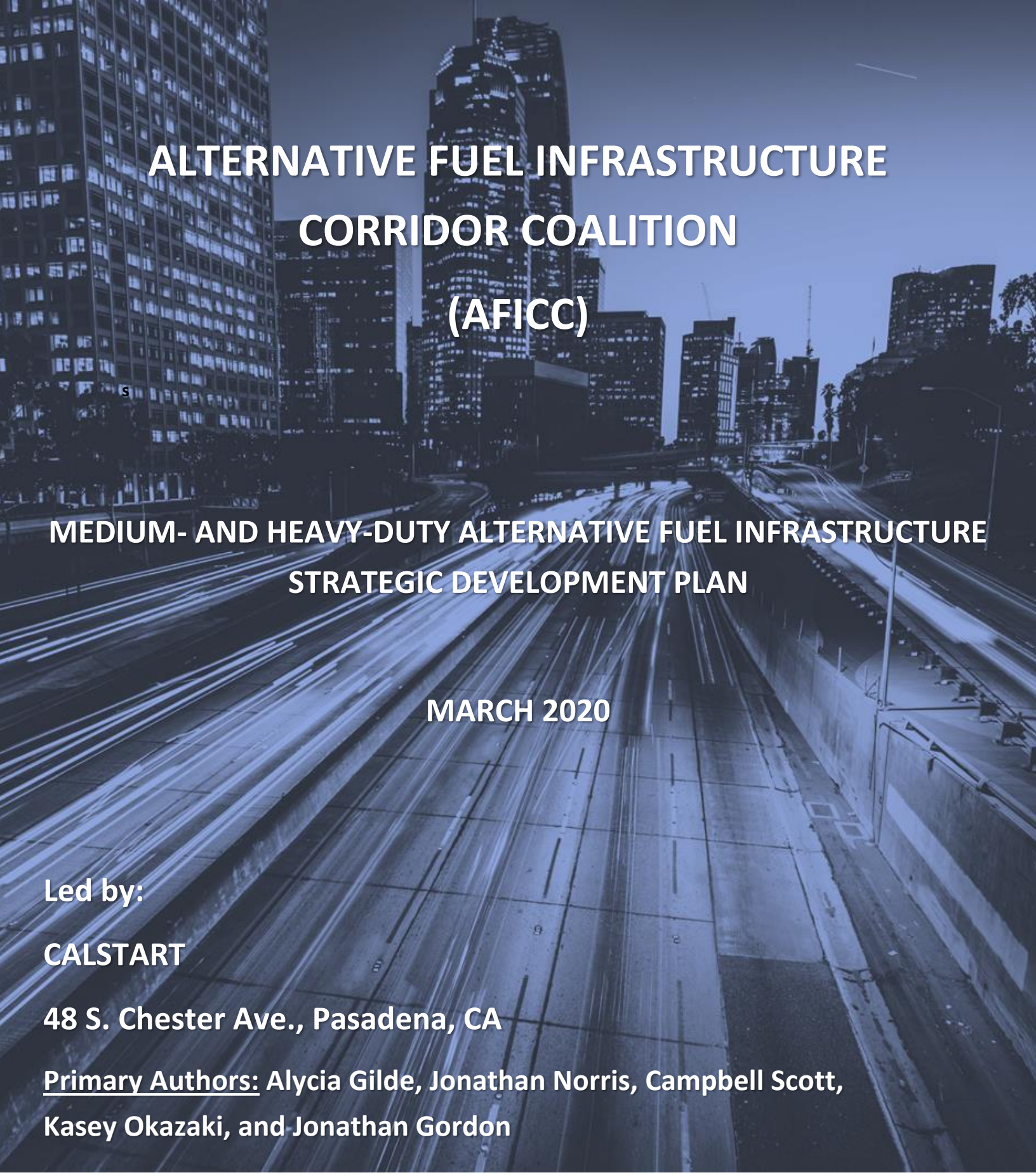

ALTERNATIVE FUEL INFRASTRUCTURE CORRIDOR COALITION (AFICC)

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MEDIUM- AND HEAVY-DUTY ALTERNATIVE FUEL INFRASTRUCTURE STRATEGIC DEVELOPMENT PLAN

MARCH 2020

Led by:

CALSTART

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www.westcoastcollaborative.org

WEST COAST COLLABORATIVE
A public-private partnership to reduce diesel emissions

This Medium and Heavy-Duty Alternative Fuel Infrastructure Strategic Development Plan was commissioned by the West Coast Collaborative Alternative Fuel Infrastructure Corridor Coalition (WCC AFICC). This document was prepared by CALSTART for the purposes of identifying potential diesel emission reduction strategies in California, Oregon, and Washington. This document captures a snapshot in time and should be considered as an initial, possible framework for medium and heavy-duty (MHD) alternative fuel infrastructure investments, not a prescriptive list of specific projects that must be endorsed for funding, or implementation. The information and recommendations presented herein do not represent the views of any individual WCC AFICC Steering Team Member, WCC AFICC Workgroup Member, or other WCC Partners.

WCC AFICC Steering Team Member Organizations

California Air Pollution Control Officers Association
California Air Resources Board
California Association of Councils of Government
California Department of Transportation
California Energy Commission
California Environmental Protection Agency
California Governor's Office of Business and Economic Development
California Public Utilities Commission
CALSTART
Columbia-Willamette Clean Cities Coalition
Discovery Institute: West Coast Corridor Coalition
Oregon Department of Energy
Oregon Department of Environmental Quality
Oregon Department of Transportation
Oregon Metro
Port of Portland
Port of Seattle
Port of Tacoma
Puget Sound Clean Air Agency
Puget Sound Regional Council
Rogue Valley Clean Cities Coalition
Ross Strategic: Pacific Coast Collaborative
United States Department of Energy, National Energy Technology Laboratory
United States Department of Energy, Vehicle Technologies Office
United States Department of Energy, National Renewable Energy Laboratory
United States Department of Transportation, Federal Highway Administration
United States Department of Transportation, Volpe National Transportation Systems Center
United States Environmental Protection Agency, Region 9
United States Environmental Protection Agency, Region 10
Washington State Department of Commerce
Washington State Department of Ecology
Washington State Department of Transportation
Western Washington Clean Cities Coalition

Guidance for Submitting Additional Infrastructure Project Proposals After Release of this Plan

This plan contains MHD alternative fuel infrastructure project proposals submitted by fleets and fuel providers who participated in the 2016-2019 WCC AFICC alternative fuel infrastructure needs assessment for MHD fleet operations in California, Oregon, and Washington. Following publication of this report, the WCC intends to create an AFICC submission form on its website to solicit additional MHD alternative fuel infrastructure project proposals from partners seeking funding assistance and partnerships to support implementation elsewhere in the WCC states and territories, including: Alaska, Arizona, California, Hawaii, Idaho, Nevada, Oregon, Washington, Tribal Lands, and the U.S. Pacific Islands: American Samoa, Guam, and Northern Mariana Islands (www.westcoastcollaborative.org).

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I. LIST OF ACRONYMS

AFICC	Alternative Fuel Infrastructure Corridor Coalition
AFV	Alternative Fuel Vehicle; includes: BEVs, FCEVs, NGVs, PHEVs and propane vehicles
AQIP	California Air Resources Board Air Quality Improvement Program
AQMD	Air Quality Management District
ARFVTP	California Energy Commission Alternative and Renewable Fuel and Vehicle Technology Program, now known as the Clean Transportation Program
BEV	Battery-Electric Vehicle
CALeVIP	California Energy Commission Electric Vehicle Infrastructure Project
Caltrans	California Department of Transportation
CAPEX	Capital Expense
CARB	California Air Resources Board
CNG	Compressed Natural Gas
CEC	California Energy Commission
CPUC	California Public Utilities Commission
DGE	Diesel Gallon Equivalent[l]
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FAST	Fixing America's Surface Transportation
FCEV	Fuel Cell Electric Vehicle
FHWA	United States Department of Transportation, Federal Highway Administration
gal	Gallons
GHG	Greenhouse Gas
GVWR	Gross Vehicle Weight Rating

[l] Some survey and outreach participants reported fuel volumes for CNG and LNG in gasoline gallon equivalent (GGE). Throughout this strategic plan, wherever outreach participants reported volumes in GGE, those values were multiplied by 1.13 to derive a volume in diesel gallon equivalent (DGE), per: https://afdc.energy.gov/fuels/equivalency_methodology.html

H_2	Hydrogen
HVIP	CARB Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
IOU	Investor Owned Utility
kg	Kilogram
kWh	Kilowatt-Hour
lbs	Pounds
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas/Propane
MHDV	Medium- and Heavy-Duty Vehicle
MOU	Memorandum of Understanding
MSRC	Mobile Source Air Pollution Reduction Review Committee
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NGV	Natural Gas Vehicle; vehicles powered by CNG or LNG
NREL	National Renewable Energy Laboratory
ODOT	Oregon Department of Transportation
OEM	Original Equipment Manufacturer
PEV	Plug-In Electric Vehicle; includes: BEVs and PHEVs
PHEV	Plug-in Hybrid Electric Vehicle
PUD	Public Utility District
RNG	Renewable Natural Gas
SB	Senate Bill
SCAQMD	South Coast Air Quality Management District
SELP	State Energy Loan Program
US DOT	United States Department of Transportation
VTO	United States Department of Energy, Vehicle Technologies Office
WCC	West Coast Collaborative
WSDOT	Washington State Department of Transportation
ZEV	Zero Emission Vehicle, includes: BEVs, FCEVs and PHEVs

II. EXECUTIVE SUMMARY

This document presents the Strategic Development Plan of the West Coast Collaborative Alternative Fuel Infrastructure Corridor Coalition (WCC AFICC) for medium and heavy-duty (MHD) alternative fuel infrastructure in California, Oregon, and Washington. The West Coast Collaborative (WCC) is a United States Environmental Protection Agency (EPA) led public-private partnership including representatives from federal, state, local, and tribal governments, as well as the private sector, academia, and environmental groups, all with a stated goal to reduce diesel emissions. In 2017, the WCC formed the Alternative Fuel Infrastructure Corridor Coalition (AFICC), a partnership committed to accelerating the modernization of West Coast transportation corridors by deploying alternative fuel infrastructure for medium- and heavy-duty vehicles (MHDVs). Consistent with the United States Department of Transportation Federal Highway Administration's (FHWA's) Alternative Fuel Corridor Program; the fuels covered under this effort include plug-in electric vehicle charging (EV), hydrogen (H_2), propane (LPG), and compressed and liquefied natural gas (CNG and LNG). Since its formation, the AFICC has focused its efforts on evaluating regional priorities within West Coast states for MHD alternative fuel infrastructure, understanding MHD infrastructure investment needs, and identifying projects suitable for funding when it is available to support MHD alternative fuel corridor development.

To help states and industry partners improve coordination and prioritization for infrastructure development, this strategic plan provides important context for policies and programs aimed at supporting deployment of alternative fuels in the three West Coast states. Secondly, AFICC's engagement process to collect feedback on infrastructure needs is carefully described and shares best practices and methods to evaluate infrastructure projects depending on maturity and development readiness. Lastly, recommendations are provided to help AFICC partners meet MHD alternative fuel infrastructure expansion goals on the West Coast. This strategic plan is intended as a living document to highlight the strong evidence of projects in need of funding, and ways the Coalition can continue to advance solutions for MHD alternative fuel transportation corridors. California, Oregon, and Washington State Departments of Transportation and Metropolitan/Regional Transportation Planning Organizations (MPOs/RTPOs) are encouraged to use this Strategic Development Plan to help advance MHD alternative fuel infrastructure development and implementation in their jurisdictions. The WCC also encourages other regions of the U.S. to replicate this project by developing their own partnerships to assess local demand for MHD alternative fuel infrastructure development.

As the market for alternative fuel vehicles (AFVs) grows, so does the need for alternative fuel infrastructure, and vice versa. Currently, diesel-fueled vehicles make up the majority of MHDVs on the road in the United States. However, market forces and state policies, such as mandates to drastically reduce mobile source emissions for purposes of National Ambient Air Quality Standards (NAAQS) attainment, toxic air contaminant exposure reduction, and climate change mitigation are increasing demand for MHD AFVs. This projected increase in demand, and the goals to reduce emissions from transportation on the West Coast, serve as key drivers for the WCC AFICC's efforts to understand MHD alternative fuel infrastructure investment needs in California, Oregon, and Washington.

CALSTART, a national clean transportation non-profit organization, was selected through a competitive solicitation to facilitate the WCC AFICC and assist the Coalition in conducting a regional infrastructure

needs assessment and drafting a strategic plan outlining near-term development opportunities along West Coast corridors. There are six core AFICC objectives to advance a strategy and effort to expand alternative fuel corridors in California, Oregon, and Washington:

1. Convene a stakeholder coalition focused on MHD alternative fuel infrastructure development.
2. Conduct stakeholder workgroups and targeted outreach to identify a subset of desired and/or unfunded MHD alternative fuel stations.
3. Synthesize stakeholder input into a plan document.
4. Provide a platform for sharing MHD alternative fuel infrastructure investment needs.
5. Use the plan as the basis for joint applications to competitive funding programs.
6. Obtain funding assistance to help implement MHD alternative fuel infrastructure in California, Oregon, and Washington.

The efforts presented in this strategic plan represent those conducted to meet objectives (1), (2), (3) and (4) in preparation for pursuing objectives (5) and (6).

To start the strategic planning process, AFICC facilitated numerous workgroup sessions for WCC Partners and other stakeholders in California, Oregon, and Washington. Through these workgroup sessions, AFICC collected feedback on which research questions would help to identify viable MHD alternative fuel infrastructure projects for development. These workgroup sessions were attended by stakeholders with varying perspectives, including but not limited to federal, state, and local government agencies, private sector entities such as fleets, infrastructure providers, original equipment manufacturers (OEMs), Clean Cities Coalitions, utilities, port authorities, and environmental groups. With the feedback obtained from these sessions, AFICC started its next step in conducting an infrastructure needs assessment.

AFICC developed project readiness criteria which served as guiding considerations for evaluating infrastructure project proposals. The readiness criteria helped AFICC develop two surveys to obtain information on infrastructure needs from fleets and fuel providers. Both surveys sought to understand MHD alternative fuel infrastructure needs, required funding for MHD infrastructure development, and proposals on where to locate infrastructure that benefit MHD fleets most. Once developed, AFICC distributed the surveys to a wide audience using the combined networks of WCC partners.

The surveys yielded responses from 26 fleets and 31 fuel providers from organizations in all three states. This included responses from MHD fleets across a variety of vocations, including but not limited to food and beverage distribution, drayage, transit, cargo handling, and school districts. Along with MHD infrastructure project proposals received through responses to these two surveys, the AFICC received additional proposals through follow-up outreach to various partners outside of the surveys. These two methods yielded a handful of important takeaways, as described below.

There is significant and proven demand for MHD alternative fuel infrastructure in all three West Coast states: California, Oregon, and Washington.

First, the surveys found that all fleet respondents are interested in procuring MHD AFVs within the next five years, creating an increased demand for MHD alternative fueling stations throughout the West Coast. Fleets expressed interest in all alternative fuel types in the AFICC purview, with electricity being the most

popular choice with 81% of respondents stating an interest in procuring MHD plug-in electric vehicles (PEVs).

Fuel providers also shared similar interest and plans to develop MHD alternative fuel infrastructure throughout the West Coast. Most fuel providers surveyed stated plans to develop MHD alternative fuel infrastructure in California within the next three to five years. Of those planned projects, most were EV charging stations, followed by CNG, H_2, LPG, and LNG. The assessment received a lower response in developing MHD alternative fuel stations in Oregon and Washington, with most fuel providers stating that they did not have current plans to build infrastructure in those states. Those that do have plans, however, are most interested in building EV charging stations.

Combined, the survey respondents and outreach participants proposed 147 alternative fuel infrastructure projects on the West Coast: 67 in California, 57 in Oregon, and 23 in Washington. Project proposals were received for all five fuel types within the AFICC planning scope: 62 EV charging stations, 36 CNG stations, 23 H_2 stations, 13 LPG stations, and 7 LNG stations. Some participants also proposed technologies outside the AFICC planning scope: 5 catenary electric infrastructure projects; and, 1 liquid biofuel station.

Fleets and fuel providers alike have a significant need for funding assistance to develop both new MHD alternative fuel infrastructure and to expand existing alternative fuel infrastructure projects.

Most fleet survey respondents required funding support to purchase and install new MHD alternative fuel infrastructure: 73% of fleet respondents require funding support to justify the decision to install infrastructure, 8% stated that they do not need funding support, and 19% stated that they do not know if they need funding support. Likewise, most fleet respondents currently developing alternative fuel infrastructure have a need for additional funding support: 68% of fleet respondents indicated they need additional funding for current projects to support a variety of uses, including but not limited to the following examples: purchasing equipment and materials, adding gas compression capacity, and expanding project scope.

Regarding funding needs, CALSTART solicited information via fleet and fuel provider surveys as well as additional outreach via phone calls. When asked what percentage of the total capital expense (CAPEX) of installing an alternative fueling station must be covered for them to consider development, 28% of these combined outreach participants' infrastructure proposals stated that at least 50% of the CAPEX must be covered by external funding, followed by 14% of proposals that said 70% of CAPEX should be covered, and then a tie between 30% and 80% of CAPEX at 9% of proposals each. Less than 1% of proposals stated that 100% of the CAPEX must be covered by funding, and nearly 22% of proposals did not list a minimum funding need amount. The remaining ~17% of proposals stated other funding amounts needed at lower frequencies than those listed above. Effectively, 77% of all proposals would be viable for development with external funding assistance up to 80% of project CAPEX.

MHD alternative fuel infrastructure development is already underway in many locations throughout West Coast states, and many of those projects require additional funding support.

When surveyed, 65% of fleet respondents had MHD alternative fuel projects underway with varying fuel types, fleet sizes, locations, and timelines. Of those projects listed, 65% are EV projects, 26% are CNG stations, and a smaller share are LNG and H_2 projects, at 9% and 4% respectively. 22% of fleet survey respondents with projects underway stated that they were for other fuel types, including renewable diesel. Most projects underway are private access stations and are likely located within the respondents' facilities. These existing projects may well serve as starting points for MHD alternative fuel infrastructure expansion on the West Coast, but given their private nature, more public and limited access stations would be needed to expand MHD AFV corridor fueling.

Survey respondents and other partners provided 147 specific proposals for MHD alternative fuel infrastructure placement. These proposals only represent a small portion of MHD alternative fuel infrastructure development needs on the West Coast as of December 2019.

As stated in an earlier takeaway, survey respondents and other partners provided 147 unique proposals for alternative fuel infrastructure development in California, Oregon, and Washington. This represents the number of proposals made to the AFICC as of December 2019 and does not fully capture all the MHD alternative fuel infrastructure development needs on the West Coast.

The West Coast Collaborative believes that the infrastructure development project proposals listed in this document, captured through responses to surveys and other targeted outreach, only cover a small percentage of the full need for comprehensive MHD alternative fuel infrastructure access on the West Coast, and it welcomes feedback on additional infrastructure needs not reflected in this document.

Table 1 shows all project proposals by fuel type and state.

Table 1 Project Proposal Numbers by Fuel Type and State

	EV	H_2	LPG	CNG	LNG	Other[II]	Totals
California	34	6	6	16	0	5	**67**
Oregon	15	14	5	17	5	1	**57**
Washington	13	3	2	3	2	0	**23**
Totals	**62**	**23**	**13**	**36**	**7**	**6**	**147**

Table 4 through Table 6 below show each proposal per state. Additionally, Figure 1 shows all proposed sites mapped by their locations. All but 20 proposals were evaluated based on a standard set of criteria

[II] This column includes 5 catenary electric infrastructure projects proposed in California, and 1 liquid biofuel station proposed in Redmond, Oregon. Per Section 1413 of the Fixing America's Surface Transportation (FAST) Act, these technologies are outside the scope of this plan (see Section IV, Federal Policy Landscape), and were note evaluated.

to vet projects for development readiness.[III] These project proposals were evaluated on the readiness criteria outlined in Section VI. Subsequently, each project was grouped into one of three readiness categories based on those evaluations. The readiness categories are defined below. The cut-offs between each of these three readiness categories were made quantitatively based on the results from evaluations using the readiness criteria defined in Section VI, Table 15.

