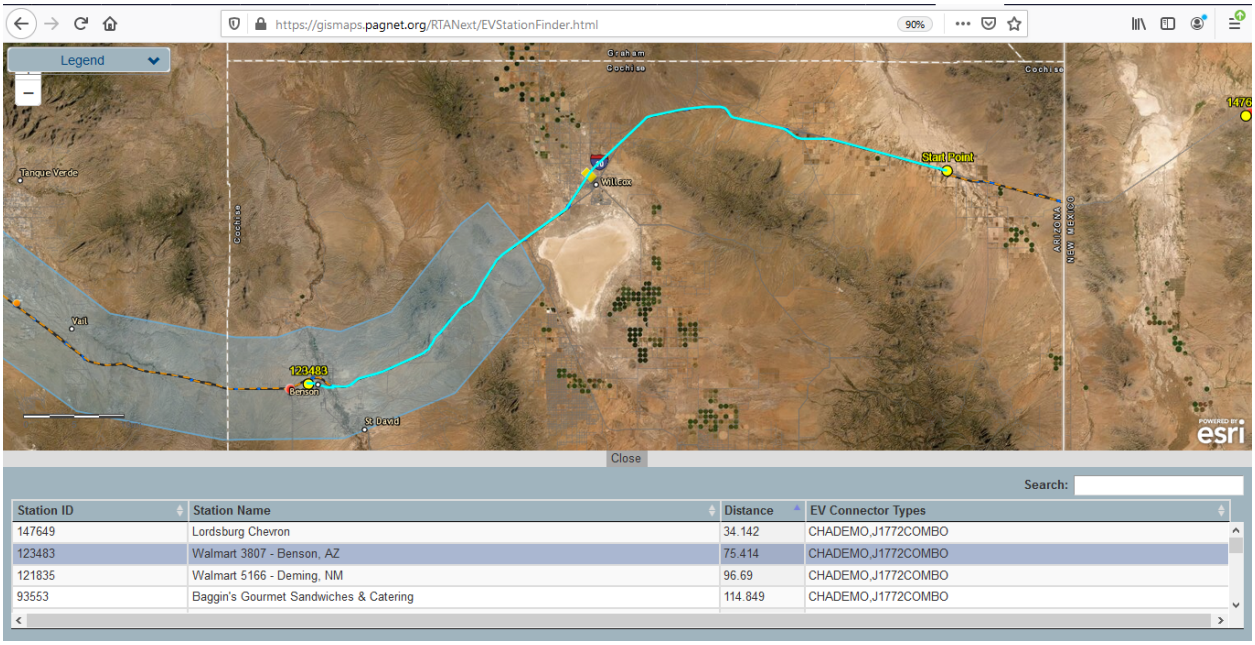
Potential San Simon EV Site Nearest Station Route Distances

Figure 17 San Simon East on I-10 to Lordsburg, NM



Station ID	Station Name	Distance	EV Connector Types
147649	Lordsburg Chevron	34.142	CHADEMO,J1772COMBO
123483	Walmart 3807 - Benson, AZ	75.414	CHADEMO,J1772COMBO
121835	Walmart 5166 - Deming, NM	96.69	CHADEMO,J1772COMBO
93553	Baggin's Gourmet Sandwiches & Catering	114.849	CHADEMO,J1772COMBO

Figure 18 San Simon West on I-10 to Benson, AZ



Station ID	Station Name	Distance	EV Connector Types
147649	Lordsburg Chevron	34.142	CHADEMO,J1772COMBO
123483	Walmart 3807 - Benson, AZ	75.414	CHADEMO,J1772COMBO
121835	Walmart 5166 - Deming, NM	96.69	CHADEMO,J1772COMBO
93553	Baggin's Gourmet Sandwiches & Catering	114.849	CHADEMO,J1772COMBO

7. PUBLIC-PRIVATE PARTNERSHIP

Development of public-private partnerships is an integral part of developing a plan for deployment of EV charging and CNG fueling facilities. Key stakeholders in this process were the potential site hosts where the facilities will be located or co-located. The facilities selected along the rural Corridor Pending gap locations of I-10 were locations of truck stop travel centers. These locations were selected due to their 24-hours-a-day/365-days-per-year operation, adequate space and parking for alternative fuel facilities and amenities such as lighting, restrooms and food and beverages. Additional invited stakeholders included electric and natural gas utilities, EV charging and CNG fueling companies, project partners, various public entities and public interest groups.

7.1 ARIZONA INTERSTATE/INFRASTRUCTURE COLLABORATIVE

The Arizona Interstate/Infrastructure Collaborative (AIIC) was formed for this project as a public-private stakeholder advisory group to assist in development of the Arizona I-10 AFC Deployment Plan. Under pandemic conditions, quarterly webinar meetings took place to determine the needs, barriers and suggested results of the project. AIIC gathered and provided data for cost estimates, rate plans, funding options, signage, traffic counts, EV, CNG and conventional vehicle statistics, demographics and other items for the plan.

AIIC Webinar Meeting Dates:

- March 27, 2020
- May 29, 2020
- August 14, 2020
- October 16, 2020

Stakeholders:

Potential Site Host Facilities:

- Pilot Company (Pilot Travel Centers), TravelCenters of America (TA), Willcox Truck Plaza, 4K Truck Stop

Utility Companies:

- Electric: Arizona Public Service (APS), Sulphur Springs Valley Electric Cooperative (SSVEC), Salt River Project (SRP), Tucson Electric Power Company (TEP), Arizona Electric Power Cooperative (AEPC)
- Natural Gas: Southwest Gas Corporation (SWG)

EV Charging Companies:

- Electrify America, ChargePoint, Greenlots

CNG fueling Companies:

- Trillium (A Love's Company), CNG Services of Arizona

Automobile Company:

- Nikola Motor Co.

Clean Cities Partner:

- Valley of the Sun Clean Cities Coalition (VSCCC)

Public Entities:

- ADOT partner, FHWA – Arizona Division, Arizona Department of Environmental Quality (ADEQ), Arizona Department of Administration (ADOA), Arizona Governor's Office, Arizona State University (ASU)

Interest Group:

- Arizona Trucking Association (ATA)

Meeting agendas, webinar recordings and summaries are available on the PAG website: https://pagregion.com/sustainability/air-quality/i10-alt-fuels-deployment-plan/

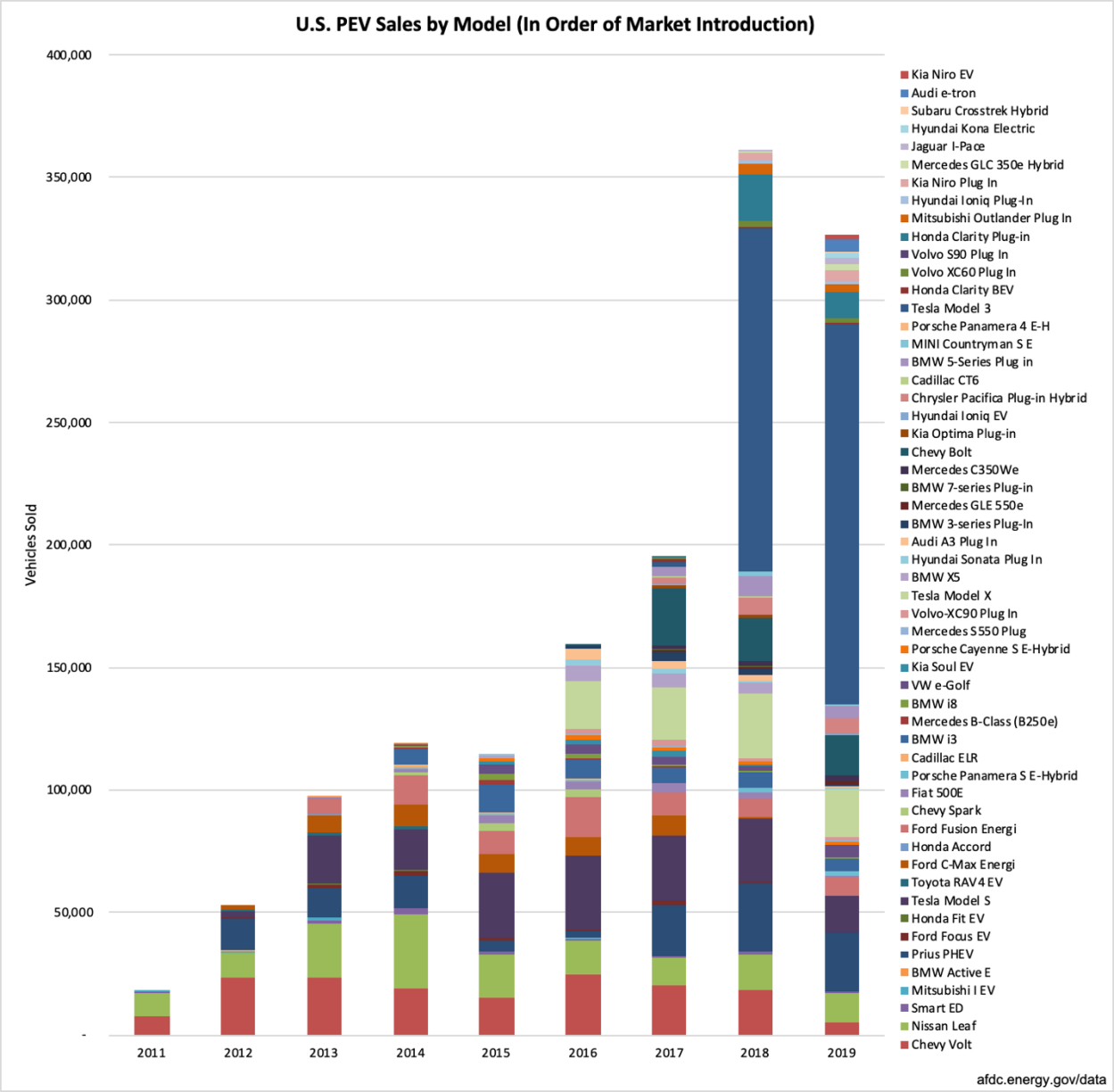
8. CHALLENGES/ISSUES/ BARRIERS

The relatively low supply of EVs and CNG vehicles in Arizona and corresponding demand for DCFC EV charging and CNG fast-fill fueling present a challenge for deploying alternative fuel infrastructure along the Arizona I-10 corridor. Approximately 900,000 light-duty BEVs were sold in the United States and approximately 24,000 registered in Arizona at the end of 2019.[17,18] Approximately 28,900 light-duty CNG vehicles were registered in the United States and 2,514 in Arizona at the end of 2019.[19,20] In contrast, 5,695,404 light-duty vehicles were registered in Arizona at the end of 2019.[19]

EV and CNG vehicle registrations are steadily increasing in Arizona. HIS Markit, Automotive Research and Analysis, was used as a resource for AFDC data and projects that EV sales will reach 7.6% of U.S. market share in 2026.[18] Figure 19 shows the U.S. PEV sales from the mainstream introduction in 2011 through 2019.