1. **Advanced Site:** Advanced Sites are the project proposals deemed most ready for development. These sites have a high degree of readiness for funding and development. For example, this could be a proposal that includes a location which is highly specific (e.g. a street address, city, and state), a clear estimate of annual fuel throughput, a location near a major west coast corridor, and a clearly defined CAPEX estimate.
2. **Emerging Site:** Emerging Sites are the second to most ready for development, behind Advanced Sites. These sites are considered less ready for funding and development than Advanced Sites, but more so than Potential Sites. These proposals were often deemed less ready than Advanced Sites due to a lack of information about project scope. For example, this could be a proposed site with demonstrated demand for fuel but lacking a specific location (e.g. proposing a county instead of a cross street or address).
3. **Potential Site:** Potential Sites are the proposals deemed least ready for development. The reasons for the lower readiness category vary across proposals, but often the project scope for these proposals is vague or is lacking responses to multiple readiness criteria metrics. For example, this could be a proposed site with a vague location (e.g. proposing location on a certain highway near a city, but with no address or cross street), and not many associated details (e.g. no listing for annual throughput or number of vehicles that the station is expected to support, no response on the amount of funding needed, and no listing for estimated CAPEX).

[III] 20 of the 147 proposed projects were not evaluated: 6 proposals were outside the technological scope of this plan, and 14 proposals did not contain enough information to properly evaluate them.

Estimated cost to build the 141 proposed stations for targeted alternative fuel technologies is $373,600,000.[IV]

This plan includes 141 proposed stations of various size, throughput, and level of construction for targeted alternative fuel technologies.[IV] Based on CALSTART's estimates, it would cost approximately $373,600,000 to fund the development of all 141 sites, assuming they were newly constructed, capable of accommodating MHD AFVs, and had average throughput and size levels. Again, these 141 sites do not represent the total need on the West Coast, therefore $373,600,000 does not represent the total funding amount needed to provide comprehensive MHD alternative fuel infrastructure access in California, Oregon, and Washington.

Table 2 Estimated Funding Needed to Build Proposed Infrastructure Projects in the AFICC Plan[V,VI]

Fueling Type	Number of Sites Proposed by Outreach Participants	Average Assumptions for Each Station	Average Estimated CAPEX Per Station	Total Cost
EV	62	750kW-1MW Peak Capacity	$2,000,000	$124,000,000
H_2	23	1,000-4,800 kg/Day	$6,000,000	$138,000,000
LPG	13	1,000 gallons/Day	$1,700,000	$22,100,000
CNG	36	1,695-2,260 DGE/Day	$2,000,000	$72,000,000
LNG	7	1,695-2,260 DGE/Day	$2,500,000	$17,500,000
Total	**141**			**$373,600,000**

Table 3 Estimated Funding Needed to Build Proposed Infrastructure Projects by State

State	Number of Stations by Fuel Type					Total Cost
	EV	H2	LPG	CNG	LNG	
California	34	6	6	16	0	$146,200,000
Oregon	15	14	5	17	5	$169,000,000
Washington	13	3	2	3	2	$58,400,000
Total	62	23	13	36	7	**$373,600,000**

[IV] Cost estimate does not include catenary electric, or liquid biofuel proposals (6 projects omitted).
[V] CAPEX estimate does not represent the total funding needed to deploy comprehensive MHD alternative fueling infrastructure in California, Oregon, and Washington; only includes proposals obtained through AFICC outreach.
[VI] Table does not include catenary electric, or liquid biofuel infrastructure proposals (6 projects omitted) as these technologies are outside the AFICC planning scope.

Based on the results of AFICC's outreach and surveying efforts, CALSTART offers the following recommendations to advance the Coalition's goals in meeting objectives (5) and (6) listed above:

1. **State Plans -**Take the learnings from this plan document and develop targeted MHD alternative fuel infrastructure investment plans per state.
2. **Alternative Fuel Policy -** Examine, in more detail, the state-level policy barriers to alternative fuel infrastructure deployment and develop policies that support accelerated MHD infrastructure project implementation.
3. **Communication and Outreach -** Share this strategic plan document throughout the WCC and with partners around the nation.
4. **Public Funding Assistance -** WCC partners are well positioned to both fundraise for MHD alternative fuel infrastructure development and to petition for increased public funding support.
5. **Implementation -** All parties interested in developing alternative fuel infrastructure are encouraged to leverage the information gathered through this effort for purposes of implementing the projects listed within this plan.
6. **Workforce Development -** Consider workforce development opportunities which are likely to arise as a result of MHD alternative fuel infrastructure development on the West Coast.
7. **Environmental Justice -** MHD infrastructure development in environmental justice communities should be prioritized where there is synergy with alternative fuel demand.
8. **Sustained Partnership -** The partnerships formed between WCC AFICC partners should be sustained, and other geographic regions are encouraged to replicate the WCC AFICC through similar regional partnerships across the United States.

By following through with these recommendations, the WCC AFICC can work toward achieving its stated goal of deploying alternative fuel infrastructure for MHD vehicles and equipment along the West Coast of the United States.

Figure 1 All Proposed MHD Alternative Fuel Infrastructure Sites

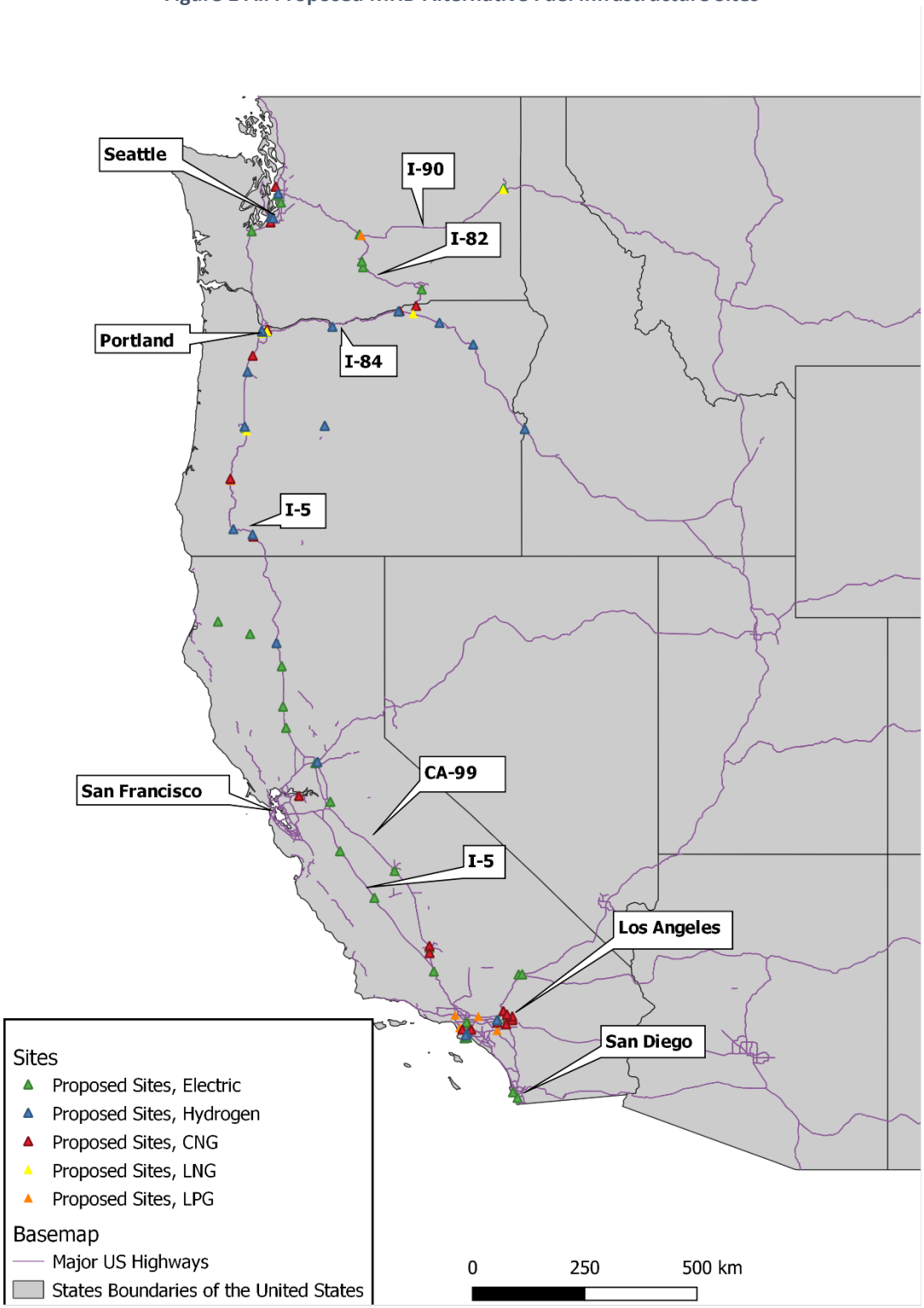


Table 4 Proposed Alternative Fuel Infrastructure Projects by Readiness Category - California[VII]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
CA-1	EV	CA	Banta	I-5 & I-205	750 kW minimum (1 MW ideal)	$2,017,499 (Reported)	50%	Advanced
CA-2	EV	CA	Barstow	I-15 & I-40	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced
CA-3	EV	CA	Blythe	I-10 & CA-78	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced
CA-4	EV	CA	Fresno	CA-99 & CA-41	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced
CA-5	EV	CA	Hamburg Farms	I-5 & CA-165	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced
CA-6	EV	CA	Long Beach	301 Mediterranean Way, Long Beach CA	50 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	30%	Advanced
CA-7	EV	CA	Long Beach	Port of Long Beach Terminal	N/A	$2,250,000	90%	Advanced
CA-8	EV	CA	National City	I-5 & CA-54	200 truck trips a day	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Advanced
CA-9	EV	CA	Red Bluff	I-5 & CA-36	6 vehicles	$100,000	50%	Advanced
CA-10	EV	CA	Redding	I-5 & CA-44	6 vehicles	$100,000	50%	Advanced
CA-11	EV	CA	Sacramento	I-80 & US-50	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced

[VII] The proposals marked "Unevaluated" did not contain enough data to properly evaluate them.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
CA-12	EV	CA	San Bernardino	1535 West 4th St San Bernardino, CA 92411	7 electric hostlers, 2 electric service trucks, 1 hybrid RTG, 1 electric side loader, 1 electric drayage truck	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Advanced
CA-13	EV	CA	San Diego	I-5 & I-8	200 truck trips a day	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Advanced
CA-14	EV	CA	Weaverville	CA-299 & CA-44	6 vehicles	$100,000	50%	Advanced
CA-15	EV	CA	Williams	I-5 & CA-20	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced
CA-16	EV	CA	Willow Creek	CA-299 & CA-96	6 vehicles	$100,000	50%	Advanced
CA-17	EV	CA	Willows	I-5 & CA-162	6 vehicles	$100,000	50%	Advanced
CA-18	H_2	CA	Long Beach	1926 East Pacific Coast Highway	547,500 kg (12 vehicles) (assuming 365 days)	$10,000,000	80-85%	Advanced
CA-19	H_2	CA	Ontario	4325 East Guasti Road	547,500 kg (12 vehicles) (assuming 365 days)	$10,000,000	80-85%	Advanced
CA-20	H_2	CA	Redding	I-5 & CA-44	365,000 kg (assuming 365 days)	$4,000,000	30-100%	Advanced
CA-21	LPG	CA	Corona	CA-91 & I-15	200,000 Gallons (50-60 vehicles)	$110,000	30-40%	Advanced
CA-22	LPG	CA	Duarte	I-605 & I-210	200,000 Gallons (50-60 vehicles)	$110,000	30-40%	Advanced
CA-23	LPG	CA	Hawthorne	N/A	200,000 Gallons (50-60 vehicles)	$110,000	30-40%	Advanced
CA-24	LPG	CA	Norwalk	I-605 & I-105	200,000 Gallons (50-60 vehicles)	$110,000	30-40%	Advanced

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
CA-25	LPG	CA	Ontario	I-10 & I-15	200,000 Gallons (50-60 vehicles)	$110,000	30-40%	Advanced
CA-26	LPG	CA	Sherman Oaks	US-101 & I-405	200,000 Gallons (50-60 vehicles)	$110,000	30-40%	Advanced
CA-27	CNG	CA	Bellflower	15330 Woodruff Ave., Bellflower, CA 90706	791,000 DGE	$2,750,000	20%	Advanced
CA-28	CNG	CA	Gardena	14800 South Spring St., Gardena CA 90248	60 CNG tractors	$4,000,000	80%	Advanced
CA-29	CNG	CA	Lost Hills	I-5 & CA-46	339,000 DGE (8-10 vehicles)	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%	Advanced
CA-30	CNG	CA	Lost Hills	I-5 & CA-46	N/A	$1,000,000	N/A	Advanced
CA-31	CNG	CA	Near Kettleman City	I-5 & CA-41	N/A	$1,000,000	N/A	Advanced
CA-32	CNG	CA	Tehachapi	CA-58 & CA-58B	339,000 DGE (8-10 vehicles)	N/A	40-60%	Advanced
CA-33	EV	CA	Bakersfield	N/A	70 vehicles	N/A	0%	Emerging
CA-34	EV	CA	Barstow	2825 W. Main St. Barstow, CA 92311	N/A	N/A	50%	Emerging

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
CA-35	EV	CA	Los Angeles / Hobart	4000 East Sheila St Los Angeles, CA 90023	10 electric hostlers, 1 electric service truck	N/A	50%	Emerging
CA-36	EV	CA	Stockton	6450 South Austin Rd. Stockton, CA 95215	6 electric hostlers, 1 hybrid RTG	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Emerging
CA-37	CNG	CA	Barstow	I-15 & Lenwood Road	339,000 DGE (8-10 vehicles)	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%	Emerging
CA-38	CNG	CA	Coachella	I-10 & Dillon Road	339,000 DGE (8-10 vehicles)	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%	Emerging
CA-39	CNG	CA	Near Bakersfield	I-5 & CA-119	N/A	$1,000,000	N/A	Emerging
CA-40	CNG	CA	Riverside County	N/A	225 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Emerging
CA-41	CNG	CA	Riverside County	N/A	225 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Emerging
CA-42	CNG	CA	San Bernardino County	N/A	225 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Emerging
CA-43	CNG	CA	San Bernardino County	N/A	225 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Emerging
CA-44	CNG	CA	San Bernardino County	N/A	225 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Emerging

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
CA-45	CNG	CA	San Bernardino County	N/A	225 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Emerging
CA-46	EV	CA	Bakersfield	Bakersfield, CA	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
CA-47	EV	CA	Between Los Angeles & Santa Barbara	US-101	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-48	EV	CA	Between Sacramento & San Francisco	I-80	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-49	EV	CA	Grapevine	I-5 & Edmonston Pumping Plant Road	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
CA-50	EV	CA	Inland Empire	I-15	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-51	EV	CA	Inland Empire	Warehouse Districts Around Inland Empire	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-52	EV	CA	Long Beach	Port of Long Beach	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-53	EV	CA	Long Beach	Port of Long Beach Terminal	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Potential

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
CA-54	EV	CA	Los Angeles	I-10	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-55	EV	CA	Los Angeles	Warehouse Districts Around Los Angeles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-56	EV	CA	Los Angeles	Port of Los Angeles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%	Potential
CA-57	EV	CA	Near Coalinga	I-5 & CA-198	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
CA-58	EV	CA	Near Los Banos	I-5 & CA-152	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
CA-59	H_2	CA	Long Beach	I-710 & I-405	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	20%	Potential
CA-60	CNG	CA	Bakersfield	Bakersfield, CA	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
CA-61	H_2	CA	Sacramento	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
CA-62	H_2	CA	Sacramento	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
CA-63	Catenary Electric	CA	Between East Los Angeles and Riverside	CA-60 (East LA to Riverside)	6000 trucks per day per direction	$5-8.7M /Mile	0%	Unevaluated

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
CA-64	Catenary Electric	CA	Between Los Angeles and Las Vegas	I-15 Los Angeles to Las Vegas	6000 trucks per day per direction	$5-8.7M /Mile	0%	Unevaluated
CA-65	Catenary Electric	CA	Between Mettler and Sacramento	CA-99 (Mettler to Sacramento)	6000 trucks per day per direction	$5-8.7M /Mile	0%	Unevaluated
CA-66	Catenary Electric	CA	Between San Diego and Redding	I-5 (San Diego to Redding)	6000 trucks per day per direction	$5-8.7M /Mile	0%	Unevaluated
CA-67	Catenary Electric	CA	Los Angeles County	I-710	14,000 trucks per day and direction	$8.7M/Mile	0%	Unevaluated

Table 5 Proposed Alternative Fuel Infrastructure Projects by Readiness Category - Oregon[VIII]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
OR-1	EV	OR	Bend	US-20 & US-97	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced
OR-2	EV	OR	Bend	US-97 & US-20	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-3	EV	OR	Boardman	I-84 & South Main Street	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-4	EV	OR	Eugene	I-5 & OR-126	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-5	EV	OR	La Grande	I-84 & OR-82	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-6	EV	OR	Medford	I-5 & OR-62	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-7	EV	OR	Ontario	I-84 & US-30	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-8	EV	OR	Pendleton	I-84 & US-395	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-9	EV	OR	Portland	I-84 & I-205	30 vehicles	$2,000,000	50%	Advanced
OR-10	EV	OR	Portland	I-5 & I-405	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-11	EV	OR	Salem	I-5 & OR-22	500 vehicles @ 350kW	$100,000	70%	Advanced
OR-12	EV	OR	The Dalles	I-84 & US-197	500 vehicles @ 350kW	$100,000	70%	Advanced

[VIII] The proposals marked “Unevaluated” did not contain enough data to properly evaluate those proposals.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
OR-13	H2	OR	Eugene	I-5 & I-105	365,000 kg/year	$4,000,000	30-100%	Advanced
OR-14	H2	OR	Grants Pass	I-5 & CA-99	365,000 kg/year	$4,000,000	30-100%	Advanced
OR-15	H2	OR	Portland	I-5 & I-84	365,000 kg/year	$4,000,000	30-100%	Advanced
OR-16	LPG	OR	Boardman	I-84 & South Main Street	3000 DGE/Hour	$100,000	50-60%	Advanced
OR-17	LPG	OR	Ontario	I-84 & US-30	3000 DGE/Hour	$100,000	50-60%	Advanced
OR-18	LPG	OR	Pendleton	I-84 & US-395	3000 DGE/Hour	$100,000	50-60%	Advanced
OR-19	LPG	OR	Roseburg	I-5 & SE Oak Avenue	3000 DGE/Hour	$100,000	50-60%	Advanced
OR-20	LPG	OR	The Dalles	I-84 & US-197	3000 DGE/Hour	$100,000	50-60%	Advanced
OR-21	CNG	OR	Bend	US-97 & US-20	500 DGE/Hour	$1,500,000	70%	Advanced
OR-22	CNG	OR	Boardman	I-84 & South Main Street	500 DGE/Hour	$1,500,000	70%	Advanced
OR-23	CNG	OR	La Grande	I-84 & OR-82	500 DGE/Hour	$1,500,000	70%	Advanced
OR-24	CNG	OR	Ontario	I-84 & US-30	500 DGE/Hour	$1,500,000	70%	Advanced
OR-25	CNG	OR	Pendleton	I-84 & US-395	500 DGE/Hour	$1,500,000	70%	Advanced
OR-26	CNG	OR	Portland	I-205 & Sandy Boulevard	40 vehicles	$1,000,000	50-70%	Advanced
OR-27	CNG	OR	The Dalles	I-84 & US-197	500 DGE/Hour	$1,500,000	70%	Advanced
OR-28	CNG	OR	Umatilla	I-82 & US-730	30 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	70%	Advanced
OR-29	CNG	OR	Woodburn	OR-214 & I-5	40 vehicles	$1,000,000	50-70%	Advanced

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
OR-30	LNG	OR	Eugene	I-5 & OR-58	5 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Advanced
OR-31	LNG	OR	Portland	N/A	7,352 DGE (5 vehicles)/year	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Advanced
OR-32	LNG	OR	Portland	I-205 & I-84	5 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Advanced
OR-33	H_2	OR	Bend	US-97 & US-20	222,650 kg/year	$4,000,000	80%	Emerging
OR-34	H_2	OR	Boardman	I-84 & South Main Street	222,650 kg/year	$4,000,000	80%	Emerging
OR-35	H_2	OR	Eugene	I-5 & OR-126	222,650 kg/year (assuming 365 days)	$4,000,000	80%	Emerging
OR-36	H_2	OR	La Grande	I-84 & OR-82	222,650 kg/year	$4,000,000	80%	Emerging
OR-37	H_2	OR	Medford	I-5 & OR-62	222,650 kg/year	$4,000,000	80%	Emerging
OR-38	H_2	OR	Ontario	I-84 & US-30	222,650 kg/year	$4,000,000	80%	Emerging
OR-39	H_2	OR	Pendleton	I-84 & US-395	222,650 kg/year	$4,000,000	80%	Emerging
OR-40	H_2	OR	Portland	I-5 & I-405	222,650 kg/year	$4,000,000	80%	Emerging
OR-41	H_2	OR	Salem	I-5 & OR-22	222,650 kg/year	$4,000,000	80%	Emerging
OR-42	H_2	OR	The Dalles	I-84 & US-197	222,650 kg/year	$4,000,000	80%	Emerging
OR-43	CNG	OR	Baker City	N/A	30 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	70%	Emerging
OR-44	CNG	OR	Portland	I-5 & I-405	500 DGE/Hour	$1,500,000	70%	Emerging
OR-45	CNG	OR	Salem	I-5 & OR-22	500 DGE/Hour	$1,500,000	70%	Emerging

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
OR-46	LNG	OR	Hermiston	I-82 & I-84	5 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Emerging
OR-47	CNG	OR	Medford	N/A	30 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	70%	Potential
OR-48	EV	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-49	EV	OR	Hood River County	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-50	EV	OR	Josephine County	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-51	H_2	OR	Portland	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-52	CNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-53	CNG	OR	Eugene/Portland	I-5 Corridor	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-54	CNG	OR	Portland	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-55	CNG	OR	SE Portland	I-5 Corridor	33,900 DGE	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
OR-56	LNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
OR-57	Biofuel	OR	Redmond	N/A	3-5 million gallons	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated

Table 6 Proposed Alternative Fuel Infrastructure Projects by Readiness Category - Washington[IX]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
WA-1	EV	WA	Bellevue	I-405 & I-5	200 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Advanced
WA-2	EV	WA	Ellensburg	Main and Washington	200 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Advanced
WA-3	EV	WA	Kennewick	I-82 & US-395	750 kW minimum (1 MW ideal)	$2,017,499	50%	Advanced
WA-4	EV	WA	Olympia	Capital & Jefferson	200 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Advanced
WA-5	EV	WA	Spokane	Division & Mission	200 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Advanced
WA-6	EV	WA	Tacoma	Market & Pacific Avenue	200 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Advanced
WA-7	EV	WA	Yakima	Yakima & 4th	200 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Advanced
WA-8	EV	WA	Yakima	Nob Hill & 1st	200 vehicles	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%	Advanced
WA-9	H_2	WA	Seattle	I-5 & I-90	365,000 kg (assuming 365 days)	$4,000,000	30-100%	Advanced
WA-10	H_2	WA	Tacoma	Tacoma	10,000 kg/day with electrolyzer production	$90,000,000[X]	10%	Advanced
WA-11	H_2	WA	Tacoma	I-5 & WA-7	365,000 kg (assuming 365 days)	$4,000,000	30-100%	Advanced

[IX] The proposals marked "Unevaluated" did not contain enough data for evaluation.

[X] This proposal is for a 35 MW electrolysis station with an expected capacity of 10,000 kg/day. A hydrogen fueling station may or may not be included in the project. CAPEX includes but is not limited to an electrolyzer, electrical connections to substations, transportation infrastructure, liquefaction, and storage.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Reported CAPEX Estimate	Funding Needed (% of CAPEX)	Readiness Category
WA-12	LPG	WA	Ellensburg	I-90 & I-82	360,000 gallons	$1,700,000	25-50%	Advanced
WA-13	LPG	WA	Ritzville	I-90 & WA-261	360,000 gallons	$1,700,000	25-50%	Advanced
WA-14	EV	WA	Everett	Cedar and Wentworth	N/A	MHD station not reported by participant; See Table 7 for estimated average CAPEX	0%	Emerging
WA-15	EV	WA	Everett	Cedar and Pacific	N/A	MHD station not reported by participant; See Table 7 for estimated average CAPEX	0%	Emerging
WA-16	EV	WA	Everett	Cedar and Pacific	10 buses, 5 small vehicles	$292,000	50%	Emerging
WA-17	EV	WA	Seattle	Port of Seattle	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
WA-18	EV	WA	Tacoma	Tacoma	15 vehicles	$500,000	100%	Potential
WA-19	LNG	WA	Seattle	N/A	7,352 DGE (5 vehicles)	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
WA-20	LNG	WA	Spokane	N/A	7,352 DGE (5 vehicles)	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Potential
WA-21	CNG	WA	Clark County	I-5 Corridor	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
WA-22	CNG	WA	Vancouver	I-5 Corridor	113,000 DGE	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated
WA-23	CNG	WA	Washington State	I-5 Corridor	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A	Unevaluated

III. INTRODUCTION

Transportation corridors are vital to the nation's economic growth and prosperity and are responsible for the movement of goods and people. Interstate 5 (I-5), stretching 1,400 miles from the borders of Canada to Mexico, is one of the most critical freight corridors in the United States. Running directly through the states of California, Oregon and Washington, I-5 serves as an international trade corridor supporting multiple industries such as import and export trade and agriculture. Connecting to major routes such I-90, I-84, I-80, I-505, I-15, and I-405, I-5 provides fundamental access to interstates, state highways, and local roads enabling a crucial transportation network for major supply chains and goods movement.

Trucks and other medium and heavy-duty vehicles that consume diesel fuel also generate significant emissions of harmful air pollution that is detrimental to public health. Though our economy depends on transportation corridors, the vehicles that traverse these roads represent 29% of the nation's greenhouse gas (GHG) emissions.[1] While it is difficult to estimate the average number of trucks that travel along the whole of the I-5 on a daily basis, the California Department of Transportation (Caltrans) tracks the number of vehicles that travel on the I-5 at certain sections of the highway, as well as the percentage of those vehicles that are trucks. As an illustrative example, in 2017 the highest volume of trucks traveling on any section of the I-5 was one near the junction of I-205 in San Joaquin County at 40,128 trucks per day (26.4% of all daily vehicle volume). Other sections of the I-5 see different truck volumes and percentages, like the I-580 junction in San Joaquin County, which had the highest truck percentage of total vehicle volume in California at 49.6% of all vehicles per day (9,424 trucks per day).[XI] As population continues to increase (est. 30% by 2050) so will the number of trucks and buses that depend on our nation's corridors.

Advancing the development of alternative fuel infrastructure along I-5 and other connecting routes will increase the adoption of clean vehicles and equipment. Alternative fuel corridors are an effective coordinating strategy to grow the clean vehicle marketplace, reduce energy dependence, improve air quality, and increase economic and environmental sustainability of the U.S. transportation system. By working across state boundaries, industries, and technologies, alternative fuel corridors can help states meet critical air quality requirements, diversify energy systems, and increase access to diverse fueling options for vehicle and equipment owners.

The West Coast Collaborative (WCC), a United States Environmental Protection Agency (EPA)-led public-private partnership between leaders from federal, state, local and tribal governments, the private sector, academia and environmental groups committed to reducing diesel emissions, have developed a regional initiative entitled, the Alternative Fuel Infrastructure Corridor Coalition (AFICC). AFICC is an important multi-state, multi-stakeholder initiative that seeks to advance station development for medium- and heavy-duty alternative fuel vehicles along the I-5 and other major connecting routes in California, Oregon, and Washington. The coalition seeks to build upon the United States Department of Transportation Federal Highway Administration's (FHWA) national program to designate alternative fuel corridors by filling in infrastructure gaps and expanding corridors to enable electric vehicle charging, hydrogen, propane, and natural gas fuel deployment.

[XI] Direct consultation with Caltrans.

Policies and partnerships in the three West Coast states have seen great success with the build-out of electric corridors for passenger vehicles. FHWA has designated I-5 as "Corridor-Ready" for light-duty electric vehicle (EV) charging with numerous EV chargers across the region. Though, there have been many efforts to incentivize infrastructure for light-duty EVs, more policies and incentives are needed to advance alternative fuel infrastructure for medium- and heavy-duty vehicles. AFICC serves as a convening platform to identify infrastructure projects that need funding and partnership assistance to be implemented. In doing so, the Coalition supports other efforts seeking to expand alternative fuel corridors that promote clean vehicle and equipment adoption.[XII]

What is AFICC

In 2017, EPA leadership of the West Coast Collaborative organized a Steering Team to help develop the mission, goals and objectives of the Alternative Fuel Infrastructure Corridor Coalition (AFICC). A meeting was held with the Steering Team in April 2017 to review a draft organizational charter that outlined a proposed plan to carry out the process of stakeholder engagement, outreach, industry feedback on infrastructure needs, plan development and partner action-setting. Members of the Steering Team included EPA, FHWA, U.S. DOT Volpe Center, state transportation, energy and environment offices, port authorities, industry associations, Clean Cities Coalitions and utilities. EPA held calls with the Steering Team to collect feedback and finalize the AFICC organizational charter and work plan.

EPA brought on contractor, CALSTART, a national clean transportation non-profit organization to help facilitate and implement AFICC objectives in May 2018. CALSTART has led some of the nation's largest emission reduction programs including clean corridor initiatives to advance alternative fuel vehicle adoption. As the stakeholder engagement process began, AFICC's membership quickly grew as members of the Steering Team assisted with identifying other critical partners that could provide value and help inform the infrastructure planning process. To capture the unique needs, priorities and concerns of each state, Champion Groups were established to ensure that communication and feedback was given regularly respective to each state's interests and needs. CALSTART worked with EPA and the Champion Groups for California, Oregon, and Washington to grow AFICC's membership to over 200 public and private partners.

Mission Statement

The mission of the West Coast Collaborative Alternative Fuel Infrastructure Corridor Coalition (WCC AFICC) is to accelerate the modernization of West Coast transportation corridors by deploying alternative fuel infrastructure for medium- and heavy-duty vehicles (MHDVs) in synergy with other investments. Public-private collaboration to plan projects, leverage funding, and construct modernized corridors with alternative fuel infrastructure will create jobs, increase domestic fuel supply diversity, reduce emissions, improve public health and support more robust MHD fleet operations.

Partnership Objectives

Coalition partners work together to evaluate regional priorities, infrastructure needs and available funding to support MHD alternative fuel corridor development. As a result of this innovative partnership

[XII] The West Coast Collaborative Alternative Fuel Infrastructure Corridor Coalition is not to be confused with the West Coast Clean Transit Corridor Initiative: a study led by nine electric utilities on the West Coast, and on which CALSTART is also a contractor, to determine how best to equip Interstate 5 with sufficient electric charging infrastructure for medium- and heavy-duty battery-electric trucks.

and the subsequent build out of alternative fuel corridors, AFICC seeks to help advance deployment of alternative fuel vehicles. MHDV fleets and the communities they serve will then be able to experience the many benefits of alternative fuel vehicle operation. The AFICC's specific objectives are to:

1. Convene a stakeholder coalition focused on MHD alternative fuel infrastructure development.
2. Conduct stakeholder workgroups and targeted outreach to identify desired/unfunded MHD alternative fuel stations.
3. Synthesize stakeholder input into a plan document.
4. Provide a platform for sharing MHD alternative fuel infrastructure investment needs.
5. Use the plan as the basis for joint applications to competitive funding programs.
6. Obtain funding assistance to help implement infrastructure in California, Oregon, and Washington (i.e., electric vehicle charging, hydrogen, propane, and natural gas fueling for public and private MHD fleets).

Partnership Roadmap

To accomplish the AFICC objectives, EPA and CALSTART developed a Partnership Roadmap to help define the process for identifying infrastructure needs to advance West Coast MHD alternative fuel corridors. The AFICC Partnership Roadmap outlines the steps taken to develop a process framework, execute meaningful stakeholder engagement, assess infrastructure needs, and produce this strategic development plan. Figure 2 below provides an overview of the Roadmap.

Figure 2: AFICC Partnership Roadmap

The following document presents AFICC's strategic development plan, which describes the important learnings from the process carried out under the AFICC Partnership Roadmap, a prioritization of MHDV infrastructure projects seeking funding for development, and partner recommendations to advance West Coast alternative fuel corridors. It is the hope of AFICC and its partners to utilize the plan in leveraging available public and private funding assistance to implement the highlighted projects. This plan is intended to serve as a tool and living document for the West Coast Collaborative and AFICC members to support ongoing interstate coordination, partnership development, and prioritization of programs and incentives to increase infrastructure development and growth of alternative fuel corridors. California, Oregon, and Washington State Transportation Agencies and Regional Metropolitan Planning Organizations are encouraged to use the Strategic Development Plan to help advance alternative fuel infrastructure development by supporting implementation of cited project opportunities located within their respective jurisdictions.

IV. MEDIUM- AND HEAVY-DUTY ALTERNATIVE FUEL VEHICLE TRENDS

Alternative Fuel Trends

There is an increase in the adoption of alternative fuel vehicles for personal and commercial use in the United States, with myriad factors driving the demand for these vehicles. On the consumer side, drivers and fleet managers recognize that with some initial investment, there can be significant cost savings when switching to alternative fuels. Faced with challenging emission reduction mandates, public agencies are implementing various policies and incentive programs to encourage consumers to adopt cleaner vehicles. For all parties, there is the recognition that traditional fuels will become less available and more expensive over time, motivating many to begin the proactive switch to alternative fuels.

Despite interest in the advancement of alternative fuels, there are still barriers that persist and make the transition difficult for some. For instance, the higher upfront cost of both vehicles and infrastructure has been prohibitive for many interested in adopting new fueling types. Public agencies have responded with incentives and rebates to remedy this challenge, but these inducements have had a limited impact to date, largely due to their limited scope and available resources. Another barrier is a lack of infrastructure for refueling vehicles. Many fleet managers are wary of transitioning to alternative fuels without abundant fueling access across their commonly used routes. A lack of knowledge of available technologies and operational cost savings is another factor that impedes potential adopters.

Although these barriers are currently inhibiting some growth in the alternative fuel market, most are surmountable with time and sustained effort. Both government and industry have introduced and encouraged alternative fuel vehicles in California, Oregon, and Washington, causing the West Coast to be home to many early adopters of these new technologies. With this preface, the following sections discuss public sector activities, and policy needs to support alternative fuel deployment on the West Coast.

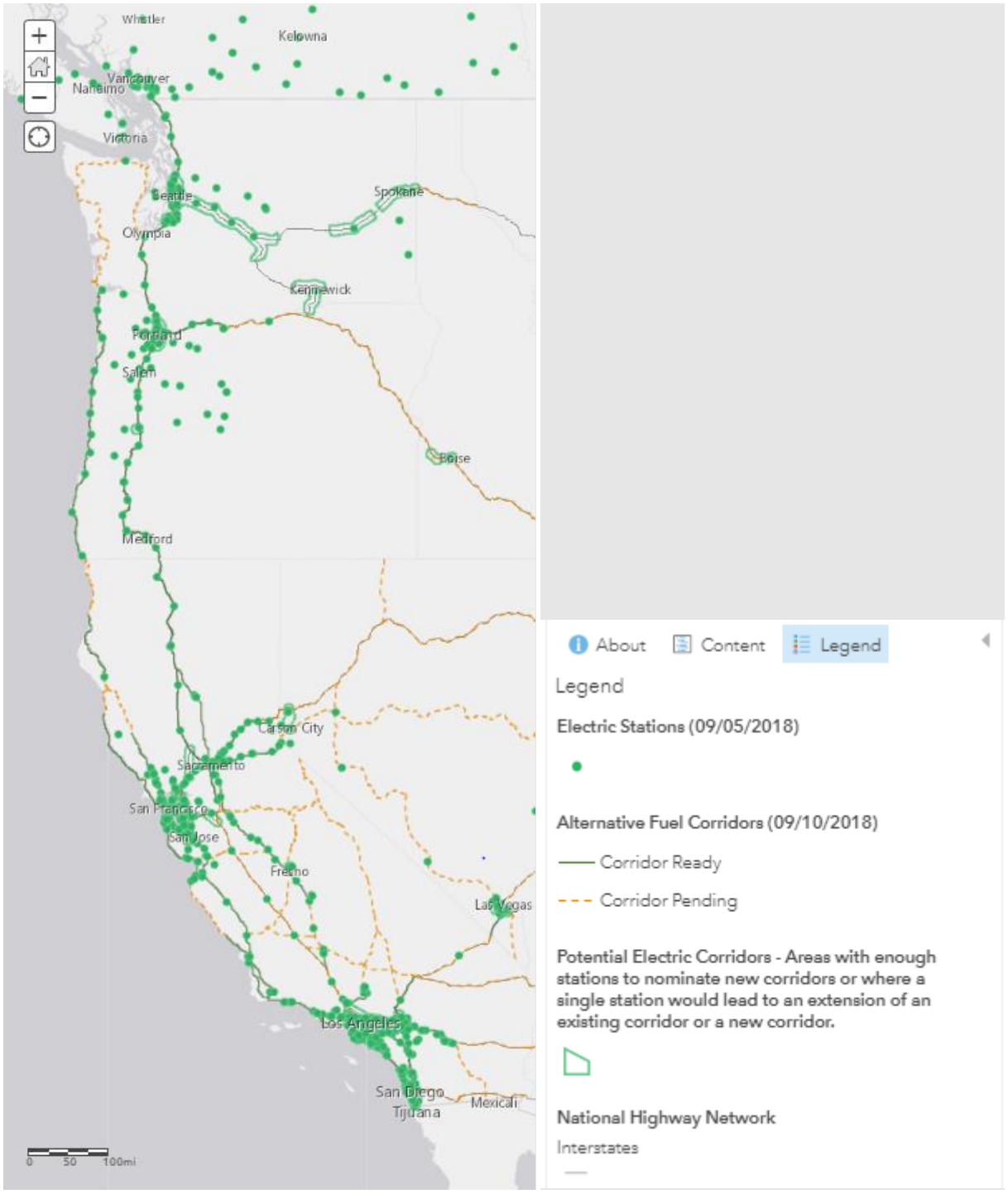
Designation and Cost of Alternative Fuel Corridors

Under Section 1413 of the Fixing America's Surface Transportation (FAST) Act, the Federal Highway Administration (FHWA) is required to designate corridors as "signage ready" or "signage pending" for alternative fuels annually through 2020.[2] Figure 3 through Figure 7 are snapshots of the FHWA corridor designations for the fuels and states that are covered in this report. The solid colored lines represent those corridors that are designated as "signage ready" and the dotted lines represent corridors that are designated as "signage pending." "Signage pending" corridors do not have sufficient alternative fuel stations to meet required mileage between stations as stated by the FHWA, whereas "signage ready" corridors do. The mileage between station requirements are defined in Section VI. Corridors with boxing or circling around them indicate that the corridor has sufficient infrastructure to be designated as corridor "signage ready" but has not yet been nominated for consideration by FHWA.