[17] AFDC Trend of sales by PEV model, 2011-2019 https://afdc.energy.gov/data/10567
[18] ADOT Data Provided to PAG
[19] AFDC Breakdown of alternative fuel vehicle (AFV) registrations by fuel type https://afdc.energy.gov/data/10861
[20] IHS Markit Automotive Research and Analysis 28 May 2019 https://ihsmarkit.com/research-analysis/--ihs-markit-forecasts-ev-sales-us.html

Figure 19 US PEV Sales 2011-2019



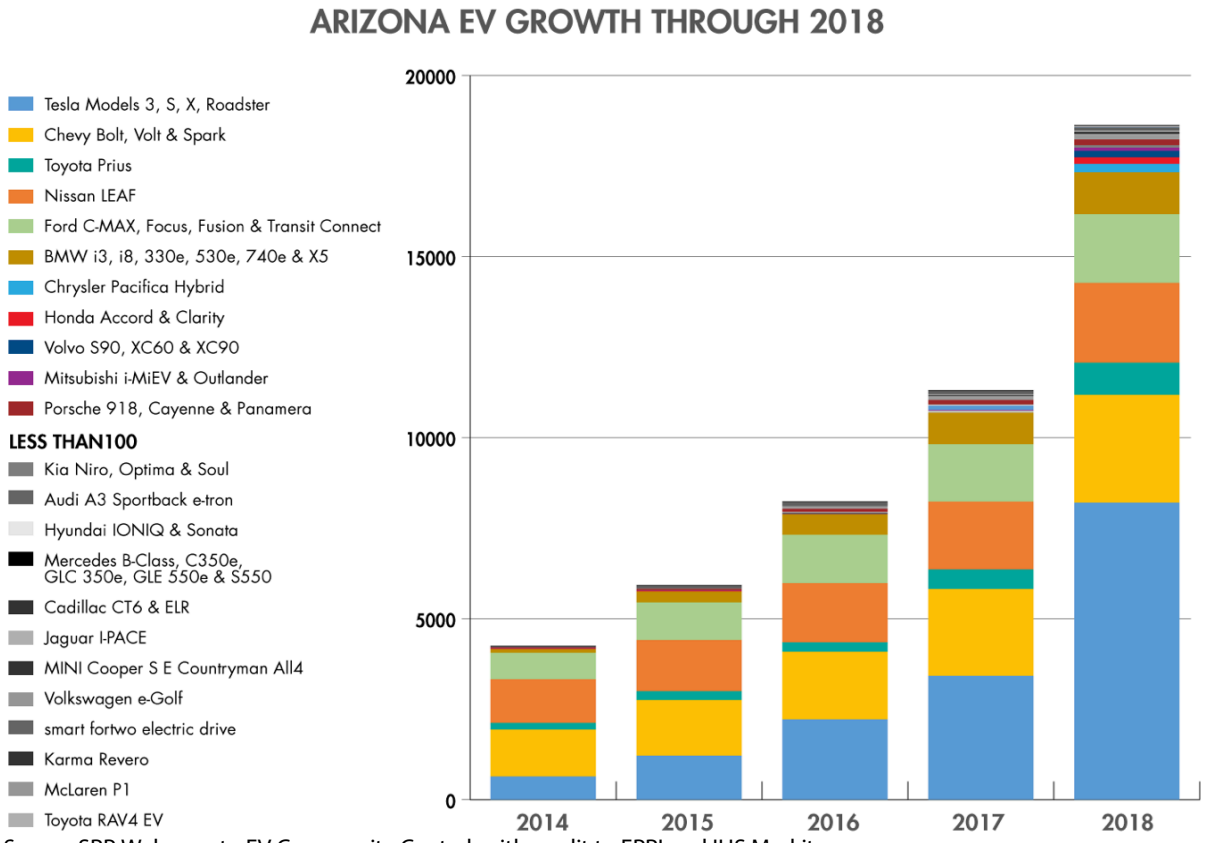
Source: AFCD US Plugin Electric Sales by Model https://afdc.energy.gov/data/

Auto dealerships selling conventionally fueled vehicles operate under a traditional sales model that relies upon profit from subsequent maintenance of vehicles sold. National Automobile Dealers Association (NADA) indicates that gross sales of the Service, Parts & Body Shop Department accounted for 50.5% of the total gross sales for the average light-duty vehicle dealership YTD December 2019.[21]

EV sales and registration data show that the EV market share is currently dominated by Tesla. Tesla BEVs use proprietary Tesla Supercharger DCFC stations although owners may purchase a CHAdeMO adaptor to charge at non-Tesla DCFC stations. Figure 20 shows growth in EV registrations in Arizona by vehicle model 2014 through 2018.

[21] https://www.nada.org/WorkArea/DownloadAsset.aspx?id=21474859932

Figure 20 **Arizona EV Registrations 2014-2018**



Source: SRP Welcome to EV Community Central, with credit to EPRI and IHS Markit
https://srpnet.com/electric/home/cars/CommunityCentral.aspx

Consumer Reports issued a September 2020 report indicating that lifetime maintenance service and repair costs of EVs is half of internal combustion engine (ICE) vehicles at $4,600 versus $9,200.[22] Under these assumptions, lower maintenance service and repair costs for EVs could potentially result in 25% less overall profit for auto dealerships. Service maintenance and repair profit margin disparity between EVs and ICE vehicles pose a barrier to EV sales for auto dealerships.

California adopted the Zero Emission Vehicle (ZEV) Program in 1990, which requires automobile manufacturers to produce and offer for sale a certain number of BEVs, PHEVs and Fuel Cell Electric Vehicles (FCEVs) annually.[23] The ZEV standards have been adopted by 11 additional states, including another of Arizona's bordering states, Colorado. Several states have proposed legislation to adopt the ZEV standards, including the bordering state of New Mexico. Automobile companies offer more EV models for sale in ZEV states than in non-ZEV states such as Arizona, which has fewer EV models for purchase in comparison to ZEV states.[24] Engaging automobile companies and dealerships to make more EV models available in the Arizona market could accelerate EV adoption, an outcome which may be assisted through a statewide cost-benefit analysis of ZEV standard adoption.

[22] Consumer Reports Electric Vehicle Ownership Costs: Today's Electric Vehicles Offer Big Savings For Consumers, Chris Harto October 2020 https://advocacy.consumerreports.org/wp-content/uploads/2020/10/EV-Ownership-Cost-Final-Report-1.pdf

[23] CARB Zero-Emission Vehicle Program https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program

[24] Smart Columbus, Engaging OEMs to Bring More ZEVs to a Non-ZEV State https://smart.columbus.gov/playbook-asset/electric-vehicle-consumer-adoption/oem-engagement-bringing-more-evs-to-a-non-zev-state

Incentives help advance adoption of alternative fuels vehicles. Several state, federal and utility incentives and laws applicable to EVs and CNG vehicles are listed on the AFDC website.[25] Examples of incentives and laws in Arizona include:

- Reduced Alternative Fuel Vehicle (AFV) License Tax
- Alternative Fuel Vehicle Emissions Test Exemption
- High Occupancy Vehicle (HOV) Lane Exemption
- Alternative Fuel and AFV Use Tax Exemption
- Idle Reduction and Natural Gas Vehicle (NGV) Weight Exemption
- AFV Parking Incentive
- AFV Dealer Information Dissemination Requirement

Electric utilities may impose fees for power demand as part of their commercial rate structure. The demand charge incurred by a customer is related to the peak power used during a monthly billing cycle. This is in contrast to the cumulative total energy usage that is the more familiar utility charge seen for most residential services. A demand charge is typically assessed for the highest average power over any 15-minute interval during the monthly billing cycle. Demand charges associated with 50-kW and higher power DCFC can have a significant impact on a business' monthly electric utility bill.[26]

The Arizona Corporation Commission (ACC) issued a Staff Policy Statement on January 16, 2019, for Electric Vehicles, Electric Vehicle Infrastructure and the Electrification of the Transportation Sector in Arizona to provide guidance for regulated electric utilities.[27] On July 19, 2019, the ACC approved Electric Vehicle Implementation Plan, requiring Public Service Corporations to develop a comprehensive, long-term Transportation Electrification (TE) Plan for Arizona, which included requirements to, "Propose rate design tariffs and technology-based load management strategies that alleviate or address demand charges and other issues faced when deploying DC fast charging stations".[28] Phase I of the Statewide TE Plan was issued in December 2019 and Phase Two is due for completion in early 2021.[29]

Distance gaps in rural areas present challenges to turning Corridor Pending to Corridor Ready NHS segments, as evidenced by the 49-mile distance between currently existing facilities in Salome and Tonopah. Federal rules currently prohibit siting of commercial alternative fueling facilities at rest stops along the NHS in the western United States. Rural areas also lack sizeable fleets that provide for baseline demand to validate investment in a CNG compressor station.

The heavy-duty long-haul classes of EV and CNG freight vehicles are on average able to travel greater distances than light and medium-duty EV and CNG vehicles. Consideration of separate passenger and commercial AFC designations could be valuable in recognizing the different vehicles types using the NHS. The distance criteria between existing EV charging and CNG fueling sites can be evaluated against data collected on the median average range of the various EV and CNG vehicle types.

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[25] AFDC Arizona Laws and Incentives https://afdc.energy.gov/laws/state_summary?state=AZ

[26] Idaho National Laboratory What is the Impact of Utility Demand Charges on a DCFC Host? https://avt.inl.gov/sites/default/files/pdf/EVProj/EffectOfDemandChargesOnDCFCHosts.pdf

[27] ACC Staff Policy Statement for Electric Vehicles, Electric Vehicle Infrastructure and the Electrification of the Transportation Sector in Arizona https://docket.images.azcc.gov/0000195197.pdf

[28] ACC Order Approving Electric Vehicle Policy Implementation Plan https://docket.images.azcc.gov/0000199128.pdf

[29] Arizona Statewide Transportation Electrification Plan December 2019, Energy and Environmental Economics, Inc. https://illumeadvising.com/files/Arizona-Phase-1-TE-Report-Final.pdf

8.1 FUNDING

Funding is one of the biggest challenges in deploying EV charging and CNG fueling stations. Selling alternative fuels supplied by various regional utilities versus petroleum from national distributors provides for a varying framework of rates and operating scenarios. Combined with gauging increased levels of EV and CNG vehicle adoption and necessary infrastructure requirements, funding opportunities arise from various sources. AIIC discussed and evaluated a variety of funding options.

The Volkswagen Environmental Mitigation Trust Fund provided nearly $57 million to Arizona for projects that reduce nitrogen oxide (NOx) emissions in areas of the state significantly affected by diesel emissions. The settlement allowed for beneficiaries to use up to 15 percent of their allocation of trust funds on acquiring, installing, operating and maintaining new light-duty zero emission vehicle supply equipment, such as DCFC stations. The State of Arizona's mitigation plan used the funds for school bus replacement and on-road fleet replacement for ADOT and the Arizona Department of Forestry and Fire Management.[30]

8.1.1 CONGESTION MITIGATION AND AIR QUALITY IMPROVEMENT PROGRAM

The Congestion Mitigation and Air Quality Improvement (CMAQ) Program, created by the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 and reauthorized under every successive Transportation Bill up to and including the FAST Act in 2015, provides funds to states for transportation projects designed to reduce traffic congestion and improve air quality, particularly in areas of the country that do not attain national air quality standards.

The FHWA's CMAQ Factsheet notes "The FAST Act continues eligibility for electric vehicle and natural gas vehicle infrastructure and adds priority for infrastructure located on the corridors designated under 23 U.S.C. 151. [23 U.S.C. 149(c)(2)]."[31] The FHWA supports the use of CMAQ to fund AFC infrastructure for EV charging and CNG fueling projects.[32]

EV charging stations or CNG fueling stations may be located anywhere in the state, with priority given to FHWA designated AFCs, in accordance with 23 U.S. Code § 149(c)(2):

> *(2) Electric vehicle and natural gas vehicle infrastructure.—A State may obligate funds apportioned under section 104(b)(4) for a project or program to establish electric vehicle charging stations or natural gas vehicle refueling stations for the use of battery powered or natural gas fueled trucks or other motor vehicles at any location in the State (giving priority to corridors designated under section 151) except that such stations may not be established or supported where commercial establishments serving motor vehicle users are prohibited by section 111 of title 23, United States Code.*[33]

[30] Arizona Volkswagen Settlement https://vwsettlement.az.gov
[31] FHWA Fast Act Fact Sheet https://www.fhwa.dot.gov/fastact/factsheets/cmaqfs.cfm
[32] FHWA Supporting Alternative Fuel Corridors with CMAQ https://www.fhwa.dot.gov/environment/air_quality/cmaq/reference/altfuel_factsheet.cfm
[33] USC https://www.govinfo.gov/app/collection/uscode

Arizona's FAST Act CMAQ apportionment in Fiscal Year 2019 was $53,637,829 per FHWA.[34]

The FHWA's CMAQ Cost Effectiveness Tables Summary was updated July 20, 2020, outlining the cost-effectiveness, in dollars per ton of emissions reduced, of 21 eligible CMAQ project types, including EV Charging Stations and Natural Gas Re-fueling Infrastructure.35 Natural Gas Re-fueling Infrastructure and EV Charging Stations projects rank 10th and 11th, respectively, out of the 21 project types analyzed, for median cost per ton of overall National Ambient Air Quality Standards (NAAQS) pollutants reduced (CO, NOx, VOCs, PM10, PM2.5). Natural Gas Re-fueling Infrastructure and EV Charging Stations projects ranked 4th and 8th, respectively, for median cost per ton of NOx reduced, and 7th and 6th, respectively, for median cost per ton of VOCs reduced. The CMAQ Public Access System can be queried to identify and compare emission reduction and cost effectiveness results for CMAQ funded projects nationwide.[36]

NOx and VOCs from conventional fuel vehicle exhaust contribute to ozone formation, a NAAQS pollutant of concern in Arizona. ADEQ has implemented the Electric Vehicle Project program aimed at increasing adoption of EVs, reducing emission from conventional fuel vehicles and improving air quality in the state.[37] Reducing vehicle contribution to NAAQS pollutants also plays a vital role in demonstrating transportation conformity for transportation planning in Arizona.[38]

FHWA's CMAQ Emissions Calculator for Unrestricted Access Alternative Fuel Infrastructure is designed to evaluate the emission reductions resulting from the replacement of conventional fuel vehicles with a percentage of alternative fuel vehicles in a study area using emission rates from the U.S. Environmental Protection Agency's (EPA) latest Motor Vehicle Emission Simulator (MOVES2014b).[39] The study area for the purposes of evaluating emission reductions for this project is defined as the selected potential location for a new DCFC station. The following assumptions and approach were used to adapt the calculator for a highway use scenario for the following INPUT values from the FHWA's calculator tool:

Input (2); The estimated number of vehicles in the study area was based upon the average annual daily traffic (AADT) provided by ADOT for I-10 along the particular exit or mile marker where a potential facility is located.[19]

Input (4); There were 5,695,404 light-duty vehicles registered in Arizona at the end of 2019, of which 1,245,347 were light-duty trucks according to ADOT data. Since no EV truck models currently are available at market, that leaves 4,450,057 light-duty vehicles which includes approximately 24,000 BEVs.[19] PHEVs are not expected to use highway DCFC stations in significant numbers, so the overall percentage of registered BEVs in the light-duty non-truck vehicle category is 0.54%

[34] FHWA Notice N 4510.832 Fiscal Year (FY) 2019 Supplementary Tables - Apportionments Pursuant to the Fixing America's Surface Transportation Act https://www.fhwa.dot.gov/legsregs/directives/notices/n4510832/n4510832_t18.cfm
[35] FHWA CMAQ 2020 Cost-Effectiveness Tables Update https://www.fhwa.dot.gov/environment/air_quality/cmaq/reference/cost_effectiveness_tables/index.cfm
[36] FHWA HEP Air Quality CMAQ Public Access System https://fhwaapps.fhwa.dot.gov/cmaq_pub/Search
[37] ADEQ Electric Vehicle Project https://azdeq.gov/node/6246
[38] ADOT Transportation Conformity https://azdot.gov/business/environmental-planning/air-quality/transportation-conformity
[39] FHWA CMAQ Toolkit, Unrestricted Access Alternative Fuel Infrastructure https://www.fhwa.dot.gov/environment/air_quality/cmaq/toolkit/, https://www.fhwa.dot.gov/environment/air_quality/cmaq/toolkit/alt_fuels_unrestricted_infra.cfm

(24,000/4,450,057)*100). The vehicles using the EV chargers will also originate from outside of Arizona, such as the neighboring states of California and New Mexico; however, Arizona registrations were selected for purposes of simplification. Assuming that EV charging stations are spaced every 50 miles according to FHWA criteria and EVs traveling at highway speed charging at 150-mile intervals, EVs would stop at every third EV charging station. The 0.54% of EVs to passenger cars value is reduced by 2/3, resulting in 0.18% input value for projected market share of replacement EVs after construction of the new EV charging station.