Please note that the FHWA's corridor designation program counts stations that service light-duty vehicles along with medium- and heavy-duty vehicles, and as of publication of this strategic development plan the FHWA's corridor maps do not offer an apparent method for disaggregating light-duty accessible stations from medium-duty and heavy-duty accessible stations. Therefore, it should be assumed that Figure 3 through Figure 7 all show fueling stations that may service light-duty, medium-duty, and/or heavy-duty vehicles. It is likely for some of the fuels, particularly with electric and hydrogen, that the majority of the

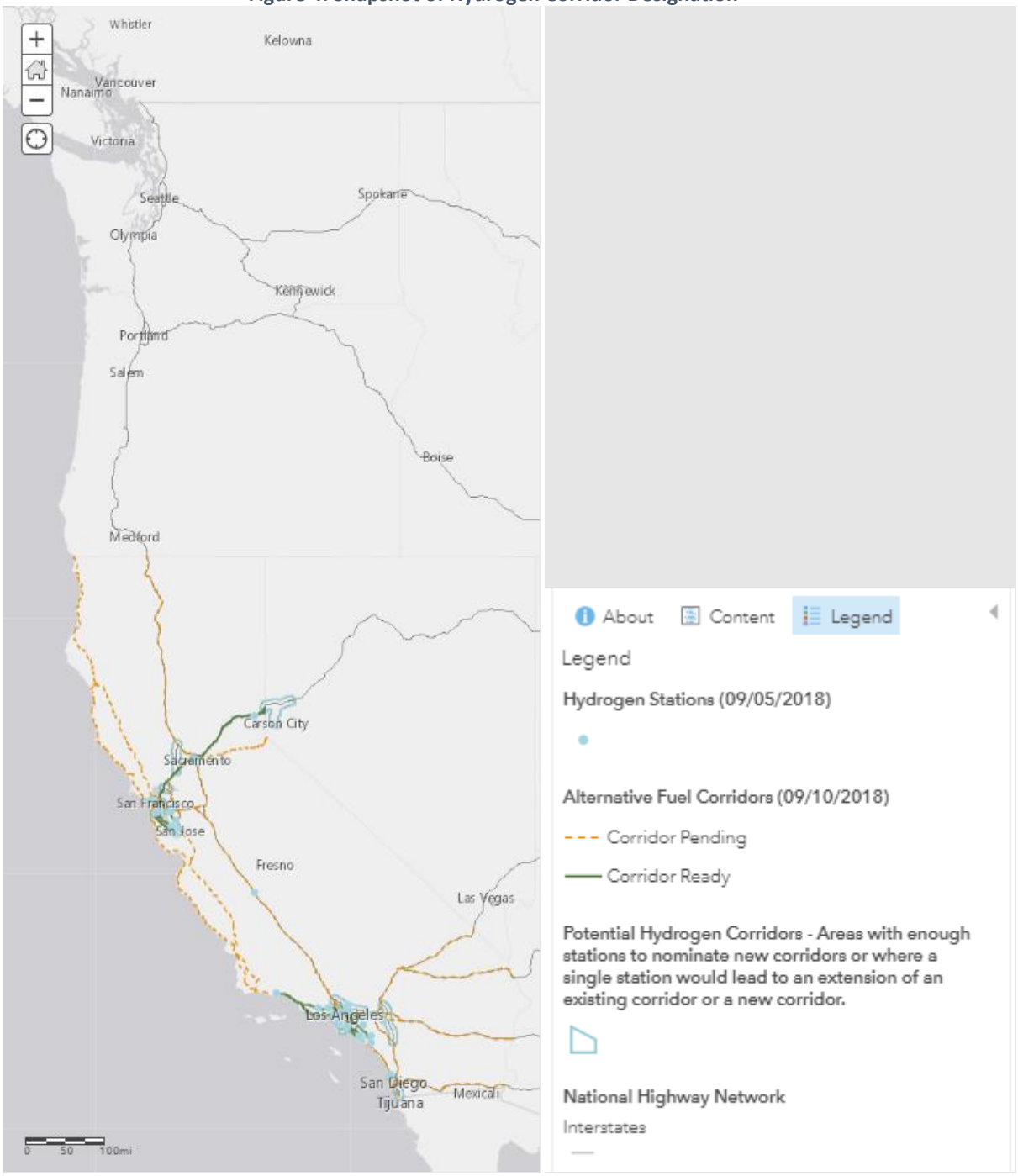
sites are light-duty and not capable of accommodating medium- and heavy-duty vehicles. Despite this, the FHWA's corridor designation program and its associated maps offer a valuable approach that may be followed with a focus on identifying gaps in alternative fuel infrastructure for medium- and heavy-duty vehicles along major West Coast corridors. Thus, CALSTART shows snapshots of FHWA's maps for each alternative fuel type below as an example and reference for methods in determining alternative fuel infrastructure completeness along corridors.

Figure 3: Snapshot of Electric Corridor Designations[3,XIII]



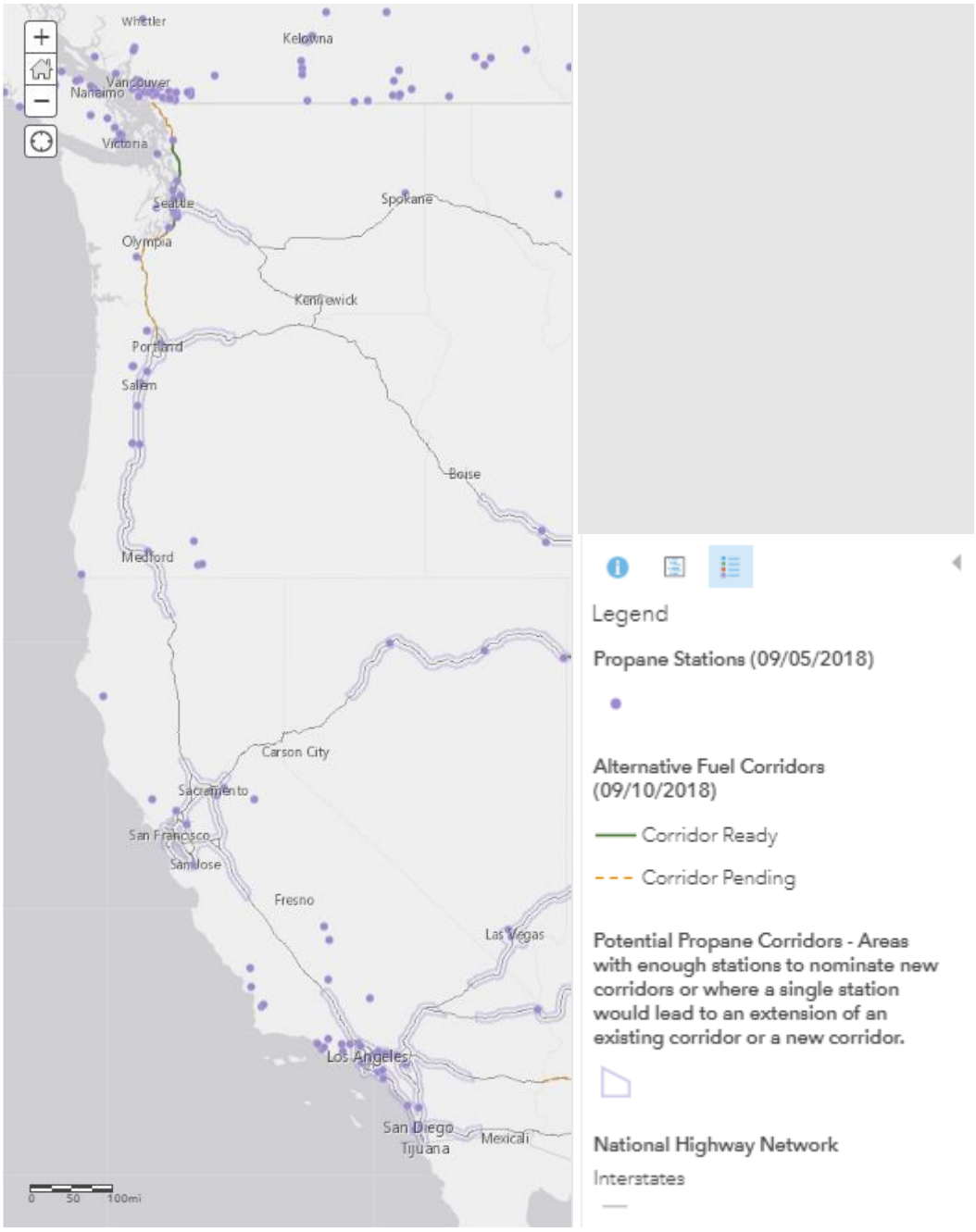
[XIII] https://www.arcgis.com/home/webmap/viewer.html?webmap=376dedd75b8347b8936abd70703cdb69&extent=-158.6002,16.7349,-56.1198,56.6162

Figure 4: Snapshot of Hydrogen Corridor Designation[4,XIV]



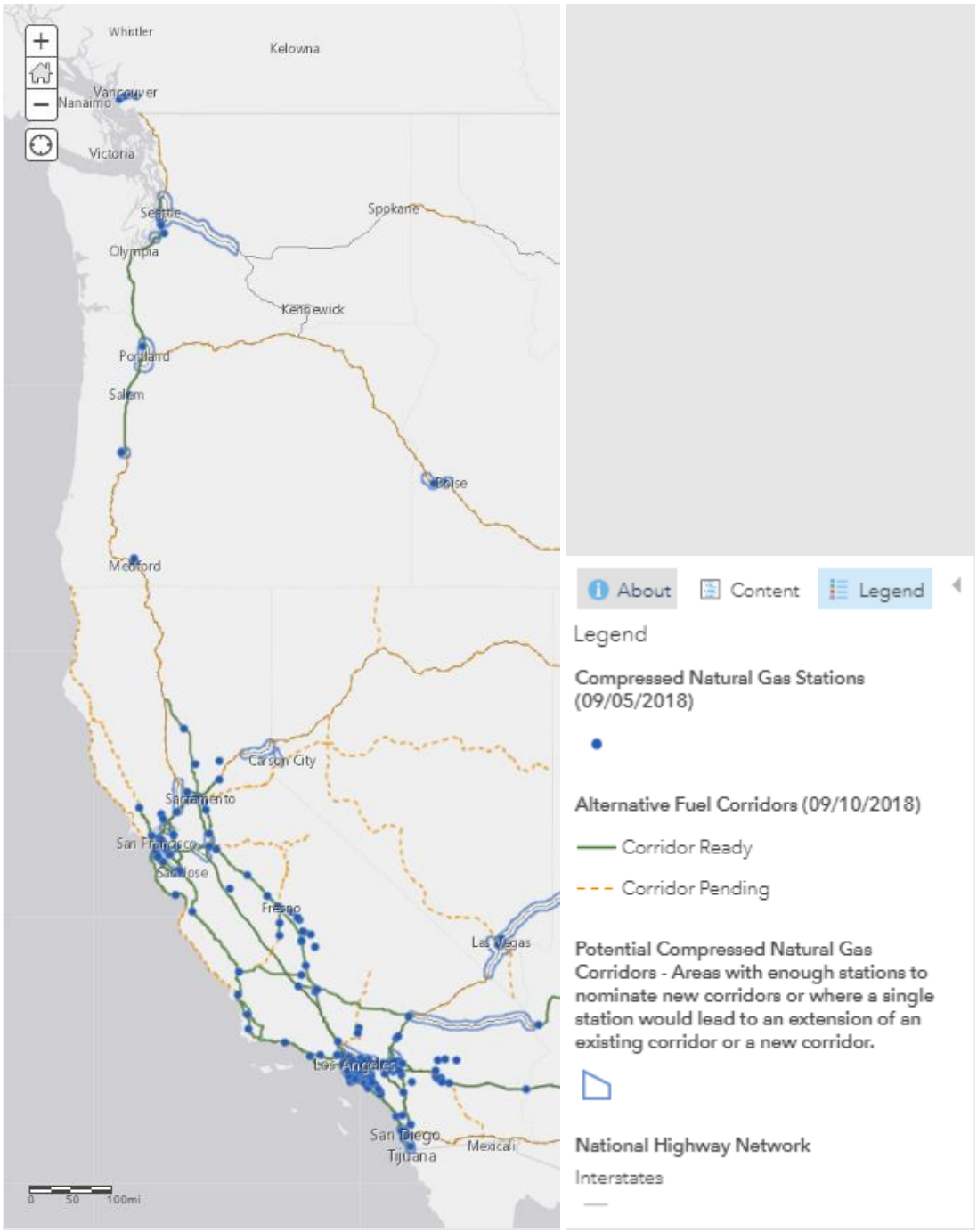
[XIV] Readers should assume that this map shows light-duty only stations along with MHD-accessible stations. The cited source did not offer a method to disaggregate light-duty only stations from MHD- accessible stations.

Figure 5: Snapshot of LPG Corridor Designation[5,xv]



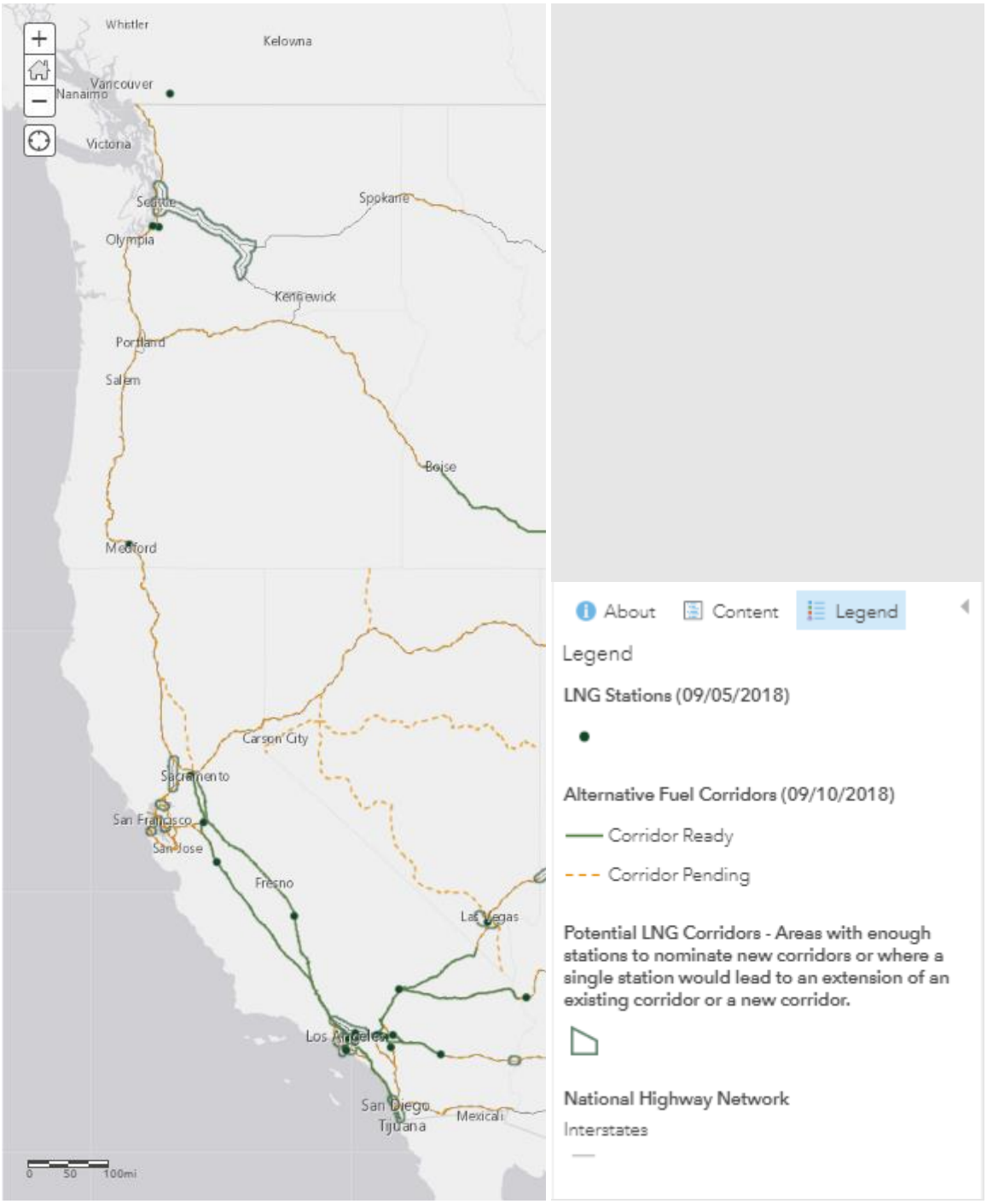
[xv] Readers should assume that this map shows light-duty only stations along with MHD-accessible stations. The cited source did not offer a method to disaggregate light-duty only stations from MHD- accessible stations.

Figure 6: Snapshot of CNG Corridor Designation[6,XVI]



[XVI] Readers should assume that this map shows light-duty CNG stations along with MHD-accessible stations. The cited source did not offer a method to disaggregate light-duty only stations from MHD- accessible stations. All depicted stations likely MHD-accessible given the prevalence of CNG fueling for MHDVs versus LDVs.

Figure 7: Snapshot of LNG Corridor Designation[7,XVII]



[XVII] Readers should assume that this map shows light-duty LNG stations along with MHD-accessible stations. The cited source did not offer a method to disaggregate light-duty accessible LNG stations from MHD-accessible stations. All depicted stations likely MHD accessible given the prevalence of LNG fueling for MHDVs versus LDVs.

Because this plan is aimed at highlighting MHD alternative fueling infrastructure needs, it is important to consider the cost of outfitting corridors with infrastructure by fuel type. CALSTART took survey responses, reached out to partners, and read available reports to estimate the costs of an average MHD fueling station for each fuel type. The data collected had varying levels of capacity, year built, and other factors, so CAPEX can vary greatly. Finally, these CAPEX estimates only factor in capital costs (construction, permitting, equipment, etc.) and not operational costs. Accordingly, the CAPEX estimate per station provided below are approximate. Also be aware that the stations included here are not truly representative of the total investment needed for comprehensive MHD alternative fuel infrastructure access on the West Coast.

Table 7 Estimated Funding Needed to Build Proposed Infrastructure Projects in This AFICC Effort[XVIII,XIX]

Fueling Type	Number of Sites Proposed by Outreach Participants	Assumptions for Each Station	Average Estimated CAPEX Per Station	Total Cost
EV	62	750kW-1MW Peak Capacity	$2,000,000	$124,000,000
H_2	23	1,000-4,800 kg/Day	$6,000,000	$138,000,000
LPG	13	1,000 gallons/Day	$1,700,000	$22,100,000
CNG	36	1,695-2,260 DGE/Day	$2,000,000	$72,000,000
LNG	7	1,695-2,260 DGE/Day	$2,500,000	$17,500,000
Total	**141**			**$373,600,000**

Table 8 Estimated Funding Needed to Build Proposed Infrastructure Projects by State

State	Number of Stations by Fuel Type					Total Cost
	EV	H2	LPG	CNG	LNG	
California	34	6	6	16	0	$146,200,000
Oregon	15	14	5	17	5	$169,000,000
Washington	13	3	2	3	2	$58,400,000
Total	62	23	13	36	7	**$373,600,000**

Federal Policy Landscape

The U.S. federal government has several programs that support the advancement of alternative fuels covered in this strategic plan (i.e., EV, H_2, LPG, CNG, LNG). The federal government recognizes infrastructure as a key barrier to consumer adoption of alternative fuels, leading to programs that encourage alternative fuel infrastructure planning and deployment nationwide.

[XVIII] CAPEX estimate does not represent the total funding needed to deploy comprehensive MHD alternative fueling infrastructure in California, Oregon, and Washington; only includes proposals obtained through AFICC outreach.
[XIX] Table does not include catenary electric, or liquid biofuel infrastructure proposals (6 projects omitted) as these technologies are outside the AFICC planning scope.

Fixing America's Surface Transportation (FAST) Act, Section 1413: Section 1413 of the FAST Act, enacted in 2015 requires the designation of national electric vehicle (EV) charging, hydrogen, propane, and natural gas fueling corridors (also defines the technological scope of this plan). This designation includes the identification of near and long-term needs for future alternative fuel infrastructure along interstate and major state highway corridors. Section 1413 also directs the Secretary of Transportation to update and re-designate corridors annually after establishment of the Act due to the continuously changing state of alternative fuel vehicle and infrastructure technology. For a highway segment to be designated as "Signage Ready", maximum distance between stations is as follows: 50 miles for electric, 100 miles for hydrogen, 150 miles for propane, 150 miles for CNG, and 200 miles for LNG. In addition, the stations must be within five miles of the designated highway corridor segment.[8]

EPA Diesel Emissions Reduction Act Program:[9] The Diesel Emissions Reduction Act (DERA) is part of the Energy Policy Act of 2005 and was reauthorized in 2010. The aim of the bill is to reduce diesel emissions by appropriating EPA funding assistance to replace, repower, and/or retrofit heavy-duty diesel engines. This bill has had a profound effect, allowing tens of thousands of diesel engines to be cleaned up, generating public health benefits nationwide. Furthermore, the DERA-related funding opportunities have led to the creation of several regional clean diesel collaboratives, including the West Coast Collaborative.[10] These Collaboratives, facilitated by EPA's regional offices, have laid the foundation for partnerships between vehicle owners, government, and environmental advocates that help further reduce diesel emissions beyond the scope of federally funded projects.

EPA Ports Initiative:[11] This initiative works in collaboration with the port industry, communities, and all levels of government to improve environmental performance and increase economic prosperity. This effort helps people living and working near ports across the country breathe cleaner air and live better lives. The program is designed to encourage retrofit, repower, or replacement of legacy heavy-duty diesel engines with lower emitting technologies, operational best practices, and partnership development. Funding provided by the EPA's National Clean Diesel Campaign aims to offset the cost of the technology and increase adoption rates at ports to compliment exist DERA program efforts in the goods movement sector.