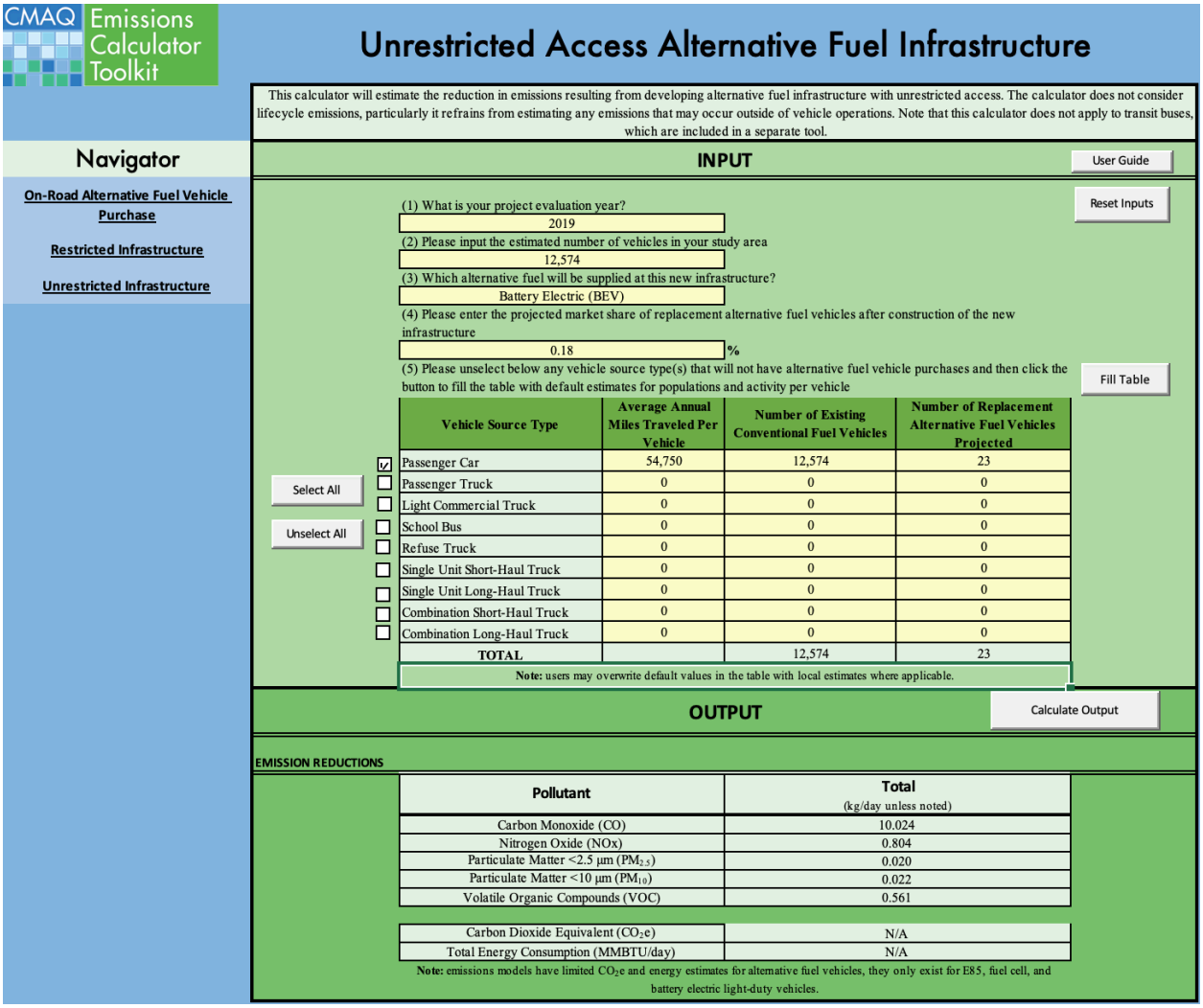
Input for Annual Average Miles Traveled Per Vehicle for Passenger Cars; Using an assumed driving distance of 150 miles between charging intervals for EVs traveling at the 75 mph speed limit along I-10 outside of metro areas, daily use of the EV charging station 365 days a year will result in 54,750 miles/year.[40] This varies from the calculator's default value which uses average annual miles of the vehicle class on the basis that EVs in a particular study area will fuel only periodically at an EV charging station, whereas the EV charging station in this project study area will be used daily by the percentage of vehicles calculated in Input (4).

Number of Replacement Alternative Fuel Vehicles Projected; 0.18% of the AADT value for the section of I-10 near the potential site results in the vehicles per day using the DCFC station.

Inputs and outputs in Figure 21 demonstrate an example calculation for Salome Arizona I-10 Exit # 45, showing daily emission reductions for transportation related NAAQS criteria pollutants in kilograms resulting from a potential EV charging site.

[40] Car and Driver EV Range: Everything You Need to Know May 22, 2020 https://www.caranddriver.com/shopping-advice/a32603216/ev-range-explained/

Figure 21 CMAQ Calculation for Potential Facility Along I-10 Exit 45, Salome



CMAQ Emissions Calculator Toolkit

Unrestricted Access Alternative Fuel Infrastructure

This calculator will estimate the reduction in emissions resulting from developing alternative fuel infrastructure with unrestricted access. The calculator does not consider lifecycle emissions, particularly it refrains from estimating any emissions that may occur outside of vehicle operations. Note that this calculator does not apply to transit buses, which are included in a separate tool.

Navigator

On-Road Alternative Fuel Vehicle Purchase

Restricted Infrastructure

Unrestricted Infrastructure

INPUT — User Guide — Reset Inputs

(1) What is your project evaluation year?: 2019

(2) Please input the estimated number of vehicles in your study area: 12,574

(3) Which alternative fuel will be supplied at this new infrastructure?: Battery Electric (BEV)

(4) Please enter the projected market share of replacement alternative fuel vehicles after construction of the new infrastructure: 0.18 %

(5) Please unselect below any vehicle source type(s) that will not have alternative fuel vehicle purchases and then click the button to fill the table with default estimates for populations and activity per vehicle — Fill Table

Select All — Unselect All

	Vehicle Source Type	Average Annual Miles Traveled Per Vehicle	Number of Existing Conventional Fuel Vehicles	Number of Replacement Alternative Fuel Vehicles Projected
☑	Passenger Car	54,750	12,574	23
☐	Passenger Truck	0	0	0
☐	Light Commercial Truck	0	0	0
☐	School Bus	0	0	0
☐	Refuse Truck	0	0	0
☐	Single Unit Short-Haul Truck	0	0	0
☐	Single Unit Long-Haul Truck	0	0	0
☐	Combination Short-Haul Truck	0	0	0
☐	Combination Long-Haul Truck	0	0	0
	TOTAL		12,574	23

Note: users may overwrite default values in the table with local estimates where applicable.

OUTPUT — Calculate Output

EMISSION REDUCTIONS

Pollutant	Total (kg/day unless noted)
Carbon Monoxide (CO)	10.024
Nitrogen Oxide (NOx)	0.804
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.020
Particulate Matter <10 µm (PM_{10})	0.022
Volatile Organic Compounds (VOC)	0.561

Carbon Dioxide Equivalent (CO_2e)	N/A
Total Energy Consumption (MMBTU/day)	N/A

Note: emissions models have limited CO_2e and energy estimates for alternative fuel vehicles, they only exist for E85, fuel cell, and battery electric light-duty vehicles.

The CMAQ Emission Reduction and Cost-Effectiveness calculations for each potential facility are included in Appendix A. The FHWA's CMAQ cost-effectiveness calculation for EV Charging Stations applies a useful project lifetime of seven years for EV charging stations based upon tax depreciation, whereas the useful project lifetime for the emission reduction estimates in Appendix A are based upon an expected useful operational period of 10 years for EV charging equipment. Depending on the future date and location of a planned EV charging or CNG fueling station, inputs would need to be reevaluated prior to application for CMAQ funds.

8.1.2 ELECTRIFY AMERICA CYCLE 3

As required by Appendix C to the 2.0-Liter Partial Consent Decree entered by the U.S. District Court for the Northern District of California on October 25, 2016, Volkswagen Group of America is investing $1.2 billion over the next 10 years in ZEV infrastructure, education, and access outside California to support the increased adoption of ZEV technology in the United States.

Volkswagen Group of America created Electrify America LLC, a wholly owned subsidiary, to fulfill the ZEV Investment Commitment in Appendix C.[41] The $1.2 billion commitment will be spent in $300 million increments over four 30-month cycles. Cycle 1 is complete and Cycle 2 concludes at the end of 2021.[42,43]

Cycle 3 investments begin in January 2022, and Electrify America solicited input for eight separate categories, including the following categories #1 and #4 relevant to the current project:

1. Suggestions and Data Relevant to Cycle 3 Investments — Specific inputs from your governmental entity or organization that are helpful to our decision-making process. These inputs include the following:

- Unique opportunities to work with your organization in deploying impactful and financially sustainable ZEV investments;
- Specific actions your organization or state/local entity is taking to support EV adoption by taxi and ride-hail vehicles;
- Anonymized usage data from existing charging stations (DCFC and L2) in your community;
- Current/expected ZEV infrastructure plans or strategies for your community; and
- Fuel Cell Electric Vehicle (FCEV) data and/or adoption perspectives, especially with regard to medium and heavy-duty vehicles.

4. Specific site locations: Specific site locations you would like to nominate for consideration in Cycle 3 infrastructure investments.[44]

Under input categories 1) and 4) above, the Arizona I-10 AFC Deployment Plan and corresponding potential EV Charging sites were submitted to Electrify America for consideration of Cycle 3 funding for DCFC station installation.

8.1.3 CHARGEPOINT/NATSO COLLABORATIVE

ChargePoint and the National Association of Truck Stop Owners (NATSO) launched a collaborative to expand EV charging along highways and in rural communities. On February 6, 2020, ChargePoint issued a news release detailing the partnership to increase access to charging at more than 4,000 travel plazas and fuel stops nationwide by 2030.[45] The NATSO's National Highway Charging Collaborative website contains additional information, including available incentives and an online form for businesses to inquire about EV charging at their facilities.[46]

[41] Electrify America Investment Plan https://www.electrifyamerica.com/our-plan/
[42] National ZEV Investment Plan: Cycle 1https://www.epa.gov/sites/production/files/2017-04/documents/nationalzevinvestmentplan.pdf
[43] National ZEV Investment Plan: Cycle 2 https://www.epa.gov/sites/production/files/2019-02/documents/cycle2-nationalzevinvestmentplan.pdf
[44] Electrify America Cycle 3 Submissions https://www.electrifyamerica.com/submissions/
[45] ChargePoint and NATSO Launch Collaborative to Significantly Expand EV Charging Along Nation's Highways and in Rural Communities February 6, 2020 https://www.chargepoint.com/about/news/chargepoint-and-natso-launch-collaborative-significantly-expand-ev-charging-along/
[46] NATSO National Highway Charging Collaborative https://www.natsoaltfuels.com/EVCharging.php

8.1.4 SOUTHWEST GAS CORPORATION – ARIZONA GAS TARIFF NO. 7

Southwest Gas Corp. (SWG) is the natural gas utility provider for the prospective CNG station locations in Willcox and San Simon. While CNG fueling projects are eligible to apply for CMAQ funds, funding assistance for compression services is available to qualified applicants through SWG's Arizona Gas Tariff No. 7, Schedule No. G-50, Compression Gas Service, issued on April 21, 2017.[47] General requirements include:

- DESIGN. The Utility will be responsible for planning, designing, procuring, installing and constructing the Compression Facilities according to the Utility's design, engineering and construction standards.
- OWNERSHIP OF COMPRESSION FACILITIES. The Compression Facilities installed under the provisions of this Schedule shall be owned, operated, and maintained by the Utility. Applicant shall own, operate and maintain any and all equipment and facilities beyond the point of delivery of the CNG.

8.1.5 PRIVATE

On July 31, 2020, General Motors and EVgo announced a plan to triple the size of the nation's largest public fast charging network by adding more than 2,700 new fast chargers over the next five years, a move set to help accelerate widespread electric vehicle adoption. General Motors and EVgo engaged in this endeavor to leverage private investment alongside government grant and utility programs. Building the necessary charging infrastructure ahead of market demands will require continued public-private partnership. Both companies will continue working with key stakeholders to leverage new and existing public-private programs to facilitate the acceleration of the EV charging infrastructure needed to support ubiquitous EV adoption.[48,49]

Trillium participated in AIIC meetings and advised that their business model for installing a CNG compressor station at a project site such as a Love's Travel Center is to provide financial investment for approximately half of the estimated $1.5 to $2 million project costs. Grant, rebate or other funding sources are required to cover the remaining half. Trillium's cost estimates for a CNG compressor station with an approximate capacity of 850-1,600 gge/day align with the USDOE EERE Clean Cities Costs Associated With Compressed Natural Gas Vehicle Fueling Infrastructure document citing a $1.2 million to $1.8 million cost estimate for a large capacity CNG compressor station that can serve light, medium and heavy-duty vehicles.[50]

The AIIC discussions covered various facility ownership and operator scenarios for EV charging and CNG fueling facilities. Ownership scenarios include privately owned and operated, third-party owned

[47] SWG Schedule No. G-50 https://www.swgas.com/1409191621466/g50-GRC-04012017.pdf
[48] EVgo General Motors and EVgo Aim to Accelerate Widespread EV Adoption by Adding Fast Chargers Nationwide July 31, 2020 https://www.evgo.com/about/news/general-motors-and-evgo-aim-to-accelerate-widespread-ev-adoption-by-adding-fast-chargers-nationwide/#fn1
[49] GM General Motors and EVgo aim to accelerate widespread EV adoption by adding fast chargers nationwide 2020-07-31 https://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2020/jul/0731-evgo.html
[50] EERE Costs Associated With Compressed Natural Gas Vehicle Fueling Infrastructure September 2014 https://afdc.energy.gov/files/u/publication/cng_infrastructure_costs.pdf

and operated, a combination of utility owned and facility owner operated and various other hybrid lease/own/operate models.

8.1.6 FEDERAL

Recently proposed transportation bills from the House of Representatives and the Senate have included direct assistance for alternative fuel infrastructure. The Senate Environment and Public Works Committee, chaired by John Barrasso (R-WY) with ranking member Tom Carper (D-DE), introduced Senate Bill S.2302, America's Transportation Infrastructure Act (ATIA) of 2019, containing funding assistance for EV charging and CNG fueling infrastructure as follows:

SEC.1401.GRANTS FOR CHARGING AND FUELING INFRASTRUCTURE TO MODERNIZE AND RECONNECT AMERICA FOR THE 21ST CENTURY.

Establishes a competitive grant program to strategically deploy alternative fuel vehicle charging and fueling infrastructure along designated alternative fuel corridors that will be accessible to all drivers of electric, hydrogen and natural gas vehicles. This bill provides the following amounts from the Highway Trust Fund: $100 million for each of fiscal years 2021 and 2022, $200 million for fiscal year 2023, and $300 million for each of fiscal years 2024 and 2025.[51]

On July 1, 2020, the U.S. House of Representatives, by a vote of 233-188, passed the $1.5 trillion Moving Forward Act, H.R. 2, which incorporates and expands upon the Investing in a New Vision for the Environment and Surface Transportation in America (INVEST in America) Act that was passed out of the House Committee on Transportation and Infrastructure in June 2020. The committee, led by Chairman Peter DeFazio (D-OR), designed the $494 billion funding package for surface transportation reauthorization. The FAST Act was set to expire September 30, 2020, and received reauthorization by Congress for a 1-year extension. Referenced in the Moving Forward Act bill are Sec. 1101. Authorization of Appropriations and Sec. 1303. Grants for electric vehicle charging and hydrogen fueling infrastructure to modernize and reconnect America for the 21st century.

SEC. 1101. AUTHORIZATION OF APPROPRIATIONS.

(8) ELECTRIC VEHICLE CHARGING, NATURAL GAS FUELING, PROPANE FUELING, AND HYDROGEN FUELING INFRASTRUCTURE GRANTS. To carry out section 151(f) of title 23, U.S. Code, $350,000,000 for each of fiscal years 2022 through 2025.

SEC. 1303. GRANTS FOR CHARGING AND FUELING INFRASTRUCTURE TO MODERNIZE AND RECONNECT AMERICA FOR THE 21ST CENTURY.

(a) Purpose.—The purpose of this section is to establish a grant program to strategically deploy electric vehicle charging infrastructure, natural gas fueling, propane fueling and hydrogen fueling infrastructure along designated alternative fuel corridors that will be accessible to all drivers of electric vehicles, natural gas vehicles, propane vehicles and hydrogen vehicles.[52]

[51] Senate Bill 2302 https://www.congress.gov/bill/116th-congress/senate-bill/2302
[52] H.R.2 — 116th Congress https://www.congress.gov/bill/116th-congress/house-bill/2

8.2 STAKEHOLDER ENGAGEMENT

The coincidence of this project with the COVID-19 pandemic presented additional challenges in engaging stakeholders due to limitations of in-person interaction and shifting of staff resources toward pandemic response. Particularly, the truck stop and travel center potential site hosts had limited engagement with the AIIC. This was partially due to allocation of staff resources toward adapting business operation models to maintain customer safety due to the highly susceptible conditions of public interaction at their facilities.

AIIC meetings were conducted virtually by webinar quarterly, and stakeholders were able to provide input at the meetings and through email correspondence.

8.3 SIGNAGE

The FHWA developed signage for AFCs in compliance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). A memorandum was issued on December 21, 2016, from the FHWA Office of Transportation Operations providing guidance to the Federal-aid Divisions regarding the signing of Alternative Fuels Corridors that have been designated by the FHWA. The memorandum did not create a mandate for the installation of signs but rather provided guidance on the design and appropriate use of signs for Alternative Fuels Corridors.[53] The FHWA also issued a series of FAQs that answer common AFC signage questions.[53,54]

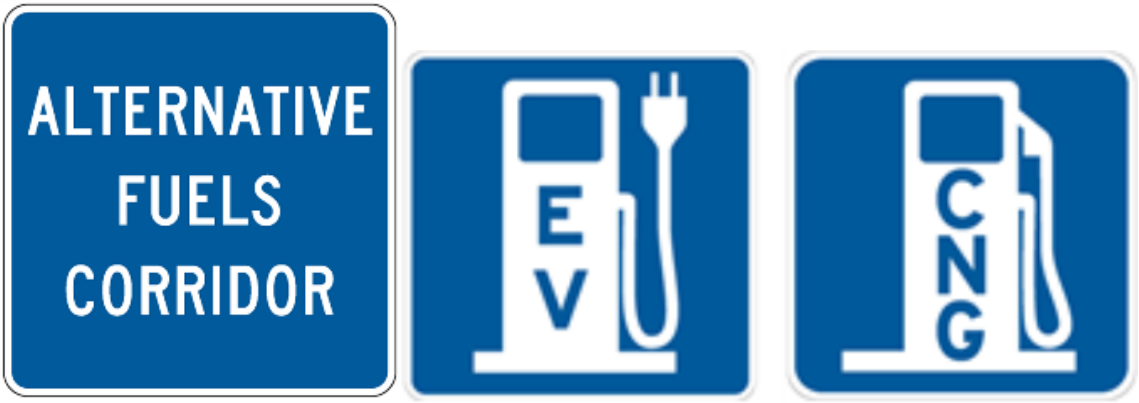
The installation of highway signage associated with an AFC has been determined to be an eligible expense under the CMAQ Program. CMAQ funds may be used for the purchase and installation of AFC-related signage when determined to serve an associated education and outreach function for a specific AFC. Title 23 U.S.C. Section 149(c)(2) specifically calls out EV and natural gas (CNG or LNG) refueling infrastructure as being eligible for CMAQ funding anywhere in a state, while other alternative fuel infrastructure projects may be restricted to nonattainment or maintenance areas.[55]

8.3.1 MUTCD

The MUTCD, which has been administered by the FHWA since 1971, is a compilation of national standards for all traffic control devices, including road markings, highway signs and traffic signals. It is updated periodically to accommodate the nation's changing transportation needs and address new safety technologies, traffic control tools and traffic management techniques.[56] The MUTCD provisions currently allow for use of General Service signs along AFCs. Figure 22 identifies the AFC Identification sign and General Service symbol signs for EV and CNG alternative fuels. The MUTCD provisions do not currently allow for use of Specific Service signs for NHS AFCs.