U.S. Department of Energy Clean Cities Program:[12] Founded in 1993 by the U.S. Department of Energy (DOE) Vehicle Technologies Office (VTO), Clean Cities aims to advance affordable, domestic transportation fuels, along with more efficient mobility systems and other fuel-saving technologies and practices. There are nearly 100 local coalitions across the nation comprised of 15,000 stakeholders, including businesses, government agencies, fuel providers, fleets and other stakeholders. At the local level, coalitions leverage the resources of DOE and their national labs to create networks of local stakeholders and provide technical assistance to fleets implementing alternative and renewable fuels and other emerging transportation technologies.

U.S. Department of Energy Zero-Emission Cargo Transportation Demonstration and SuperTruck Programs:[13] DOE recognizes the need for funding in the heavy-duty space. It demonstrates zero-emission vehicles through the Zero-Emission Cargo Transportation Demonstration, which aims to accelerate the introduction of electric trucks into the market. There is also the SuperTruck Initiative, which aims to increase Class 8 tractor trailer fuel efficiency by 50%.

U.S. Department of Energy Hydrogen and Fuel Cells Program:[14] This program conducts research and development in hydrogen production, delivery, storage, and fuel cells, as well as activities in technology validation, manufacturing, systems analysis and integration, safety, codes and standards, and education.

Current Federal Government Activities

The federal government is implementing various programs to support the deployment of alternative fuel vehicles and infrastructure, however, as this strategic plan outlines, additional funding is required to support infrastructure development for medium- and heavy-duty vehicles. This is seen as a necessity to the industry as expansion of zero- and near-zero emission alternative fuel vehicles in commercial fleet applications is not possible without the development of infrastructure to support them.

Opportunities to Meet Alternative Fuel Goals

Federal funding assistance is needed to incentivize the purchase and operation of commercially available medium- and heavy-duty alternative fuel vehicles, as well as to support infrastructure development along transportation corridors. Research, development, and demonstration funding will also help to commercialize high-efficiency and low emission vehicle technologies, helping build a more robust clean transportation industry in the U.S.

California Policy Landscape

California has several statutes, programs, and initiatives supporting alternative fuel deployment. Many related policies in California are comprehensive in that they cover vehicles, fueling infrastructure, and fuel production.

Senate Bill 32:[15] The California Global Warming Solutions Act of 2006, requires greenhouse gas (GHG) emission reduction to 40% below 1990 levels by 2030. Under this statute, the California Air Resources Board (CARB) is directed to develop and implement the GHG emission reduction strategies required to achieve the 2030 mitigation mandate.

Senate Bill 350:[16] The Clean Energy and Pollution Reduction Act established clean energy, clean air, and GHG reduction goals, including reducing GHG to 40% below 1990 levels by 2030 and to 80% below 1990 levels by 2050. Under this bill, agencies including the: California Public Utilities Commission (CPUC), California Energy Commission (CEC), and CARB are working with stakeholders to support transportation electrification. In doing so, the CPUC is actively working with investor owned electric utilities (IOUs) to develop and implement programs and investments to accelerate transportation electrification throughout the state. The CPUC approved several California IOUs to operate an electric vehicle infrastructure rebate program for a total of $786 million in funding.

Senate Bill 1383:[17] This bill codified CARB's Short-Lived Climate Pollutants (SLCP) Strategy and prescribed related pollution reduction goals. This includes reducing methane emission by 40% below 2013 levels by 2030. To support this goal, the bill allows for an increase in the production and use of in-state biomethane for electricity and transportation sectors and for the development of at least 5 dairy biomethane pilot projects.

Assembly Bill 784:[18] This bill would exempt certain public agencies in the state from paying taxes on the purchase of specified zero-emission technology transit buses.

Assembly Bill 2061:[19] This bill allows for zero and near-zero emission heavy-duty trucks to exceed California's weight limits by 2,000 pounds due to the extra weight associated with alternative fuel systems (e.g., powertrain and fuel storage components). With this additional weight limit, many heavy-duty alternative fuel vehicles can now weigh up to 82,000 pounds.

California Executive Order N-19-19:[20] Signed on September 20, 2019, EO N-19-19 requires California state agencies to enhance their efforts in reducing GHG emissions and mitigating the impacts of climate change while focusing on economic growth. This executive order requires multiple actions from several agencies. First, it requires the Department of Finance to create a Climate Investment Framework by leveraging the state's $700 billion investment portfolio. The purpose of this Framework is to set a strategy for investing the state's pension funds into companies and industry sectors that have growth potential based on reducing carbon emissions. Second, the EO requires the State Transportation Agency to leverage California's more than $5 billion in annual transportation spending to reduce fuel consumption and GHG emissions associated with the transportation sector, working to meet the objectives of the state's Climate Change Scoping Plan. Third, the EO requires the Department of General Services to minimize its fleets' carbon footprints. Finally, the EO requires CARB to accelerate efforts toward the state's goal of five million zero-emission vehicles (ZEV) sales by 2030 through new strategies for increasing demand for such vehicles and incentivizing ZEV production.

California Executive Order B-48-18:[21] Signed on January 26, 2018, EO B-48-18 commits California to a goal of five million ZEVs on the road by 2030, and 250,000 vehicles charging stations and 200 hydrogen refueling stations by 2025. The order also states the ways in which all State entities should collaborate with stakeholders to aid in the implementation of this order. This includes updating the 2016 ZEV Action plan, recommending actions to create jobs and boost economy through ZEV infrastructure development, recommend ways to expand infrastructure through Low Carbon Fuel Standards Program, etc.

California Climate Change Scoping Plan:[22] California Assembly Bill 32 (AB 32), passed in 2006, required CARB to develop a Scoping Plan which would outline the approach that the state would take to reduce GHGs to 1990 levels by 2020. With the passage of Senate Bill 32 (SB 32), the Scoping Plan updated in 2016 to include a 2030 GHG emissions reduction goal of 40% below 1990 levels. Additionally, AB 197 was passed alongside SB 32 providing additional direction on community health protection within the Scoping Plan. Thus, CARB updated the current version of the Climate Change Scoping Plan in 2017, which describes the state's strategy for achieving its 2030 target for GHG emission reductions, including emissions reductions in the transportation sector, which constitutes approximately 41% of current carbon emissions in California.

CARB Three Year Heavy-Duty Investment Strategy:[23] Identifies three MHD beachhead pathways to target for future investment in alternative fuels for the state of California: Zero-Emission, Low NOx, and Efficiencies. The idea behind these beachheads is that the advancements in these areas will support the development of other, emerging technologies that overlap with existing technologies and therefore have a "multiplier" effect upon the industry and alternative fuel development.

CARB Low Carbon Fuel Standard (LCFS):[24] Aims to reduce the carbon intensity (CI) of transportation fuels by 10% by 2020, and 20% by 2030, and encourage the production of cleaner fuels. In this program, transportation fuels with a higher CI level than a CARB-designated cap generate deficits for the organization that produced them, and fuels with a lower CI level than a CARB-designated cap generate credits for the organization that produced them. Fuel providers must comply with the fuel CI caps, and if they cannot do so using internally produced fuel products, they can purchase credits on the market from other LCFS market participants.

CARB Innovative Clean Transit Rule: Requires that mass transit agencies in California will only be permitted to purchase buses that are fully electric by 2029. As part of the rule, state transit agencies will have benchmarks to reach sooner than 2029. By 2023 and 2026, one quarter and half of new buses must be electric, respectively.

CARB Advanced Clean Truck Regulation: This regulation has been proposed and will be subject to change until CARB's Board makes a final decision (expected in 2020). This regulation focuses on manufacturers of Class 2b-8 vehicles with combustion engines, requiring increasing percentages of their annual California truck sales from the model years 2024 to 2030 to be zero-emission capable vehicles (i.e., plug-in hybrid, battery-electric, and fuel cell electric).

CARB Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP):[25] Offers point-of-sale incentives for zero- and near-zero emission trucks and buses, allowing for a streamlined incentive process that benefits adopters of clean technology. At the time of writing this plan, HVIP has deployed more than 4,000 MHDVs, helping to grow the MHD advanced powertrain market by 30%. IOUs such as Pacific Gas & Electric, Southern California Edison, and San Diego Gas and Electric are coordinating closely with the administrators of HVIP on infrastructure incentives for MHD plug-in electric vehicles.

CARB Clean Off-Road Equipment (CORE) Voucher Incentive Project: Similar to the HVIP model, this program offers point-of-sale incentives for zero-emission medium- and heavy-duty off-road equipment used by the goods movement industry. Launched in 2020, CORE provides $44 million in incentives for equipment across various functions including; cargo handling equipment, yard tractors, transport refrigeration units, rail car movers, airport cargo loaders among others. Additional incentives are available for infrastructure and for users operating in disadvantaged communities.

Volkswagen NOx Mitigation Trust Fund:[26] The funds from the Volkswagen Light-Duty Diesel Settlement will provide $423 million in funding assistance for various engine replacement, zero emission vehicle deployment and ZEV infrastructure development projects that will reduce NOx emissions throughout California. The fund aims to provide a "balanced approach" by committing funding to cost-effective, cleaner combustion technologies (e.g., low NOx powertrains) and zero-emission technologies to reach longer term emission reduction goals. Funding will support deployment of MHD alternative fuel vehicles and light-duty ZEV infrastructure.

CEC Clean Transportation Program:[27] In 2007, the California Legislature passed Assembly Bill 118 which created the CEC's Clean Transportation Program (formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program or ARFVTP). In 2013, this program was reauthorized through 2023 by the passage of Assembly Bill 8. The CEC has provided nearly $830 million for fuel production,

infrastructure, vehicles, and other related needs for a wide variety of alternative fuels throughout California. For FY 2019-2020, over $95 million was allocated for investment under this program.

CEC Electric Vehicle Supply Equipment Rebates:[28] There are multiple rebate programs available to incentivize the cost of electric vehicle supply equipment (EVSE). A major program, the California Electric Vehicle Infrastructure Project (CALeVIP) under the CEC's Clean Transportation Program, offers incentives for the purchase and installation of electric vehicle charging infrastructure at publicly accessible sites in several regions throughout California. CALeVIP works with local partners to develop and implement EV charger incentive projects that meet regional needs for Level 2 chargers and direct-current fast chargers. This statewide project aims to provide a streamlined process for getting chargers installed and fill gaps in charging availability.

CDFA Dairy Digester Research and Development Program:[29] This program, administered by the California Department of Food and Agriculture (CDFA), provides financial assistance for the installation of anaerobic digesters at California dairies. This technology converts manure and other organic waste into biomethane, a renewable transportation fuel that can be used in CNG and LNG powered vehicles.

Current California Government Activities

Under Assembly Bill 2127 (2017), the CEC must publish a statewide assessment of the EVSE infrastructure required to accommodate anticipated increases in charging demand to achieve the goal of at least five million ZEVs by 2030. Executive Order B-48-18, directs the state to add 250,000 EVSE and 200 hydrogen stations by 2025, primarily for light-duty vehicles. The CPUC has approved or is in the process of approving approximately $2 billion for EVSE investment, and the VW settlement funds will also provide financial support for ZEV deployment and related infrastructure development. It is widely acknowledged that the state will need additional funding assistance to accomplish its existing ZEV deployment goals.

Opportunities to Meet Alternative Fuel Goals

California is advancing alternative fuel technology through a suite of legislation, regulations, funding programs, and thoughtful coordination between stakeholders. CARB has produced foundational plans that seek to coordinate these efforts, including CARB's Three Year Heavy-Duty Investment Strategy and the Climate Change Scoping Plan. Through these plans, incentive programs such as HVIP and CORE were developed to help propel new technologies into the market and help existing technologies further penetrate the market. CARB is also consulting with other state agencies, air districts, utilities and ports to evaluate ways to coordinate across funding programs and investment needs for MHD vehicles and infrastructure through a working group called the California Funders Forum. In addition, through the MHD Infrastructure Working Group, stakeholders are working together to evaluate infrastructure needs across the state to advance clean transportation and to be better prepared for zero-emission transportation. California has shown how coordinated policy and funding can help quickly accelerate alternative fuel vehicle adoption. Although great progress has been made, significant, additional, and sustained funding assistance is needed to build on this momentum and achieve transformative change within California's transportation sector.

Oregon Policy Landscape

Oregon has several policies and programs that encourage the development of alternative fuel stations and the deployment of low and zero emission vehicles. Additional funding is required to advance the medium- and heavy-duty alternative fuel vehicle market and support corridor growth within the state.

Senate Bill 1044:[30] Aims to promote ZEV adoption by requiring certain state fleet purchases and leases to be ZEVs. In addition, this bill provides funding for school bus fleets to deploy EV charging infrastructure.

Senate Bill 583 and Oregon Energy Incentive Program:[31] Passed in 2013, this bill created "eligibility for alternative fuel vehicles used in business activities to receive tax credits under the Oregon Energy Incentive Program beginning January 1, 2015". Eligible vehicles would receive a 35% credit on the incremental cost between a conventional vehicle and an EV. Despite this tax credit, the number of applications from businesses for EVs has been low thus far. This is likely due to a lack of knowledge of low operating costs of EVs and the cost of the EVs being larger upfront compared to conventional vehicles despite the tax credit. Although this program is beneficial for the promotion of EVs, the rebate may need to be larger to have greater impact on purchasing. As of December 2019, this program was no longer running.

Senate Bill 98:[32] This bill allows natural gas utilities to rate base incentives for renewable natural gas (RNG). It also sets voluntary RNG portfolio goals to support a smooth transition to a low carbon energy economy. For example, the suggested renewable portfolio target for gas purchased by natural gas utilities for distribution to retail customers reaches as high as 30% by 2050.

Senate Bill 1547:[33] This bill mandates that electric utilities eliminate coal-based electricity generation by 2026. This is significant in the alternative fuel sector because it reduces emissions associated with EV charging by enabling renewable energy production.

House Bill 3543 and the Oregon Global Warming Commission:[34] Introduced the goal of reducing GHG levels to 75% below 1990 levels by 2050 and created the Oregon Global Warming Commission. This advisory group, consisting of 25 appointed members, develops long-term policy recommendations for the State of Oregon to combat and adapt to global warming.

House Bill 2017:[35] Created a transportation fuel tax that funds a variety of initiatives, including additional funding for transit agencies to deploy low to zero emission buses. This policy has supported increased adoption of alternative fuel buses in Oregon.

House Bill 2007:[36] In addition to allocating funds received under the Volkswagen Diesel Settlement, HB 2007 established deadlines after which older-model MHD diesel engines cannot be titled or registered in Clackamas, Multnomah and Washington counties. The phase-out deadlines occur in 2023, 2025 & 2029. Criteria for certified diesel retrofits will be established prior to these deadlines to allow for regulated parties to comply with the new titling and registration rules. The Oregon Department of Environmental Quality (ODEQ) will also establish minimum standards for both on road and off-road diesel engines used on certain public improvement contracts.

ODEQ Clean Fuels Program:[37] The Oregon Clean Fuels program, analogous to California's Low Carbon Fuel Standard, is designed to reduce the average carbon intensity of Oregon's transportation fuels by 10% over a 10-year period. As of December 2019, the program had approximately 160 regulated parties who were registered importers of conventional and alternative fuels. Deficits and credits are generated based on the carbon intensity of fuel imports to the state. A Credit Clearance Market provides an opportunity for regulated parties to comply with the standard if they cannot generate enough credits during the year. Additionally, owners of EV charging infrastructure can earn clean fuel credits, incentivizing the adoption of MHD electric vehicles. The program incentivizes and promotes alternative fuel usage in all transportation sectors statewide in order to reduce GHG emissions.

Executive Order No. 17-21, Accelerating Zero Emission Vehicle Adoption in Oregon to Reduce Greenhouse Gas Emissions and Address Climate Change:[38] Issued in November 2017, this EO focuses on accelerating ZEV adoption, and proposes a strategy to triple ZEVs in the state by 2020. The group tasked with implementing EO No. 17-21 is The ZEV Interagency Working Group (ZEViWG), a team of Oregon state agencies, including the: Department of Transportation, Department of Environmental Quality, Public Utility Commission, Department of Administrative Services, and Department of Energy. Another organization contributing to this effort is the Oregon Electric Vehicle Collaborative, headed-up by Oregon Solutions.[39]

Volkswagen NOx Mitigation Plan:[40] Oregon will reduce diesel emissions from at least 450 school buses over the next three years and is on track to meet that goal at an estimated of cost $18-22M. HB 2007 directed Oregon to spend the remainder of the $72.9M on a new Clean Diesel Initiative grant program to reduce diesel emissions from trucks and equipment with a preference for projects in the greater Portland Metropolitan area.

Multi-State Zero Emission Vehicle (ZEV) Task Force:[41] Oregon, along with California, Connecticut, Maryland, Massachusetts, New Jersey, New York, Rhode Island, and Vermont, signed a memorandum of understanding (MOU) to promote and advance strategies to increase ZEV adoption. Through a ZEV Program Implementation Task Force, the states are seeking to deploy at least 3.3 million ZEVs with adequate fueling infrastructure in participating states by 2025. Oregon is a participant in the Multi-State ZEV Action Plan to implement this MOU.[42] Additionally, the Multi-State ZEV Task Force created the International ZEV Task Force, and Oregon will be hosting its annual conference in Portland in 2020.

Oregon's Clean Car Standards:[43] As of December 2019, Oregon is one of eleven states that have adopted both California's Low Emission Vehicle Program and ZEV mandate. The Low Emission Vehicle program requires new light-duty vehicles to meet certain emissions performance requirements for GHGs, criteria pollutants, and air toxics. The ZEV mandate requires automobile manufacturers to provide a certain number of new ZEVs (battery electric, fuel cell electric and plug-in hybrid electric) for sale within the state. While focused on light-duty vehicles, these standards indicate the state's continued commitment to transportation electrification.

West Coast Electric Highway:[44] Oregon is actively working to enhance its portion of the West Coast Electric Highway by recapitalizing it to provide dual-protocol DC Fast Charging, including SAE CCS Combo and CHAdeMO compatible DC Fast Charging infrastructure. Each of the 44 sites along Oregon's West Coast Electric Highway segment will be upgraded in this way. The State of Oregon committed over $4 million to

this effort in 2019, with the Oregon Transportation Commission approving $3.5 million in federal funding for this work and HB 5050, Section 63 (adopted in 2019) authorizing the Oregon Department of Transportation to use $650,000 as match funding for the same effort.[45]

Current Oregon Government Activities

Currently, Oregon is dedicated to both transportation electrification and expanding RNG development and use. Oregon's commitment to transportation electrification is indicated through its Clean Car Standards, EO No. 17-21, existence of the ZEV Interagency Working Group, participation in the Multi-State ZEV Task Force, enhancements of the West Coast Electric Highway, and the Oregon Clean Fuels Program. Additionally, there are several ratepayer-funded pilots and programs underway to develop EV charging infrastructure. Examples of these projects are listed later in this strategic plan: an EV charging station in Josephine County, OR and an EV charging station in Hood River County, OR. Regarding natural gas expansion, one example is the Oregon Biogas/Renewable Natural Gas Inventory (SB 334), which requires development of a detailed RNG feedstock inventory, air pollution improvement estimates for RNG use, and an Advisory Committee to provide input on ways to develop more RNG opportunities in the state. Additionally, AFICC member Columbia Willamette Clean Cities Coalition has the goal of delivering the infrastructure to increase CNG and Propane on major Interstate corridors, particularly I-5 and I-84, as well as state highway corridors (e.g., OR 26, 30, 101, 97).

Opportunities to Meet Alternative Fuel Goals

FHWA has already designated much of the I-5 corridor in Oregon as signage ready for CNG with a small area between Oregon and California that is currently signage pending. However, stakeholders have noted that there is a need for policies and incentives to facilitate the development and deployment of RNG supply for new and existing CNG stations. For example, existing policy prevents Oregon utilities from making ratepayer-funded capital investments in RNG infrastructure, which includes extension of pipelines, or connection points for RNG producers. To encourage RNG production, Oregon has the option of mandating the source separation of wastes (such as food wastes) for RNG production. Additionally, financial incentives for natural gas fueling infrastructure may encourage investment in this alternative fuel technology. In addition to natural gas, Oregon may continue to deepen its commitment to transportation electrification. By leveraging the current EV charging pilots and programs that exist in the state, Oregon can further develop needed EV charging infrastructure. Some stakeholders in Oregon have also suggested that the development of a GHG cap-and-trade program similar to California's Climate Investments Program would help support such efforts.[46]

Washington Policy Landscape

The State of Washington has shown legislative commitment to increasing the use of alternative fuels. Historically, there has been a greater emphasis on electric vehicles compared to other alternative fuels. Like Oregon, Washington has shown significant interest in RNG, however, state legislation has focused on the production of RNG rather than its use in the transportation sector.