[53] FHWA Memorandum December 21, 2016 Signing for Designated Alternative Fuels Corridors https://mutcd.fhwa.dot.gov/resources/policy/alt_fuel_corridors/index.htm
[54] FHWA AFC FAQs https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/resources/faq/
[55] FHWA Interim Program Guidance Under MAP-21 November 12, 2013 https://www.fhwa.dot.gov/environment/air_quality/cmaq/policy_and_guidance/2013_guidance/index.cfm
[56] Manual on Uniform Traffic Control Devices for Streets and Highways https://mutcd.fhwa.dot.gov

Figure 22 **MUTCD AFC Identification and General Service Symbol Signs for EV and CNG Alternative Fuels**



8.3.2 GENERAL SERVICE

General Service signs guide road users to motorist services such as gas, food, lodging and hospitals, that are generally not within sight of motorist nor generally available at frequent intervals while driving. General Service signs are typically used only on freeway and expressways as motorist services on conventional roads are more frequently available and assessable on these roadways. General Service signs are also generic in that they do not identify the brand of the service facility providing the service.

The decision on when and where to install signs on a highway, including General Service and Specific Service signs, is up to the owner of the highway. Most states have policies detailing the provisions for when, where and how a General or Specific Service sign can be installed. MUTCD Section 2I.03, Line 06, states that General Service signs for Gas, Diesel, EV charging and/or other Alternative Fuels "should" have "1. Vehicle services such as gas, oil, and water; 2. Modern sanitary facilities and drinking water; 3. Continuous operations at least 16 hours per day, 7 days per week; and 4. Public telephone." The ADOT has issued guidance to clarify the criteria General Service Signing requirements for Gas, Diesel, CNG, E85 and/or EV signs as follows:

ADOT's Traffic Engineering Guidelines and Processes- Subsection 343 General Service Signing

343.1 CRITERIA

(1) Gas, Diesel, CNG, E85, and/or EV signs may be considered if the following criteria are met:
   a. Fuel (of the designated type or types) and water are available; and
   b. Restroom facilities and drinking water are available; and
   c. Continuous operation at least 16 hours per day, seven days per week. However, facilities which are in continuous operation ten hours per day, five consecutive days per week may be considered for signing where no other facilities are within fifteen miles.[57]

[57] ADOT Traffic Engineering Guidelines and Processes June 2015 Section 300 - Signs 343 General Service Signing https://azdot.gov/sites/default/files/2019/05/tgp0343-2015-06.pdf

State DOTs have several options for paying for signage, but this is up to state policy. Traffic signs are generally eligible for federal-aid funding within projects funded by FHWA. However, there is no requirement for states to use federal-aid funds to pay for signing; that is a state DOT decision.

The ADOT staff position is currently that additional stationary signs are not recommended because: 1) ADOT is facing considerable revenue shortfalls, and funding is not available for alternative fuel corridor signage; 2) stationary signage is inflexible, and issues could arise if private fueling stations close down or are not open to serve customers during hours of need; and 3) private applications are currently available and are in use, and they are more flexible and have technological advantages.

8.3.3 GRAND CANYON STATE LOGO SIGN PROGRAM

In contrast to General Service signs, Specific Service signs are defined as guide signs that provide road users with business identification and directional information for eligible services and attractions. Eligible service categories are limited to gas, food, lodging, camping, attractions and 24-hour pharmacies. The MUTCD Section 2N details information on Specific Service signs. Alternative fuel stations/facilities are not eligible for Specific Service signing as they do fit into one of the restricted categories for these signs. This would require a rule making change to the MUTCD to change the "Gas" category to "Fuel" and the qualifying criteria for the category.

Specific Service signs in Arizona are instituted through the ADOT Grand Canyon State Logo Sign Program.[58] If there are future changes to the MUTCD to allow for Alternative Fuels signage, then businesses providing alternative fuels would be able to participate in the program.

[58] ADOT Grand Canyon State Logo Sign Program https://azdot.gov/business/programs-and-partnerships/grand-canyon-state-logo-sign-program

9. FINDINGS AND RESULTS

Fulfillment of the goal to transition the Corridor Pending segments of I-10 in Arizona will require the addition of four DCFC EV charging stations and one CNG fueling station:

- Two additional DCFC EV charging stations are required between Phoenix, and California
- Two additional DCFC EV charging stations are required between Tucson, and New Mexico
- One additional CNG fast-fill fueling station is required between Tucson, and New Mexico

Appendix B identifies existing EV Charging and CNG fueling sites along the I-10 corridor in Arizona from California to Phoenix, and Tucson, to New Mexico that meet FHWA criteria, along with potential locations identified for the transition of Corridor Ready segments of I-10 to Corridor Ready. Potential sites were selected based upon adequacy of available utility infrastructure, space for EV charging and CNG fueling station installation and parking, hours of operation and other amenities.

Exact infrastructure cost estimates for EV charging and CNG fueling were difficult to obtain from stakeholders due to proprietary cost setting, the lack of contract bid solicitation and specific engineering and site study details required. Cost estimates for EV charging hardware and installation in Table 5 are based upon the International Council on Clean Transportation (ICCT), Working Paper 2019-14 - Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas.[59] Costs estimates in Table 6 are based upon EERE Clean Cities *Costs Associated With Compressed Natural Gas Vehicle Fueling Infrastructure* document and data provided by Trillium.

Table 5 DCFC Hardware and Installation Costs Per Charger

Power Level	50 kW				150 kW				350 kW			
# of Chargers	1	2	3-5	6-50	1	2	3-5	6-20	1	2	3-5	6-10
Charger	$28,401				$75,000				$140,000			
Labor	$19,200	$15,200	$11,200	$7,200	$20,160	$15,960	$11,760	$7,560	$27,840	$22,040	$16,240	$10,440
Materials	$26,000	$20,800	$15,600	$10,440	$27,300	$21,840	$16,380	$10,920	$37,700	$30,160	$22,620	$15,080
Permit	$200	$150	$100	$50	$210	$158	$105	$53	$290	$218	$145	$73
Taxes	$106	$85	$64	$42	$111	$89	$67	$45	$154	$123	$92	$62
Total	$73,907	$64,636	$55,365	$46,133	$122,781	$113,047	$103,312	$93,578	$205,984	$192,541	$179,097	$165,655

Source: ICCT https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf

[59] ICCT Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas August 2019 https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf

Table 6 CNG Compressor Station Costs

Type	gge*/day	Cost Range	Example Application	Assumptions
Medium Station Fast-Fill	500-800	$700,000-$900,000	Public retail station serving 50-80 light/medium-duty vehicles fueling 10 gge/day	One 180-300 scfm (86-143 gge/hr) compressor; 30 psi inlet gas pressure; 34,000 scf storage (270 gge); One dual-hose metered dispeser; Included installation costs are estimated at 65% of equipment costs
Large Station Fast-Fill	850-2,000	$1.2-2.0 million	Large retail station serving light- to heavy-duty vehicles such as delivery vans, work trucks, refuse trucks, class 8 trailers and local fleets	Two 300-400 scfm (143-190 gge/hr) compressor; 30 psi inlet gas pressure; 55,000 scf storage (437 gge); Two dual-hose metered dispensers; Included installation costs are estimated at 50% of equipment costs

*1 gge = 126 scf

Sources: Trillium and AFDC CNG: https://afdc.energy.gov/files/u/publication/cng_infrastructure_costs.pdf

Appendix C identifies cost estimates for EV charging and CNG fueling deployment at potential host sites identified in the project, including equipment, installation and utility costs for each site. Maintenance was not included in cost estimates due to variability of owner/operator scenarios.

Electricity rate plans and utility cost estimates for potential EV charging and CNG fueling sites were provided by **APS**, **SSVEC** and **SWG**:

APS - Rate Schedule E-32 XS, E-32 S, E-32 M, or E-32 L based on the Customer's average summer monthly maximum demand, as determined by APS each year.[60]

Salome:

- 500 kW or less – 500kVA transformer: $40,000.00
- 1,000 kW or less – 1000KVA transformer: $48,000.00
- 2,000 kW or less – 1500KVA or 2000KVA transformer: $68,000.00

Tonopah:

- 500 kW or less – 500kVA transformer: $53,000.00
- 1,000 kW or less – 1000KVA transformer: $65,000.00
- 2,000 kW or less – 1500KVA or 2000KVA transformer: $98,000.00

SSVEC – Rate P.[61]

Willcox, San Simon:

- 1,000 kW or less - 1,000 kVA transformer: $27,100
- 2,000 kW or less – 2x 1,000 kVA transformer: $32,200
- 3,000 kW or less – 3x 1,000 kVA transformer: $51,700

[60] APS Business and Non-residential Plans https://www.aps.com/en/Utility/Regulatory-and-Legal/Rates-Schedules-and-Adjustors#Business

[61] SSVEC Electric Rates Standard Tariff https://www.azcc.gov/docs/default-source/utilities-files/electric/tariffs/sulphur-springs-valley-electric-cooperative-inc.pdf?sfvrsn=e29f8144_2

SWG - Arizona Gas Tariff No. 7, Schedule No. G-50, Compression Gas Service.

Willcox, San Simon:

- The Utility and Applicant will negotiate a rate structure based on the Utility's cost of service and shall recover costs including, but not limited to, depreciation, return on capital investment, income taxes, property taxes, and operational expenses. In the event of early termination of the Compression Services Agreement, the Utility shall recover from Applicant an amount based on the Utility's unrecovered ownership and removal costs and any early termination provisions in the Applicant's Compression Services Agreement.

CNG stations capable of filling multiple vehicles in short periods of time require a large volume of natural gas at a high pressure. In Willcox, the potential site locations are several miles from a pipeline that could provide the high volume and pressure needs required for a CNG station. A substantial infrastructure investment would be required to connect the potential Willcox site to the pipeline. In San Simon, the potential site locations are nearby to a high-pressure pipeline and significantly less infrastructure investment would be required to connect to the pipeline. However, the pipeline is smaller in diameter than the Willcox pipeline and engineering calculations will need to be undertaken to determine if adequate capacity exists for a planned CNG compressor station.

Rural areas along I-10 often lack the required numbers of municipal or commercial fleet vehicles that operate or can be converted to CNG such as buses, waste hauling trucks, and service and industrial vehicles. Project supporter and stakeholder, Trillium, cited a need for 50-80 heavy-duty Class 8 CNG vehicles to support baseload justification for CNG station investment. The most suitable site location based on the FHWA's current 150-mile criteria for distance between existing CNG stations, and most convenient access to natural gas, is San Simon, which is a census-designated place with a 2010 population of 165.[62] San Simon Unified School District has approximately 40 students and two school buses. The City of Willcox had a 2010 census population of 3,757. Willcox Unified School District has three schools with approximately 1,100 students and 14 school buses. The City of Willcox owns or contracts approximately five dump trucks, three waste hauler trucks, two water trucks, two street sweepers and no transit buses.[63] Land of Enchantment Clean Cities (New Mexico) advised that there are no current plans in place to install an additional CNG fueling station between the existing location in Deming, N.M., and the 81 miles to the border with Arizona, leaving San Simon and Willcox as the only locations to fulfill the FHWA's distance siting criteria for potential CNG-fueling location.

In 2020, in the light-duty vehicle class, there were five CNG dedicated models and five CNG bi-fuel models available in the United States compared to 41 light-duty BEV models and 47 PHEVs.[64,65] The dedicated models are trucks and vans offered with "prep package" or "prep ready" options to modify non-CNG model vehicles to run on CNG. No car or sport/compact utility vehicle CNG dedicated models were available from OEMs in 2020. In the medium and heavy-duty vehicle classes, there were 104 CNG dedicated models and 13 CNG bi-fuel models, and 85 EV models and five PHEV models.

[62] San Simon Population Arizona 2010 Census of Population and Housing https://www.census.gov/prod/cen2010/cph-2-4.pdf
[63] Correspondence with City of Willcox, Transit Service Plan for the City of Willcox https://willcox.az.gov/media/Transit%20System/Willcox%20Transit%20Implementation%20Service%20Plan.pdf
[64] AFDC Alternative Fuel and Advanced Vehicle Search https://afdc.energy.gov/vehicles/search/
[65] EERE Find Electric Vehicle Models https://www.energy.gov/eere/electricvehicles/find-electric-vehicle-models

10. LESSONS LEARNED

A variety of owner/operator scenarios existed at the truck stops and travel centers evaluated in the project. This included a variety of options available for EV charging stations such as owner/operator controlled, third-party controlled or a hybrid option with variations in profit sharing, maintenance options and contract lengths. Rate plans for electric utilities are dynamic and can change over time with periodic rate changes; the Arizona Transportation Electrification Plan under development may provide rate stability.[66] CNG compressor stations can also vary in ownership and operation dependent upon utility investment and involvement.

Benefits of working with a company that has national or regional presence were realized in that there are opportunities for efficiency in evaluating multiple potential alternative fuel sites under the same ownership; an increased guarantee that project will have long-term presence and impact; and generally, a more productive communication process lending from greater staff availability and understanding of AFV charging and fueling. Sites with individual owners and operators generally demonstrated a lower level of knowledge of alternative fuels; had fewer amenities available to customers such as onsite restaurants; and added operational complexities such as leased facilities, services from food venders and fuel providers.

Providing precise cost estimates for potential EV charging and CNG fueling host facilities was untenable due to the numerous variables involved, such as equipment capacity and site logistics scenarios, and without completing the process of bid solicitation for each particular potential site facility.

Rural stretches of corridors in Arizona along I-10 have limited prospective facilities at which to deploy EV charging and CNG fueling infrastructure. Meeting minimum distance siting requirements can be challenging due to spacing of towns, prohibition on use of rest stop locations and balancing the supply of EV charging and CNG fueling infrastructure based upon current and projected demand. The fueling capacity of corridor alternative fuel stations are comparatively less than gasoline and diesel fuel stations, with a DCFC charger able to charge two vehicles per hour at a half hour charge time and a large retail fast-fill CNG station capacity of 850-2,000 gge per day. An expansive increase of EV charging and CNG fueling stations and their capacities will be required to accommodate future increased adoption of electric and compressed natural gas vehicles.

[66] Illume Advising Arizona Statewide Transportation Electrification Plan https://illumeadvising.com/azte/

11. FUTURE ACTIONS

Project documentation and a summary case study are available on the PAG website, https://pagregion.com/sustainability/air-quality/i10-alt-fuels-deployment-plan/, as a resource for stakeholders and the public. Potential facilities, in coordination with EV charging and CNG fueling companies, are encouraged to apply for grant funding assistance through utility tariffs and rebate programs, automobile manufacturer and Electrify America Cycle 3 funding assistance, the National Highway Charging Collaborative, the CMAQ program and alternative fuels infrastructure grants that may come available following passage of future congressionally approved transportation bills. Project partners will apprise relevant stakeholders of new information related to changes to the MUTCD to remove Specific Service signage restrictions that currently prevent alternative fuel providers from using ADOT's Grand Canyon State Logo Sign Program. FHWA AFC criteria for EV charging and CNG fueling distance standards will be monitored for revisions to minimum distance siting requirements, rural area exemptions or addition of passenger/commercial AFC designations.

PAG, ADOT and VSCCC will continue to coordinate with stakeholders, FHWA and California and New Mexico AFC representatives to facilitate deployment of EV charging and CNG fueling at suitable locations along the I-10 corridor in Arizona and achieve Corridor Ready designation.

Appendix A: CMAQ Calculations for Potential Facilities
Appendix B: Existing and Potential EV Charging and CNG Facilities
Appendix C: Cost Calculations for Potential Facilities

APPENDIX A:
CMAQ CALUCLATIONS FOR POTENTIAL FACILITIES

Potential Facilities:

Exit 45 - Salome
Pilot Travel Center #1212; 48286 Vicksburg Rd, Salome
Pilot Travel Center (One9 Fuel Network) #1215; 48710 Vicksburg Rd, Salome

Inputs

(1) What is your project evaluation year?

2019

(2) Please input the estimated number of vehicles in your study area

12,574

(3) Which alternative fuel will be supplied at this new infrastructure?

Battery Electric (BEV)

(4) Please enter the projected market share of replacement alternative fuel vehicles after construction of the new infrastructure

0.18 **%**

(5) Please unselect below any vehicle source type(s) that will not have alternative fuel vehicle purchases and then click the button to fill the table with default estimates for populations and activity per vehicle

Vehicle Source Type	Average Annual Miles Traveled Per Vehicle	Number of Existing Conventional Fuel Vehicles	Number of Replacement Alternative Fuel Vehicles Projected
Passenger Car	54,750	12,574	23

Outputs

Pollutant	Daily Emission Reduction (kg/day)	Annual Emission Reduction (tons/year)
Carbon Monoxide (CO)	10.024	4.033
Nitrogen Oxide (NOx)	0.804	0.324
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.020	0.008
Particulate Matter <10 µm (PM_{10})	0.022	0.009
Volatile Organic Compounds (VOC)	0.561	0.226

Cost Effectiveness

Pollutant	Lifetime Emission Reduction (tons/10-year)	Annual VMT Reduction (annual)	Total Project Cost	Cost Effectiveness ($/ton)
Carbon Monoxide (CO)	40.33	1,259,250	$175,443	$4,350
Nitrogen Oxide (NOx)	3.24			$54,149
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.08			$2,193,038
Particulate Matter <10 µm (PM_{10})	0.09			$1,949,367
Volatile Organic Compounds (VOC)	2.26			$77,630

Exit 94 - Tonopah

Pilot Travel Center #1180; 41112 West Indian School Road, Tonopah

Inputs

(1) What is your project evaluation year?

2019

(2) Please input the estimated number of vehicles in your study area

12,473

(3) Which alternative fuel will be supplied at this new infrastructure?

Battery Electric (BEV)

(4) Please enter the projected market share of replacement alternative fuel vehicles after construction of the new infrastructure

0.18 **%**

(5) Please unselect below any vehicle source type(s) that will not have alternative fuel vehicle purchases and then click the button to fill the table with default estimates for populations and activity per vehicle

Vehicle Source Type	Average Annual Miles Traveled Per Vehicle	Number of Existing Conventional Fuel Vehicles	Number of Replacement Alternative Fuel Vehicles Projected
Passenger Car	54,750	12,473	22

Outputs

Pollutant	Daily Emission Reduction (kg/day)	Annual Emission Reduction (tons/year)
Carbon Monoxide (CO)	9.944	4.021
Nitrogen Oxide (NOx)	0.798	0.321
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.020	0.008
Particulate Matter <10 µm (PM_{10})	0.022	0.009
Volatile Organic Compounds (VOC)	0.557	0.224

Cost Effectiveness

Pollutant	Lifetime Emission Reduction (tons/10-year)	Annual VMT Reduction (annual)	Total Project Cost	Cost Effectiveness ($/ton)
Carbon Monoxide (CO)	40.21	1,204,500	$188,443	$4,686
Nitrogen Oxide (NOx)	3.21			$58,705
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.08			$2,355,538
Particulate Matter <10 µm (PM_{10})	0.09			$2,093,811
Volatile Organic Compounds (VOC)	2.24			$84,126

Exit 340 - Willcox

TravelCenters of America, TA Willcox #226; 1501 North Fort Grant Rd, Willcox
Willcox Truck Plaza; 1190 W Rex Allen Dr, Willcox

Inputs

(1) What is your project evaluation year?

2019

(2) Please input the estimated number of vehicles in your study area

14,550

(3) Which alternative fuel will be supplied at this new infrastructure?