GHG Emission Reduction Targets:[47] Washington has set statewide GHG emission reduction targets that will likely encourage alternative fuel production and deployment in the state. Washington's existing GHG emission reduction targets include:

- By 2020, reduce statewide GHG emissions to 1990 levels;

- By 2035, reduce statewide GHG emissions 25% below 1990 levels; and
- By 2050, reduce statewide GHG emissions to 50% below 1990 levels.

Senate Bill 5588:[48] Authorizes Public Utility Districts (PUDs) to produce, distribute, and sell renewable hydrogen.

Senate Bill 5116:[49] Requires electric utilities to eliminate coal generation and pay off remaining construction costs from coal plants by 2025, to become "GHG neutral" by 2030, and to provide 100% carbon free power by 2045.

House Bill No. 2580:[50] Accomplished the following:

1. Restored lapsed tax incentives for anaerobic biomethane digester projects and expanded types of eligible projects and the total incentive value per project;
2. Called for a study to quantify near-term opportunities, identified uses by state agencies, and evaluated RNG portfolio standard policy options; and,
3. Called for work with the Washington Utilities and Transportation Commission (UTC), energy utilities, developers and other stakeholders on gas pipeline quality standards.

House Bill 1512:[51] Authorized municipal utilities and PUDs to create and implement transportation electrification plans aimed at offering programs that promote related services and incentives.

House Bill 2042:[52] Enabled the following programs:

1. Alternative Fuel Commercial Vehicle Tax Credit:[53] Tax credits are available to businesses that purchase new alternative fuel commercial vehicles. The tax credit applies to vehicles primarily powered by natural gas, propane, hydrogen, dimethyl ether, or electricity. The tax credit may cover up to 50% of the incremental cost and is based on the gross vehicle weight rating (GVWR) of the vehicles. See below for the maximum credit values:

Table 9: Washington State Alternative Fuel Commercial Vehicle Tax Credit Structure

GVWR	Max Credit Values: January 1, 2018 to January 1, 2021
Up to 14,000 pounds (lbs.)	$25,000
14,001 to 26,500 lbs.	$50,000
Over 26,500 lbs.	$100,000

2. Clean Alternative Fuel Charging and Refueling Infrastructure Program:[54] The EV Charging Infrastructure pilot program was made subject to appropriations through the 2023-25 biennium. It was expanded to include the opportunity for bidders to propose hydrogen fueling station infrastructure that can address an existing gap in the state's low-carbon transportation infrastructure and meet other program evaluation criteria.

3. Electric Vehicle Battery and Hydrogen Fuel Cell, Infrastructure, and Zero-Emission Bus Retail Sales and Use Tax Exemption:[55] The EV battery and infrastructure retail sales and use tax exemption

was extended to apply to batteries sold as a component of an electric bus at the time of the vehicle's sale and to the sale of zero-emission buses. It was also extended to apply to hydrogen fuel cells, hydrogen fueling stations, and renewable hydrogen production facilities.

4. Leasehold Excise Tax Exemption for Electric Vehicle Infrastructure, Hydrogen Fueling Stations, and Renewable Hydrogen Production Facilities:[56] The leasehold excise tax exemption for EV infrastructure was expanded to include public lands used for hydrogen fueling stations and renewable hydrogen production facilities, and the expiration date was extended to June 30, 2025.

5. Green Transportation Capital Grant Program for Public Agencies:[57] Subject to amounts appropriated for this specific purpose through the 2023-25 biennium, the Washington State Department of Transportation's (WSDOT's) Public Transportation Division is required to establish a green transportation capital grant program to aid transit authorities in funding cost-effective capital projects such as the electrification of fleets (battery and fuel cell), modification or replacement of capital facilities to facilitate electric and hydrogen fueling, and upgrades to electrical transmission and distribution systems.

Clean Truck Program:[58] Starting in January 2019, The Northwest Seaport Alliance, a marine cargo operating partnership of the Ports of Tacoma and Seattle, required all heavy-duty drayage trucks serving port terminals to be powered by a model year 2007, or newer engine (with some exceptions).

Plug-in Electric Vehicle (PEV) Promotion and Infrastructure Development:[59] Washington mandates that regional planning organizations with more than one million residents must promote and invest in PEV use and EV charging using federal or private funding. Some efforts related to this planning mandate include: 1) developing plans outlining how state, regional, and local governments can construct EV charging locations to ensure that this infrastructure can be supported by the existing electrical distribution grid; 2) supporting public education and training programs on PEVs; 3) developing an implementation plan for counties with a population greater than 500,000 to have 10% of public and private parking spaces ready for PEV charging; and 4) developing model ordinances and guidance for local governments for site assessment and installing PEV infrastructure.

Volkswagen NOx Mitigation Plan:[60] The State of Washington is also focused on building charging infrastructure for both light-duty and heavy-duty EVs. For example, the Washington State Department of Ecology (WSDOE) will partner with WSDOT to use 15% of Washington's Volkswagen Mitigation Trust Fund allocation to create, operate, and maintain additional light-duty EV charging infrastructure. Although the plan does not provide funding for heavy-duty EV charging infrastructure, it provides funding for a variety of heavy-duty vehicles, including school buses, transit buses, freight trucks, and drayage trucks in order to accelerate vehicle adoption and reduce emissions.

Current Washington Government Activities

In Washington, transportation electrification has been an important priority. Although there has been recent legislation to promote RNG production, much of this resource is exported to other states for transportation fuel use as opposed to being used in Washington for that purpose.

The Washington Governor's Office is currently working to introduce legislation aimed at creating a state program similar to California's Low Carbon Fuel Standard (LCFS) and Oregon's Clean Fuel Program. Additionally, some policymakers have identified a cap and trade program as an important priority for advancing clean transportation in Washington as well.

Opportunities to Meet Alternative Fuel Goals

Many Washington stakeholders are working to develop a low carbon fuel program to complement existing State efforts to support alternative fuel deployment. Given that Seattle and Tacoma are major port cities and goods movement hubs, Washington has an opportunity to significantly reduce emissions by developing RNG and ZEV technologies in the state to support the transition of heavy-duty truck fueling from diesel to lower emission alternative fuels.

Barriers, Solutions, and Drivers of Alternative Fuel

Development of alternative fuels included in this report face a variety of barriers related to infrastructure, the cost of technology, information gaps, and regulations. This section reviews the barriers, potential solutions, and the drivers propelling alternative fuel adoption. To start, Table 10 shows a brief overview of these barriers.

Table 10: Overview of Barriers by Alternative Fuel

	Infrastructure	Technology Cost	Information Gap	Incentives / Regulations
EV	• Cost of installation • Lead time • Demand charges • Availability of chargers • Duration of charging • Non-universal chargers	• Higher price of vehicle • Battery replacement expense • Battery capacity drain • Reduced range	• Investor risk perception • End-user awareness of technology and incentives • Training and education for municipal staff	• Little financial incentive to be first investor • Lack of inter-state coordination • Unmet goals and expectations
H_2	• Lead time • Expensive initial investment • Expensive fuel cost • Insecurity in fuel supply and demand • Limited number of fueling stations	• Higher vehicle cost • Maintenance and replacement costs	• Lack of public awareness • Investor risk perception	• Little financial incentive to be first investor • Lack of inter-state coordination
CNG LNG LPG[xx]	• Cost of installation • Lead time • Price and timeline of maintenance facility	• Higher price of vehicle • Reduced range	• Investor risk perception • End-user awareness of technology and incentives • Misinformation of first-generation vehicles • Lack of inter-state coordination	• Lack of inter-state coordination • Push towards zero-emission technologies

[xx] Many barriers are common across these fuels.

Electric Charging

As the only non-liquid or gaseous fuel in this plan's purview, battery electric vehicles (BEVs) face a variety of unique barriers. The table below examines the major barriers with regard to infrastructure, technology cost, information gaps, incentives, and regulations.

Table 11: Electric Barriers and Solutions

Barrier		Description	Solutions
Infrastructure	**Cost of Installation**	Not including the EVSE unit, Level 2 installation averages $3000 and Level 3 installation averages $21,000, although these costs may vary on a case-by-case basis.[61]	Rebates and incentives are available per state, utility, air district, and city.
		Level 3 (DC Fast Charging) material and installation costs can vary from $14,000 to $91,000.[62]	
	Lead Time	The lead time required for labor and to obtain city permits can significantly delay EV infrastructure installations.	City streamlining of permits and beginning infrastructure discussion early in project process.
	Demand Charges	Demand charges state that after a specified amount of energy consumption is surpassed by a ratepayer, the energy provider will charge a much higher fee for all additional consumption in the remaining month.[63]	Utilities can create commercial EV rates that account for massive energy demand by BEV fleets.[XXI]

[XXI] Southern California Edison has an EV charging rate for commercial vehicles. Pacific Gas & Electric Company and San Diego Gas & Electric are both in the process of developing similar rate structures.

Barrier		Description	Solutions
Infrastructure	**Availability of Chargers**	Charging stations along corridors are often not designed to accommodate MHDVs.	Early consideration of charging requirements with respect to space and supply can help account for this barrier.
		For private fleets considering BEV adoption, the amount of space required for EVSE acts as a barrier.	For growing fleets, it is important to take scaling into account.
	Duration of Charging	The length of time required for charging is a barrier to mass EV adoption.	Technological improvements in battery capacity, DC Fast Chargers, and pairing charging stations with truck stops can help avoid this barrier.
		For MHDVs on routes requiring recharging, long charge times may make BEVs inefficient.	
	Non-Universal Chargers	There are a variety of different EV charging adapters as well as different payment methods based on the EVSE provider.	Facilitating discussion among EVSE providers and automakers can help streamline this process and create consensus about charging standards.
		Technology inconsistency may complicate EV charging corridors that do not comply easily with all vehicles.	Some companies may see benefits to keeping their own systems in place which would further complicate these discussions.

Barrier		Description	Solutions
Technology Cost	**Battery Replacement Expense**	A major concern about adopting BEVs is the formidable price of replacing a battery.	Long-term warranties, renting/leasing, battery repurposing, and battery exchange programs all address this barrier.
	Battery Capacity Drain	Battery capacity reduces over time which can prohibit a BEV from meeting its required duty cycle.	Purchasing a battery with a larger initial capacity than required can ensure the BEV meets duty cycle requirements even after capacity drain.
			Proper maintenance of the battery may also slow its degradation.
	Reduced Range	BEVs have a reduced range compared to conventional vehicles due to battery limitations, energy demands of duty cycle and creature comforts.	Planning before purchase to ensure that the BEVs range can meet its required duty cycle can address this issue.
	Investor Risk Perception	Lack of adequate information available to investors on costs, pricing, operational benefits, competition, secondary market applications and other factors stalls investment.	Connecting industry, government, end-users, and investors to build a shared understanding of EV market dynamics can help spur investor confidence.
		Previously missed EV adoption goals created chilling effect in the marketplace.	Effectively presenting total cost of ownership (TCO) comparisons across vocations and duty cycles.
	Higher Price of Vehicle	EVs usually have an up-front cost higher than conventional vehicles due to the high price of the battery.	Due to economies of scale for battery production, EV prices are dropping.
			Incentive programs help address incremental purchase cost.
			Lower fuel costs can result in a lower TCO for EVs.

Barrier		Description	Solutions
Information Gap	**End-user Awareness of Technology and Incentives**	Manufacturers, dealers, and end-users are not always aware of the incentives or technologies available to them. Fleet owners may not be aware of potential savings through lower charging rates and low carbon fuel credits.	Stakeholder education campaigns that raise awareness of available incentives can significantly accelerate market growth.
	Training and Education for Staff	Lack of education and training on charging, maintenance, and other operational best practices may result in negative BEV experiences that discourage further adoption.	Ensuring that operators and staff are properly trained can significantly boost effectiveness of BEV deployment.
	Little Financial Incentive to be First Investor	The current market does not create additional benefit for initial investors. As a result, investors may wait until the market is more established and still reap similar results, which slows market near-term acceleration.	Creating regulations that incentivize primary investment in infrastructure and deployment can help spur EV market acceleration.
Incentives / Regulations	**Lack of Inter-State Coordination**	A lack of inter-state coordination about fueling infrastructure plans and locations may act as a barrier to projects that otherwise could be co-funded through partnerships.	Facilitated discussion between state and local governments, fleet owners, and fueling infrastructure companies could help align future plans and spur growth (e.g., WCC AFICC).

Hydrogen

Hydrogen is a promising and emerging ZEV infrastructure technology, however the current open retail stations on the West Coast region are all in California and primarily service the light-duty fuel cell electric vehicle (FCEV) market. This section describes the barriers to development of MHD hydrogen stations, and potential solutions to those barriers.

Table 12: Hydrogen Barriers and Solutions

Barrier		Description	Solutions
Infrastructure	**Lead Time, Station Codes, Permitting, and Site Assessment**	The average reported time for a station to achieve open-retail status is 18 months, subject to station codes, permitting, and site assessments.[64]	California agencies are seeking to streamline the station development process, which could have significant impacts in accelerating the deployment timeline.
	Expensive Initial Investment	The cost to build hydrogen fueling stations remains a significant barrier (average of ~$4 million/MHD station).	Additional funding and incentives may be necessary to propel the hydrogen infrastructure market to commercial scale.
		Despite its funding and incentives, California is falling behind on its 200-station goal by 2025.[65]	Coordination and investment in hydrogen infrastructure outside of California may both accelerate vehicle adoption and decrease fuel prices.
	Expensive Fuel Cost	The average price for open retail hydrogen fuel is $13.99/kg (as of December 2019).[66]	Currently, manufacturers include 3 years of fuel with light-duty FCEV purchases in California.
		Because FCEVs are significantly more energy efficient than conventional vehicles, price parity is expected to occur when hydrogen is priced at $8/kg assuming $3.50/gasoline gallon.[67]	Building more hydrogen fuel production facilities both in and outside of California can help lower costs.

Barrier		Description	Solutions
Infrastructure	**Insecurity in Fuel Supply and Demand**	Dependence on limited hydrogen supply chains and increasing demand have created instances of fuel shortages at stations.	FCEV automakers have quickly responded in instances of fuel shortages to offer FCEV customers free rental programs.
		A lack of consumer-confidence may act as a barrier to FCEV adoption.	Additional production and distribution chains are necessary to resolve this barrier.[68]
Technology Cost	**Maintenance and Replacement Costs**	Because there are few FCEVs on the road, maintenance and replacement of parts, including the fuel cell stack, can be slow and expensive.	As more FCEVs get on the road, manufacturers will be more inclined to train technicians and have parts ready to handle maintenance and replacement.
	Higher Vehicle Cost	FCEVs are significantly more expensive than conventional internal combustion engine vehicles, posing a barrier to purchase.	Incentives help subsidize the higher costs, however additional funding for vehicles and infrastructure is necessary to reach commercial scale.
			Leasing may provide a successful alternative ownership option for encouraging FCEV adoption.
Information Gap	**Lack of Public Awareness**	FCEV and hydrogen technologies are largely unknown to the general public.	Awareness and education campaigns, ride and drive events, community rideshare programs, and other campaigns can help promote FCEV and hydrogen awareness.
		Investors may also experience an information gap on the emerging market and California's consistent financial support.	
		Fleet owners in California and Oregon may also be unaware of potential savings through low carbon fuel credits.	

CNG, LNG, and LPG

CNG, LNG, and LPG face similar barriers, solutions, and drivers.[XXII] As such, they are combined in this section. Barriers that only affect one of each these fuel types are specified.

Table 13: CNG, LNG, and LPG Barriers and Solutions

Barrier		Description	Solutions
Infrastructure	**Cost of Installation**	Costs of installation vary widely with CNG stations ranging from $1 to $4 million with fast-fill dispensers.	Various incentives are available per state, utility, air district, and city.
		Slow-fill LNG stations averaging $2.5 million	Fleet partnerships on shared station development can increase throughput and reduce costs, especially for CNG users considering slow and fast-fill stations.
		Small propane station averages around $65,000.[69,70] Larger stations can cost up to $2 million.	
		Varying costs and site conditions can act as barriers to constructing infrastructure.	
	Lead Time	The lead time required for labor and obtaining city permits can significantly delay infrastructure installations.	Streamlining local permitting processes and beginning infrastructure consultations with relevant authorities early in the station development process.
	Price of and Timeline of Maintenance Facility	CNG and LNG maintenance facilities must be upgraded for compliance, which generally costs $45,000 - $100,000.	Advanced planning can help prepare for the capital and timeline. Additional incentives may still be necessary.
		This process can take 12 to 24 months.[71]	

[XXII] LNG faces a few unique barriers associated with cryogenic fuel storage and transportation, as well as siting and permitting for large-scale bunkering facilities which can require specialized infrastructure and comes with associated costs.

Barrier		Description	Solutions
Technology Cost	**Higher price of Vehicle**	Heavy-duty CNG trucks can carry a 40 to 80% price premium over diesel alternatives.[72]	Despite higher premiums, heavy-duty trucks can save ~$30,000 per year in fuel and maintenance costs in some applications.[73]
			Incentive programs can help lower premiums and speed up ROI.
	Reduced Range	LNG contains about 60% as much energy per gallon compared to diesel, and CNG contains less.[74]	Lower fuel prices for all three alternative fuels compared to diesel or gas make them more cost-effective.
		Propane also has a lower fuel economy than diesel.[75]	Low carbon fuel programs help further reduce consumer cost for these fuels.
Information Gap	**Investor Risk Perception**	Existing gas and diesel infrastructure to compete with, low fuel utilization relative to fixed costs, and lack of knowledge of future incentive funding all act as investment barriers.	Connecting industry, government, end-users, and investors to discuss the changing market can help spur investor confidence.
			Making government intentions for funding more transparent may also help reduce the perception of risk.

Barrier		Description	Solutions
Information Gap	**End-User Awareness of Technology and Incentives**	Manufacturers, dealers, and end-users are not always aware of the incentives or technologies available to them.	Education campaigns to connect stakeholders and make them aware of available incentives can significantly accelerate market growth.
		Confusion about future zero-emission mandates also act as a barrier.	
	Misinformation of First-Generation Vehicles	The original generation of CNG vehicles were underpowered and some could not meet their required duty cycles, creating long-lasting doubt in the technology that still harms the industry.	While CNG technology improved greatly, additional awareness campaigns are necessary to inform end-users about modern CNG capabilities.
	Lack of Inter-State Coordination	A lack of inter-state coordination about fueling infrastructure plans and locations may act as a barrier to projects that otherwise could be co-funded through partnerships.	Facilitated discussion between state and local governments, fleet owners, and fueling infrastructure companies could help align future plans and spur growth (e.g., WCC AFICC).
Incentives / Regulations	**Push Towards Zero-emission Technology**	The push for ZEVs threatens both the consumer market and potential funding for CNG, LNG, and propane vehicles.	ZEV technologies do not currently have the capability to meet all required duty cycles for MHD fleet applications.
			CNG, LNG, and propane can be promoted as critical intermediaries. Some fuel functions, like LNG carriers, may prove dominant over other fuel types.

Environmental Benefits and Environmental Justice

EPA defines Environmental Justice (EJ) as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.[76] Promoting the expansion and development of alternative fuel corridors provides an important opportunity to reduce the impact of harmful emissions from vehicles and equipment that frequent our interstates, state highways, and freight hubs situated in and near communities overburdened with air pollution and other environmental impacts.

Each of the West Coast states participating in the AFICC partnership have goals to promote EJ within their respective state programs. For instance, and relevant to transportation, the State of California through Senate Bill 350, the Clean Energy and Pollution Reduction Act, directs state agencies to conduct research to evaluate the barriers to ZEV adoption within Disadvantaged Communities (DACs). Likewise, Assembly Bill 1550 requires that 25% of the Greenhouse Gas Reduction Fund (GGRF) is spent on projects within DACs. Under these statutes, multiple California state agencies are collaborating on evaluating best practices and strategies to educate and inform DACs about the benefits of advanced vehicle technologies, incentives available to support deployment, and partnership development opportunities to implement emission reduction programs and strategies.

The environmental benefits of alternative fuel vehicle technologies are significant, specifically emissions reductions. While, due to a lack of data on potential conventional vehicle replacement levels, it is difficult to quantify the potential emissions reductions that may result from deployment of the infrastructure proposed in this strategic plan, it is important to take note of these environmental benefits in general. DOE reports that each of the alternative fuels in this plan's purview can contribute to emissions reductions when used in vehicles. Both BEVs and FCEVs have zero tailpipe emissions, virtually eliminating on-road hydrocarbon, oxides of nitrogen, carbon monoxide, particulate matter, and air toxics. GHG emissions from ZEV operation are also significantly lower than conventional internal combustion engine vehicles, but the scale of lifecycle GHG benefit generated by ZEVs varies greatly depending on the energy sources used to charge/fuel them. Typically, renewable feedstocks for ZEV fuel will generate the greatest emission benefits (e.g., solar, wind, organic waste, hydroelectric, etc.).[77,78] Argonne National Laboratory's Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model estimates that, on a life-cycle basis, GHG emissions are reduced by approximately 13% when propane is used to fuel vehicles compared to conventional diesel fuel.[79] Likewise, natural gas vehicles are lower-carbon fuels compared to diesel, and their use can also result in significant reductions of hydrocarbons, carbon monoxide, oxides of nitrogen, and GHG emissions.[80] Such emissions reductions will improve air quality, and in turn, lead to better health outcomes in EJ communities.

There are also economic incentives for deploying alternative fuel technology in EJ communities. Many programs have additional funding provided for grantees located in EJ communities. In addition, there are other financial incentives for investments in EJ zones or similar areas more generally. For example, Opportunity Zones, from the Tax Cuts and Jobs Act, allow any corporation or individual with capital gains in one of these zones to qualify for some tax benefits. This flexibility could allow for a variety of investors to benefit from alternative fuel infrastructure investment in undercapitalized communities as defined by U.S. DOT.

EPA's Regional Diesel Collaboratives, including the West Coast Collaborative (WCC), provide an important mechanism for communities to participate with other stakeholders in developing and implementing

programs, policies and strategies to reduce diesel emissions. Through AFICC, the WCC can engage EJ communities and groups within their respective states to participate in planning activities to support infrastructure development of alternative fuels that will enable the adoption of clean vehicles and equipment that operate within and near impacted communities. As an important next step in promoting and further supporting the development of the proposed sites in this strategic plan, AFICC should evaluate ways to encourage EJ community and environmental group feedback and participation. Community members that live within the locations that are targeted for a proposed alternative fuel site can be important ambassadors and champions for project implementation.

The following are best practices and strategies to promote EJ and community involvement for the development and expansion of alternative fuel corridors:

- State transportation agencies and regional MPOs may evaluate commercial vehicle traffic volumes and locations to help prioritize advancement of alternative fuel infrastructure in environmental justice and disadvantaged communities.
- Use community-based approaches for stakeholder involvement such as community facilitated engagement, or collaborative governance.
- Apply diverse communication tools to reach and engage with environmental justice communities.
- Conduct research and needs assessments to understand priorities within EJ communities to determine the best way to engage and support alternative fuel infrastructure development.
- Evaluate commercial vehicle activity within communities and identify industry partners to target and collaborate with on infrastructure development.
- Provide access to online tools (websites, apps, and webinars) for communities to better understand technologies and the benefits, strategies to support emission reductions, and access to information on funding resources to support development and implementation.
- Make online and printed collateral on alternative fuels, funding programs, partnership opportunities and outreach events available in multiple languages. Be familiar with the diversity of languages spoken within a respective EJ community.
- Provide opportunities for communities to comment on and have a voice in planning activities within their area.
- Engage schools to support awareness building campaigns, educate a child and you'll educate the parent.
- Provide grants to help build the capacity of EJ or community groups to support the promotion of clean transportation programs.

In Appendix B, CALSTART evaluates projects proposed in this strategic plan that are located within environmental justice or disadvantaged communities to help AFICC partners understand how the proposed projects can serve as important emission reduction solutions for air quality improvement and public health protection.

California has developed a comprehensive and detailed environmental justice zone mapping tool that incorporates pollutants, adverse environmental conditions, socioeconomic factors and prevalence of certain health conditions. This tool, CalEnviroScreen 3.0, is the California Environmental Protection Agency's (CalEPA) preferred tool for administering environmental justice grants and is used to identify disadvantaged communities in California, as well as for data tracking pursuant to relevant laws and regulations in the state.[81] Given the significance this tool has for California's policy decisions, CALSTART

used the CalEnviroScreen 3.0 tool to approximate EJ community status for California infrastructure sites proposed in this plan. CalEnviroScreen 3.0, developed by CalEPA's Office of Environmental Health Hazard Assessment (OEHHA), works by scoring locations on 19 indicators, 12 pollution indicators and 7 population characteristics. The individual scores for each of these 19 indicators are weighted and added together to derive a final percentile score.[XXIII] It is important to note that defining EJ communities varies state by state, but for consistency CALSTART considered 80th percentile and above to be the threshold for a "Yes" designation in the table shown in Appendix B. This table lists the infrastructure project proposals evaluated in this plan document with a designation regarding potential EJ community classification, using the process described above.

For Oregon and Washington, CALSTART used the EPA's environmental justice (EJ) mapping and screening tool called EJSCREEN, which is based on nationally consistent data that combines environmental and demographic factors in its maps. Specifically, CALSTART evaluated sites on the following variables through a comparison to each respective state (as opposed to the US as a whole): NATA Diesel PM, Ozone, and PM 2.5. CALSTART considered 80th percentile and above on these measures to be the threshold for a "Yes" designation in the table in Appendix B, as described in the paragraph above.[XXIV]

Workforce Development Considerations

As fleets continue their transition from conventionally fueled vehicles to alternative fuel vehicles (AFVs), the demand for training and workforce development associated with AFV operation and maintenance is expected to increase. In a 2014 study conducted by the California Community Colleges Chancellor's Office, along with the California Energy Commission and the Centers of Excellence, it was estimated that fleets, dealerships, and auto shops in California expected a 13-14% increase in the combined number of workers in five occupations key to those businesses (from 58,900 in 2014 to 67,100 in 2015). Those five occupations were as follows: automotive service technicians and mechanics, automotive master mechanics, bus and truck mechanics, first-line supervisors, and fleet managers. Given the expected growth in these occupations and given the differences between conventional vehicle technology and AFV technologies, expanded and additional training will be required to support increased adoption of AFVs across the West Coast.[82]

The California study focused only on occupations required to operate, service, and maintain AFVs. In addition to the expected growth in those occupations, additional training will be required for workers focused on alternative fuel infrastructure development. As AFVs are deployed, new fueling and charging infrastructure needed to support them will be installed, requiring workers in fields including, but not limited to design and engineering, manufacturing, construction, commissioning, maintenance, sales, etc. While some alternative fuel infrastructure operates in similar ways to conventional fueling infrastructure, additional training on the following topics may be required for workers focused on the installation and operation of such infrastructure: safety, fuel science, high voltage electronics, etc.

Currently, there are a few programs across the West Coast that offer training on AFVs and supporting technology. Sunline Transit Agency hosts a Center of Excellence in Zero Emission Technology, focused on

[XXIII] For more details on CalEnviroScreen 3.0, visit this link: https://oehha.ca.gov/calenviroscreen/calenviroscreen-faqs

[XXIV] Due to the state-level differences in defining EJ communities, CALSTART cannot guarantee that each site with a "Yes" designation is, in fact, located within an EJ community, but this represents CALSTART's best judgement on the topic.

providing training on zero-emission buses.[83] Los Angeles Metro and the County of Los Angeles now provide a Transportation School, preparing youth in the county for careers in transportation.[84] The National Alternative Fuels Training Consortium, organized by West Virginia University but national in scope, offers courses on a wide range of AFV- and infrastructure-related topics at training centers hosted at El Camino College, Fresno City College, Rio Hondo College, and Yuba College in California.[85] The International Brotherhood of Electrical Workers offers training and certification on EV charging infrastructure work.[86] The Southern California Regional Transit Training Consortium offers some training on battery-electric transit buses. According to the 2014 study mentioned above, eight community colleges in California offer approved alternative fuels training programs while 25 offer alternative fuels coursework. Additionally, private for-profit institutions like Universal Technical Institute (UTI) also offer certificates and degree programs on related topics.[82] Finally, training is also often provided to fleets by AFV manufacturers.

While some training programs exist, expanded training will be required to develop a national workforce skilled in AFV infrastructure installation, service, and maintenance. As stated previously, the primary focus of this document is to highlight the demand for alternative fuel infrastructure on the West Coast, along with funding needs to spur development of that infrastructure. Development of this infrastructure, and the associated deployment of AFVs, will increase demand for a workforce skilled and trained on alternative fuels. Thus, opportunities to leverage alternative fuel infrastructure development in building workforce capacity should be considered. If and when funding becomes available to develop alternative fuel infrastructure projects listed in later sections of this document, a portion of that funding may be well-suited for expanded workforce development programs, and as demonstrated by the existing programs above, such training can come from a variety of educational institutions, government agencies, and private organizations.

V. UNDERSTANDING ALTERNATIVE FUEL INFRASTRUCTURE NEEDS

Given the current and anticipated trends in alternative fuel vehicle adoption, AFICC sought to better understand the need for medium and heavy-duty (MHD) alternative fuel infrastructure across the three-state West Coast region of California, Oregon, and Washington. This section describes the outreach conducted to understand those needs and to identify funding prioritization for prospective infrastructure projects on the West Coast.

Stakeholder Engagement and Industry Outreach

Stakeholder engagement and industry outreach was critical to help realize the goals and objectives of AFICC. By building a diverse and multi-disciplinary coalition of stakeholders across the three West Coast states, AFICC was able to collect important feedback from partners on regional priorities, collaboration strategies and opportunities to advance alternative fuel corridors. Throughout the project, the AFICC conducted stakeholder outreach using different methods to understand infrastructure needs in the region. Working through its Champion Groups, AFICC collected feedback on state goals related to MHDV technology advancement and the various programs and policies to help support consumer adoption. AFICC worked closely with the Champion Groups to help devise a broader stakeholder engagement and industry outreach program that would include a series of webinars featuring government and industry leaders sharing perspectives on state priorities, the availability of alternative fuel technologies, and infrastructure investment needs.

AFICC stakeholders include federal, state and local governments, industry associations, fleets, port authorities, fueling providers, vehicle and equipment manufacturers, Clean Cities Coalitions, utilities and environmental organizations. The stakeholder engagement program used email, newsletter, telephone, and in-person outreach to help raise awareness regarding the Champion Group meetings and the webinar workgroup sessions. The Steering Team also facilitated several teleconferences and in-person meetings with stakeholders to obtain specific information on existing funding programs, MHDV technology advancement objectives, and alternative fuel infrastructure investment needs.

In this section, a detailed overview is provided on AFICC's Stakeholder Engagement Program and the process used to collect feedback from Coalition members. This section also includes an overview of the learnings from the California, Oregon, and Washington Champion Group meetings and AFICC's webinar workgroup sessions.

Champion Groups

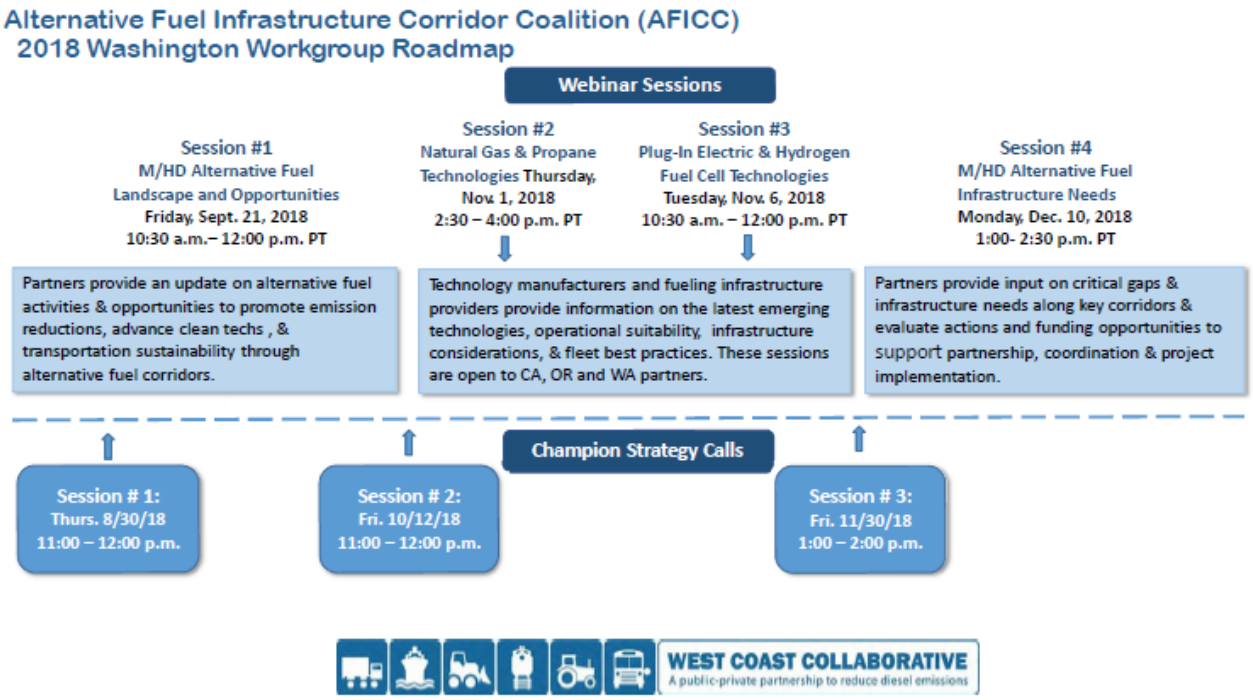
AFICC held nine Champion Group meetings with each state throughout the stakeholder engagement process. During the Champion Group meetings, the following topics were covered:

1. Current alternative fuel technologies and infrastructure projects and deployments in each state;
2. Concerns and thoughts from fleets regarding adopting alternative fuel technologies;
3. Current incentives that are available for each state;
4. Applications for deployment of alternative fuel vehicles and infrastructure in the region; and
5. Goals and hopes for this collaborative effort.

Following each webinar, the Champion Groups would discuss the progress of the project, learnings from the webinar sessions, and feedback on topics to cover/include in subsequent workgroup webinars and

Champion Group meetings. Figure 8 provides an example of the stakeholder engagement carried out for the Washington Champion Group and the webinar series for Washington stakeholders. All AFICC partners were invited to partake in all webinar sessions regardless of their geographic location.

Figure 8: AFICC Workgroup Roadmap



The following are key takeaways from the Champion Group meetings.

California Champion Group

1. The California Public Utilities Commission has approved $2 billion for EVSE investment by Investor Owned Utilities (IOUs). Utilities are looking into specialized rates for MHD EVs to combat demand charges and make fleet electrification more cost effective.
2. California's Volkswagen NOx mitigation funds will support ZEV deployment and related infrastructure development.
3. California's ZEV Executive Order directs the state to implement 250,000 additional light-duty EVSE and 200 hydrogen stations by 2025. The California Governor's Office of Business and Economic Development is actively coordinating MHD hydrogen infrastructure deployment activities in partnership with organizations including, but not limited to the following: Nikola, Toyota, the California Fuel Cell Partnership, and the California Hydrogen Business Council.
4. California is looking into additional highway segments for the next round of FHWA Alternative Fuel Corridor nominations.
5. Freight also flows east-to-west, future engagement with Arizona and Nevada will be useful to expand MHD alternative fuel corridors.

6. Ports of Long Beach and Los Angeles are seeking to electrify their operations, which will require significant charging and/or hydrogen fueling capacity. The port authorities are actively working with their tenants to electrify equipment in all feasible applications.
7. When moving towards alternative fuel technologies, community involvement will be imperative, and the Assembly Bill 617 advisory committees can help to guide deployment in this regard.

Oregon Champion Group

1. There is a large existing natural gas network with landfill RNG access. Oregon is interested in expanding public access to natural gas fueling infrastructure using in-state RNG supplies.
2. According to Oregon truckers, there is not a huge incentive for moving to alternative fuels. Many members of the Oregon Trucking Association have indicated that they do not want to adopt technologies beyond clean diesel.
3. There is a technology readiness gap because many MHD ZEV products will not be commercially available in the near-term, so most MHDVs will continue to run on clean diesel powertrains. Fleets need more specifics on the operational capabilities of MHD ZEVs.
4. Oregon wants to increase their connections with California and Washington. This coalition is a good way of growing relations throughout the region.
5. Oregon supports near-term heavy-duty alternative fuel deployment goals for local applications, like last-mile delivery. Oregon Metro has developed a regional freight strategy including sustainability goals for multi-modal goods movement.[87]
6. For fleets to adopt alternative fuel technologies at a large scale, differential vehicle weight and size issues need to be resolved.
7. To support more alternative fuel deployment, more incentives need to be available for adoption of these technologies.

Washington Champion Group

1. Pacific Coast Collaborative is working along the same track with light-duty electrification infrastructure and there is much to learn from this effort.
2. Puget Sound Clean Air Agency is looking into changing urban delivery and goods movement supply chains to accommodate alternative fuel technologies. Infrastructure is needed to prepare for a large increase in alternative fuel vehicles in urbanized areas like the Puget Sound region.
3. Private business fleets should be part of this effort to educate them on heavy-duty freight planning work and strategies to advance their fleet sustainability goals.
4. Washington is working on a techno-economic assessment of RNG production and natural gas pipeline injection of RNG.
5. Washington wants to address municipal concerns with infrastructure development obligations.
6. Washington has completed corridor designations both internally, and in collaboration with neighboring states. It was difficult to complete a tri-state designation that included both California and Oregon. California is a large state with many ongoing alternative fuel efforts, and that made it difficult to collect needed information in the timeframe needed to compose the designation nominations.
7. Fleets want electric buses, but the manufacturers cannot make them fast enough. There is a manufacturer capacity problem in creating these buses. That makes it difficult to set accurate and timely schedules for related infrastructure investments.

Workgroup Webinar Sessions

To better understand the needs of Oregon and Washington, AFICC hosted a workgroup webinar series to gain an understanding of the states' alternative fuel landscape, the availability of alternative fuel technologies, and infrastructure needs to advance MHD AFVs.[xxv] For Oregon and Washington, there were a total of six webinars; Oregon and Washington each kicked off their webinar series with a "Medium- and Heavy-Duty Alternative Fuel Landscape" webinar. After each of those webinars, the coalition hosted two technology webinars to educate participants on the current medium- and heavy-duty alternative fuel technologies. This included a "Natural Gas and Propane Technologies & Infrastructure" webinar and a "Plug-In Electric and Hydrogen Fuel Cell Technologies & Infrastructure" webinar. After the technology webinars, Washington and Oregon each had a final webinar on the "Medium- and Heavy-Duty Alternative Fuel Infrastructure Needs" for each state. The goal of this series was to learn about current alternative fuel projects in the region and identify opportunities for synergy of new alternative fuel infrastructure investments.

For each webinar hosted by the Coalition, targeted outreach was used to increase interest and guarantee that desired stakeholders were able to participate in the webinar series. Various forms of communication were used to gain interest and ensure that relevant individuals participated in the event, such as calls, personal emails, and WCC email newsletter announcements. The Steering Team also asked the Champion Groups to invite relevant parties to attend the webinars.

Session 1: Medium- and Heavy-Duty Alternative Fuel Landscape and Opportunities in Oregon

The first session in the AFICC webinar series was entitled, "Medium- and Heavy-Duty Alternative Fuel Landscape in Oregon". The goal of this webinar was to learn from Oregon partners about the activities they were conducting to promote emissions reductions, advance clean technologies and transportation sustainability throughout the state. Discussion leaders included: Federal Highway Administration, Oregon Department of Transportation, Oregon Trucking Association, Oregon Department of Energy, Oregon Metro, and Rogue Valley Metropolitan Planning Organization. During this webinar, the coalition established a shared understanding of Oregon's alternative fuel goals, and progress to date.

Key takeaways from this webinar included:

1. Oregon has a great opportunity to designate many of its highways as Alternative Fuel Corridors for plug-in electric, hydrogen, propane, and natural gas technologies.
2. Oregon has worked extensively to support the development of the West Coast Electric Highway (a light-duty electric corridor) and can apply learnings from this work to medium- and heavy-duty alternative fuel infrastructure deployment efforts in the state.
3. Oregon has a large amount of RNG production potential that can be allocated to transportation fuel applications.
4. Oregon is developing a regional strategy to support RNG production and distribution.
5. Oregon Metro has a regional freight policy and action plan that emphasizes the need to deploy low and zero-emission goods movement technologies.