Battery Electric (BEV)

(4) Please enter the projected market share of replacement alternative fuel vehicles after construction of the new infrastructure

0.18 **%**

(5) Please unselect below any vehicle source type(s) that will not have alternative fuel vehicle purchases and then click the button to fill the table with default estimates for populations and activity per vehicle

Vehicle Source Type	Average Annual Miles Traveled Per Vehicle	Number of Existing Conventional Fuel Vehicles	Number of Replacement Alternative Fuel Vehicles Projected
Passenger Car	54,750	14,550	26

Outputs

Pollutant	Daily Emission Reduction (kg/day)	Annual Emission Reduction (tons/year)
Carbon Monoxide (CO)	11.600	4.667
Nitrogen Oxide (NOx)	0.931	0.375
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.023	0.009
Particulate Matter <10 µm (PM_{10})	0.026	0.011
Volatile Organic Compounds (VOC)	0.649	0.261

Cost Effectiveness

Pollutant	Lifetime Emission Reduction (tons/10-year)	Annual VMT Reduction (annual)	Total Project Cost	Cost Effectiveness ($/ton)
Carbon Monoxide (CO)	46.67	1,423,500	$162,543	$3,483
Nitrogen Oxide (NOx)	3.75			$43,345
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.09			$1,806,033
Particulate Matter <10 µm (PM_{10})	0.11			$1,477,664
Volatile Organic Compounds (VOC)	2.61			$62,277

Exit 378 - San Simon

Pilot Dealer #1269/Jay's Travel Center; 2500 W Business Loop I-10, San Simon
4k Truck Stop/Petroleum Wholesale; 2507 W Business Loop I-10, San Simon

Inputs

(1) What is your project evaluation year?

2019

(2) Please input the estimated number of vehicles in your study area

7,533

(3) Which alternative fuel will be supplied at this new infrastructure?

Battery Electric (BEV)

(4) Please enter the projected market share of replacement alternative fuel vehicles after construction of the new infrastructure

0.18 **%**

(5) Please unselect below any vehicle source type(s) that will not have alternative fuel vehicle purchases and then click the button to fill the table with default estimates for populations and activity per vehicle

Vehicle Source Type	Average Annual Miles Traveled Per Vehicle	Number of Existing Conventional Fuel Vehicles	Number of Replacement Alternative Fuel Vehicles Projected
Passenger Car	54,750	7,533	14

Outputs

Pollutant	Daily Emission Reduction (kg/day)	Annual Emission Reduction (tons/year)
Carbon Monoxide (CO)	6.005	2.416
Nitrogen Oxide (NOx)	0.482	0.194
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.012	0.005
Particulate Matter <10 µm (PM_{10})	0.013	0.005
Volatile Organic Compounds (VOC)	0.336	0.135

Cost Effectiveness

Pollutant	Lifetime Emission Reduction (tons/10-year)	Annual VMT Reduction (annual)	Total Project Cost	Cost Effectiveness ($/ton)
Carbon Monoxide (CO)	24.16	766,500	$162,543	$6,728
Nitrogen Oxide (NOx)	1.94			$83,785
Particulate Matter <2.5 µm ($PM_{2.5}$)	0.05			$3,250,860
Particulate Matter <10 µm (PM_{10})	0.05			$3,250,860
Volatile Organic Compounds (VOC)	1.35			$120,402

APPENDIX B:
EXISTING AND POTENTIAL EV CHARGING AND CNG FACILITIES

Arizona I-10 EV Charging Corridor Pending

- ***Existing Facility***
- **Potential Facility**

Arizona/California Border to Phoenix

- *Denny's DC CORRIDOR*; 876 W. Donlon St; Blythe, CA 92225
- *Hampton Inn & Suites*; 2011 E Donlon St; Blythe, CA 92225
- *Love's Travel #286*; 760 S Quartzsite Blvd; Quartzsite, AZ 85346 (Pending)
- Pilot Travel Center #1212; 48286 Vicksburg Rd, Exit 45; Salome, AZ 85348
- Pilot Travel Center (One9 Fuel Network) #1215; 48710 Vicksburg Rd, Exit 45; Salome, AZ 85348
- Pilot Travel Center #1180; 41112 West Indian School Rd, Exit 94; Tonopah, AZ 85354
- *Walmart 3407*; 1060 S. Watson Rd; Buckeye, AZ 85326

Tucson, AZ to Arizona/New Mexico Border

- *Baggin's Gourmet Sandwiches & Catering*; 3191 E Valencia Rd; Tucson, AZ 85706
- *Walmart 3807*; 201 S Prickly Pear Ave; Benson, AZ 85602
- TravelCenters of America, TA Willcox #226; 1501 North Fort Grant Rd, Exit 340; Willcox, AZ, 85643
- Willcox Truck Plaza; 1190 W Rex Allen Dr, Exit 340; Willcox, AZ 85643
- Pilot Dealer #1269/Jay's Travel Center; 2500 W Business Loop I-10, Exit 378; San Simon, AZ 85632
- 4k Truck Stop/Petroleum Wholesale; 2507 W Business Loop I-10, Exit 378; San Simon, AZ 85632
- *Lordsburg Chevron*; 1882 Stagecoach Rd; Lordsburg, NM 88045

Arizona I-10 CNG Corridor Pending

Tucson, AZ to Arizona/New Mexico Border

- *Trillium - Golden Eagle*; 705 E Ajo Way; Tucson, AZ 85713
- Willcox Truck Plaza; 1190 W Rex Allen Dr, Exit 340; Willcox, AZ 85643
- TravelCenters of America, TA Willcox #226; 1501 North Fort Grant Rd, Exit 340; Willcox, AZ, 85643
- 4K Truck Stop/Petroleum Wholesale; 2507 W Business Loop I-10, Exit 378; San Simon, AZ 85632
- Pilot Dealer #1269/Jay's Travel Center; 2500 W Business Loop I-10, Exit 378; San Simon, AZ 85632
- *City of Deming*; 1315 W Pine St; Deming, NM 88030

APPENDIX C:

COST CALCULATIONS FOR POTENTIAL FACILITIES

EV Charging

DCFC charging station cost estimates in Tables AC-1 through AC-3 are based upon the International Council on Clean Transportation (ICCT), Working Paper 2019-14 - Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas and estimates provided by APS and SSVEC.

Exit 45 - Salome
Pilot Travel Center #1212; 48286 Vicksburg Rd, Exit 45; Salome
Pilot Travel Center (One9 Fuel Network) #1215; 48710 Vicksburg Rd, Exit 45; Salome

Table AC-1 **DCFC Charging Station Cost Estimates - Salome**

# Chargers/Power Level/Type	2 Chargers 1 50 kW CHAdeMO 1 150 kW CCS	4 Chargers 1 50 kW CHAdeMO 3 150 kW CCS	8 Chargers 1 50 kW CHAdeMO 6 150 kW CCS 1 350 kW CCS
Chargers	$103,401	$253,401	$618,401
Labor	$31,160	$46,480	$63,000
Materials/Transformer	$40,400	$48,800	$69,600
Permit	$308	$415	$441
Taxes	$174	$265	$374
Total	$175,443	$349,361	$751,816

Exit 94 - Tonopah
Pilot Travel Center #1180; 41112 West Indian School Rd, Exit 94; Tonopah

Table AC-2 **DCFC Charging Station Cost Estimates - Tonopah**

# Chargers/Power Level/Type	2 Chargers 1 50 kW CHAdeMO 1 150 kW CCS	4 Chargers 1 50 kW CHAdeMO 3 150 kW CCS	8 Chargers 1 50 kW CHAdeMO 6 150 kW CCS 1 350 kW CCS
Chargers	$103,401	$253,401	$618,401
Labor	$31,160	$46,480	$63,000
Materials/Transformer	$53,400	$65,800	$99,600
Permit	$308	$415	$441
Taxes	$174	$265	$374
Total	$188,443	$366,361	$781,816

Exit 340 - Willcox
TravelCenters of America, TA Willcox #226; 1501 North Fort Grant Rd, Exit 340; Willcox, Willcox Truck Plaza; 1190 W Rex Allen Dr, Exit 340; Willcox

Exit 378 - San Simon
Pilot Dealer #1269/Jay's Travel Center; 2500 W Business Loop I-10, Exit 378; San Simon
4k Truck Stop/Petroleum Wholesale; 2507 W Business Loop I-10, Exit 378; San Simon

Table AC-3 DCFC Charging Station Cost Estimates – Willcox & San Simon

# Chargers/Power Level/Type	2 Chargers 1 50 kW CHAdeMO 1 150 kW CCS	4 Chargers 1 50 kW CHAdeMO 3 150 kW CCS	8 Chargers 1 50 kW CHAdeMO 6 150 kW CCS 1 350 kW CCS
Chargers	$103,401	$253,401	$618,401
Labor	$31,160	$46,480	$63,000
Materials/Transformer	$27,500	$27,900	$33,800
Permit	$308	$415	$441
Taxes	$174	$265	$374
Total	$162,543	$328,461	$716,016

CNG

CNG compressor station costs estimates in Table AC-4 are based upon EERE Clean Cities *Costs Associated With Compressed Natural Gas Vehicle Fueling Infrastructure* document and data provided by Trillium.

Exit 340 - Willcox
Willcox Truck Plaza; 1190 W Rex Allen Dr, Exit 340; Willcox
TravelCenters of America, TA Willcox #226; 1501 North Fort Grant Rd, Exit 340; Willcox

Exit 378 - San Simon
Pilot Dealer #1269/Jay's Travel Center; 2500 W Business Loop I-10, Exit 378; San Simon
4k Truck Stop/Petroleum Wholesale; 2507 W Business Loop I-10, Exit 378; San Simon

Table AC-4 CNG Compressor Station Cost Estimates – Willcox/San Simon

Size/Capacity	Medium Station 500-800 gge/day	Large Station 850-2,000 gge/day
Compressor Station	$700,000-900,000	$1,200,000-2,000,000

Pima Association of Governments

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PAGregion.com