[xxv] Webinar recordings and presentation slides are available at: https://westcoastcollaborative.org/workgroup/wkgrp-fuels.htm

Session 2: Medium- and Heavy-Duty Alternative Fuel Landscape and Opportunities in Washington

The second session in the AFICC webinar series was entitled, "Medium- and Heavy-Duty Alternative Fuel Landscape and Opportunities in Washington". The goal of this webinar was to learn from Washington partners about the activities they were conducting to promote emissions reductions, advance clean technologies and transportation sustainability throughout the state. Discussion leaders included: Federal Highway Administration, Washington Department of Transportation, Puget Sound Regional Council, Puget Sound Clean Air Agency, and Washington State University.

Key takeaways from this webinar included:

1. Washington has a great opportunity to designate many of its highways as Alternative Fuel Corridors for plug-in electric, hydrogen, propane, and natural gas technologies.
2. Washington worked extensively to support implementation of the West Coast Electric Highway and will use that experience to examine electrification of its goods movement and public transit systems as well.
3. Puget Sound Regional Council presented its four-part GHG mitigation strategy with vehicle technology advancement being a key component.
4. Washington recently conducted an RNG development study and is exploring state policy options to address the study's recommendations.
5. Participants talked about their interest in increasing RNG, as well as the funding sources needed to support deployment of RNG and other alternative fuel technologies.

Session 3: Natural Gas and Propane Technologies and Infrastructure

After the initial Washington and Oregon webinars, the coalition hosted two technology webinars for all interested WCC partners. The first technology webinar was entitled, "Natural Gas and Propane Technologies & Infrastructure". The goal of this webinar was to learn from vehicle manufacturers, fuel suppliers, and fleets about the benefits, applications, and business case for natural gas and propane technologies. Discussion leaders for this webinar included: Trillium-Love's, Ruan Transportation Management Systems, Western Propane Gas Association, ROUSH Clean Tech, City of Vancouver-Washington, and National Renewable Energy Laboratory (NREL).

Key Takeaways from this webinar included:

1. Natural gas technology is attractive, reliable, and clean compared to liquid, petroleum-based technologies. There are currently incentives for natural gas deployment, and fleets can work with fueling providers to develop refueling infrastructure.
2. Ruan presented its case study on how to implement RNG technology in heavy-duty trucking operations. They also shared the key stakeholders needed to successfully develop an RNG station.
3. MHD propane vehicles are safe and reliable. They have been particularly successful in school bus and emergency response applications, and the fueling infrastructure is relatively affordable.
4. The City of Vancouver, Washington presented a case study on propane technology adoption. There are many different fleet applications for propane, the return on investment is strong, and it is relatively easy to transition from diesel.

5. When compared to diesel, propane generally generates operational cost savings. However, there are currently limitations for Class 8 propane vehicle availability.

Session 4: Plug-In Electric & Hydrogen Fuel Cell Technologies & Infrastructure

After the Natural Gas and Propane Webinar, the coalition hosted a session entitled, "Plug-In Electric & Hydrogen Fuel Cell Technologies & Infrastructure". The goal of this webinar was to learn from vehicle manufacturers, fuel suppliers, and fleets about the benefits, applications, and business case for plug-in electric and hydrogen fuel cell technologies. Discussion leaders for this webinar included: Chanje, GreenPower Motor Company, Hydrogenics, and Ballard Power Systems.

Key Takeaways from this webinar included:

1. Fleets are placing large orders for medium-duty battery-electric vehicles (e.g., delivery vans). There are few barriers to electrifying this application for small-scale deployments. However, charging infrastructure planning and investment are key constraints for large-scale, fleetwide deployments.
2. Many GreenPower fleet customers have been able to utilize existing charging infrastructure, which has made their transition from diesel to battery-electric technology easier.
3. There are many applications for MHD FCEVs in goods movement and other commercial transport applications. Moving to hydrogen technology is an easy fit for many MHD fleets from an operations perspective (e.g., short refueling time, range, and equipment performance).
4. Hydrogen fuel can be created onsite using natural gas steam reforming, or water electrolysis.
5. FCEV incremental cost, and hydrogen fueling infrastructure planning and investment are the primary barriers to fleet adoption of these technologies.

Session 5: MHD Alternative Fuel Infrastructure Needs & Opportunities in Washington

The final session in the Washington webinar series was entitled, "Medium- and Heavy-Duty Alternative Infrastructure Needs & Opportunities in Washington". The goal of this webinar was for ports, fleets, industry associations, and state agencies to provide input on infrastructure needs and opportunities to advance medium- and heavy-duty alternative fuel corridors in Washington. Discussion leaders included the following: Port of Tacoma, Northwest Seaport Alliance, Port of Seattle, National Association of Truck Stop Operators, Washington Trucking Association, King County Department of Transportation, and Washington State Energy Office.

Key Takeaways from this webinar included the following:

1. NREL's Station Locator allows users to locate gaps in alternative fuel corridor designations as well as existing alternative fuel stations.[88]
2. Many ports are introducing alternative fuel technologies into parts of their marine, cargo handling, and airport operations.
3. Some ports are working on sustainability strategies that include ambitious emission reduction targets.

4. Truck stops are starting to deploy alternative fuel infrastructure, but there is a need for more federal and state funding and policy assistance to support these efforts.
5. Washington truckers are struggling to move to alternative fuels because there is a lot of uncertainty on which direction the industry will move. They need certainty in which technology to adopt into their operations (i.e., choosing a fleet technology transition pathway among electric, hydrogen, propane, and natural gas).
6. King County Metro provides a helpful case study for deploying battery-electric transit buses and scaling up charging infrastructure to meet operational needs.
7. Washington continues its work on RNG production and future policy considerations.

Session 6: MHD Alternative Fuel Infrastructure Needs & Opportunities in Oregon

The last session in the Oregon webinar series was entitled, "Medium- and Heavy-Duty Alternative Infrastructure Needs & Opportunities in Oregon". The goal of this webinar was for ports, fleets, industry associations, and state agencies to provide input on infrastructure needs and opportunities to advance medium- and heavy-duty alternative fuel corridors in Oregon. Discussion leaders included: U.S. Department of Transportation – Volpe Center, National Association of Truck Stop Operators, Columbia Willamette Clean Cities Coalition, Oregon Department of Energy, and the Port of Portland.

Key takeaways from this webinar included the following:

1. NREL's Station Locator allows users to locate gaps in alternative fuel corridor designations as well as existing alternative fuel stations.[89]
2. Port of Portland working to convert some of its operations to alternative fuel technologies.
3. Policy reform and funding support are needed to help implement alternative fuel infrastructure, and if federal leadership is lacking, then the states need to pick up the slack.
4. Columbia Willamette Clean Cities Coalition is working on a large-scale natural gas and propane infrastructure project to deploy stations along major interstate and highway corridors.
5. Oregon is continuing their work on RNG production, and these efforts need to be expanded to include RNG fueling infrastructure.

From the last two webinars and targeted outreach, the AFICC Steering Team aimed to gather the information shown in Table 14 regarding potential alternative fuel infrastructure projects on the West Coast.

Table 14: Information Gathered from Outreach

Project Description	Infrastructure Needs
Project Location	Station Type
Distance to Nearest Corridor	Number of Dispensers/ Chargers
Project Partners	Estimated Fuel/ Energy Use
Fleet Vocation	Equipment Costs
Vehicle Technology/ Fuel Type	Development Costs
Number of Vehicles	Operational Costs
Project Timeline	Construction Schedule

The Steering Team chose the information in Table 14 to learn more about infrastructure projects throughout the region, and if there were projects that needed funding assistance to complete development. CALSTART then worked to obtain this information and collected data on many potential alternative fuel infrastructure project proposals.

VI. ALTERNATIVE FUEL INFRASTRUCTURE PROJECT READINESS CRITERIA

After conducting outreach to AFICC partners across the three West Coast states, CALSTART sought to obtain deeper insights from fueling infrastructure providers to develop a standard approach for evaluating potential projects on measures of readiness. The Champion meetings, webinars, and targeted outreach helped set the stage for further analysis into infrastructure funding needs throughout the region and developing these readiness criteria was deemed a logical next step for that analysis. The purpose of this exercise was to develop a set of readiness criteria that CALSTART could use to adequately vet and categorize the alternative fuel infrastructure project proposals it would receive during the AFICC planning process. As described in the following sections, CALSTART developed and distributed surveys to fleets and fuel providers to obtain infrastructure project proposals for which survey respondents wished to receive funding. With the expectation of receiving numerous proposals through these surveys, CALSTART developed the criteria to prioritize those project proposals that appear to be most ready for funding. Importantly, it is CALSTART's view that while some projects would be more ready for funding than others, all project proposals should be considered.

To develop this set of criteria, CALSTART contacted multiple fuel providers and developers to gain their insights into what should be considered when determining the readiness of an infrastructure project for development. This targeted outreach included discussions and meetings with specific stakeholders to learn more about their role in alternative fuel infrastructure development and how infrastructure is deployed. Operating under the notion that any future funding for projects will likely be allocated based on a competitive application process, CALSTART sought to work with fuel provider partners to develop criteria that would serve as a basis for evaluating projects under this notion. The list of organizations which CALSTART spoke to on this matter is as follows:

1. EV: CALSTART Internal Experts, ChargePoint;
2. H_2: Trillium-Love's, Hydrogenics, Mitsui, First Element;
3. LPG: Columbia-Willamette Clean Cities Coalition; and,
4. CNG and LNG: Trillium, a Love's Company;

From these discussions and its own research, CALSTART put together the following criteria to be considered when examining infrastructure projects. The remainder of this section explains these criteria and how they were used to evaluate projects on their readiness for development and funding.

1. Fuel type must be one of the following: EV, H_2, LPG, CNG, LNG
2. Estimate number of anchor fleet vehicles (for fleet-proposed projects) / Estimated annual fuel throughput (for fuel provider-proposed projects)
3. Strategic location
    a. Distance from a major corridor
    b. Distance from the closest station of the same fuel type
4. Cost share
5. Defined scope and budget
6. Medium-and heavy-duty vehicle accessibility

First, as a requirement, any projects considered in this plan must include one of the alternative fuel types in the project's purview. Fuels included in this list are plug-in electric, hydrogen, liquefied petroleum gas (propane), compressed natural gas, and liquefied natural gas.

Second, to justify the development of any medium- and heavy-duty accessible station, demand for the fuel provided by that station must be guaranteed. Based on CALSTART's conversations with the partners mentioned above, having an anchor fleet is critical for an applicant, and more vehicles committed to using the station are better as they spread out risk. Having fleets committed to using the station being developed proves demand for that fuel. CALSTART identified optimal minimum annual fuel throughput amounts for MHDV accessible stations, listed below:

1. EV: 50 kilowatt charger minimum[XXVI]
2. H_2: 30,000 kilograms per year
3. LPG: 165,000 gallons per year
4. CNG: 220,000 DGE per year
5. LNG: 220,000 DGE per year

Third, as this plan seeks to identify gaps in corridor-specific fueling needs for alternative fuel vehicles, it is important that infrastructure projects be strategically located to support completion of any signage pending/incomplete corridors as designated by FHWA. For this criterion, CALSTART determined that two criteria are important: 1) the distance from the fueling station to the nearest corridor, and 2) the distance from the fueling station to the closest fueling station of the same fuel type. FHWA has set the following requirements for alternative fuel corridors as it relates to these distances:

1. EV: Within five miles from a highway, 50 miles between stations
2. H_2: Within five miles from a highway, 100 miles between stations
3. LPG: Within five miles from a highway, 150 miles between stations
4. CNG: Within five miles from a highway, 150 miles between stations
5. LNG: Within five miles from a highway, 200 miles between stations

For purposes of considering readiness categories, CALSTART considers the mileage requirements listed above as optimal. Mileage from a corridor and mileage between stations which are under the optimal distance thresholds are considered more ready than mileage that is above the optimal distance thresholds.

Fourth, another important criterion is cost share. Based upon survey results, which are discussed in more detail below, CALSTART determined that a cost share requirement would be ideal for alternative fuel infrastructure projects considered as part of this effort. While no minimum cost share threshold has been defined for this readiness evaluation system, proposals that report lower funding needs (in percentage of CAPEX) are categorized as more ready than those which have higher funding needs.

[XXVI] The minimum kilowatt charging capacity for MHD capable electric vehicle charging stations will impact the time required to charge a vehicle of that size. Higher power levels will lower charging durations and make for a more seamless charging experience for fleets. The 50 kW minimum is determined from a Penske fleet case study in which 50-150 kW fast chargers were installed (https://blog.gopenske.com/lease/penske-truck-leasing-opens-high-speed-commercial-electric-truck-chargers-in-southern-california/)

Fifth, regarding project scope and budget, those suggested projects which have a clearly defined scope and budget are categorized as more ready than those that have not provided these details. Scope and budget include, but are not limited to, the capacity and throughput of the station, where the station will be located, what fuels it will include, the size of the station, which fleets are expected to use it, and a budget estimate for developing the station. The project may either be a new fueling station development or the addition of capacity at an existing alternative fuel station; both were considered.

Finally, all stations – public, private, and limited access – must be capable of accommodating a medium-duty vehicle at minimum. As the focus of this effort is to fill alternative fuel infrastructure gaps for MHDVs, this is considered a requirement. Additionally, as there is a projected need for heavy-duty vehicle accessible alternative fueling stations, any project capable of fueling up to Class 8 vehicles (i.e., >33,000 lbs GVWR) are considered more ideal than those that are not.

Table 15 below shows all current readiness criteria with descriptions of how each criterion was used to evaluate project proposals.

Table 15: Project Readiness Criteria

Weights	Metric	Fuel Type	Evaluation Type	Evaluation System Description
Requirement	Fuel type	All fuel types	Requirement	Fuel type(s) must be chosen from this list: EV, H2, LPG, CNG, LNG
30% **(for fleets only)**	Number of anchor fleet vehicles **(fleet-proposed projects only)**	All fuel types	Minimum Requirement, 1 Through 10	At least 1 anchor fleet is required, more vehicles are valued higher than less
30% **(for fuel providers only)**	Proven demand for fuel **(fuel-provider proposed projects only)**	EV	Minimum Requirement, 1 Through 10	50 kW charger minimum, higher power rating correlates to a higher readiness category
		H2	Minimum Requirement, 1 Through 10	30,000 kg per year minimum, more demand correlates to a higher readiness category
		LPG	Minimum Requirement, 1 Through 10	165,000 gallons per year minimum, more demand correlates to a higher readiness category
		CNG	Minimum Requirement, 1 Through 10	220,000 diesel gallon equivalent per year minimum, more demand correlates to a higher readiness category
		LNG	Minimum Requirement, 1 Through 10	220,000 diesel gallon equivalent per year minimum, more demand correlates to a higher readiness category
20%	Strategic location	All fuel types	Optimal Requirement, 1 Through 10	Optimal distance from highway: five miles maximum. Shorter distance is categorized as more ready higher than farther distance.
20%	Strategic location	All fuel types	Optimal Requirement, 1 Through 10	Optimal distance between stations: Optimal amounts are categorized as more ready. Shorter distances are better than farther distances.
		EV	Optimal Requirement, 1 Through 10	EV - 50 miles
		H2	Optimal Requirement, 1 Through 10	Hydrogen - 100 miles
		LPG	Optimal Requirement, 1 Through 10	Propane - 150 miles
		CNG	Optimal Requirement, 1 Through 10	CNG - 150 miles
		LNG	Optimal Requirement, 1 Through 10	LNG - 200 miles
15%	Cost share	All fuel types	1 Through 10	Projects that share more cost are categorized as more ready higher than those that share less cost.
15%	Scope and budget defined	All fuel types	Requirement, 1 Through 10	Scope and budget required in application. Projects with more details provided on scope and budget will be categorized as more ready.
Requirement	Medium-and heavy-duty vehicle accessible	All fuel types	Requirement	All stations must be at least Class 5 vehicle accessible, and ideally, they should be up to Class 8 accessible.

After being evaluated on the metrics listed in Table 15, each project was grouped into one of three readiness categories based on those evaluations. Those readiness categories are defined below. It is important to note that cut-offs between each of these three readiness categories were made quantitatively based on the results from evaluations using the readiness criteria mentioned above, but they do not sort the proposals into equal thirds. See ranges of resulting scores for proposals across fuel types on each readiness category in Table 16. The cutoffs between readiness categories were applied after scoring all of the proposals, not before scoring, and therefore the resulting minimum and maximum scores per readiness category vary by fuel type. Because the richness and the amount of information contained in each proposal varied so much, it was not ideal to assign readiness category cutoff scores that would be uniform across all fuel types. Instead, CALSTART assessed the readiness of proposals by fuel type and used its discretion to determine cutoffs between readiness categories based on both quantitative and qualitative measures.

1. **Advanced Site:** Advanced Sites are the project proposals deemed most ready for development. Based on the readiness criteria in Table 15 these sites have a high degree of readiness for funding and development, and a high degree of viability in meeting WCC AFICC's goals for alternative fuel infrastructure development. For example, this could be a proposal that includes a location which is highly specific (e.g. a street address, city, and state), a clear estimated annual fuel throughput, a location near a major west coast corridor, and a defined CAPEX estimate.

2. **Emerging Site:** Emerging Sites are the second to most ready for development, behind Advanced Sites. These sites are considered less ready for funding and development than Advanced Sites but more so than Potential Sites. These proposals were often deemed less ready than Advanced Sites due to a lack of information about project scope. For example, this could be a proposed site with demonstrated demand for fuel but lacking a specific location (proposing a county instead of a cross street or address).

3. **Potential Site:** Potential Sites are the proposals deemed least ready for development. Based on the readiness criteria in Table 15, these sites have a low degree of readiness for funding and development. The reasons for the lower readiness category vary across proposals, but often the project scope for these proposals is vague or is lacking responses to multiple readiness criteria metrics. For example, this could be a proposed site with a vague location (e.g. proposing location on a certain highway near a city, but with no address or cross street), and not many associated details (e.g. no listing for annual throughput or number of vehicles that the station is expected to support, no response on the amount of funding assistance needed, and no CAPEX estimate reported).

Table 16 Range of Resulting Scores for Readiness Category by Fuel Type

	EV	H_2	LPG	CNG	LNG
Advanced	48.5 - 62	57.5 - 59	50.5 - 63.5	45 - 68	42 - 44
Emerging	30.5 - 42.5	38	N/A	35 - 41.5	26
Potential	20 - 27.5	32	N/A	16.5 - 21	12 - 20

VII. FLEET AND FUEL PROVIDER SURVEY RESULTS

After speaking with fuel provider partners about what criteria would be best for evaluating infrastructure projects, AFICC needed to obtain information on proposed and potential alternative fuel infrastructure developments on the West Coast. To do this, CALSTART developed and administered two surveys. One survey was administered to fleets and equipment users operating in a variety of vocations within the three states. The purpose of this survey was to evaluate both the demand for alternative fuel infrastructure on the West Coast, as well as the funding resources needed to support such projects.

The second survey was administered to fuel providers and infrastructure developers supporting the West Coast states. Similar to the fleet survey, its purpose was to understand where fuel providers see needs and opportunities for alternative fuel infrastructure development, and to understand the funding and throughput required to justify station development. Both surveys were developed using SurveyMonkey, and with the help of AFICC partners, CALSTART administered both surveys to a broad audience using email announcements and one-on-one targeted outreach. The targeted stakeholders included participants from the webinar series and stakeholders that were suggested by the Champion Groups. It was imperative that West Coast Ports complete the surveys and that the Clean Cities Coalitions distribute the survey to fleets in their regions. From this outreach effort, CALSTART received numerous responses for both the fleet survey and the fueling provider survey.

Survey Results In and Of Themselves Are Incomplete: Refer to Sections IX and VIII for Full and Final Results and Takeaways

While these surveys yielded many of the proposed infrastructure projects that are listed in Section IX, CALSTART also conducted targeted outreach to various partners which yielded additional project proposals and information included in this plan. As a result of the added non-survey outreach efforts, some of the survey results do not match the final results represented in the full project listings shown in Section IX. For example, the surveys asked respondents to explain how much funding would be needed to justify infrastructure project development in terms of a minimum percentage of the total CAPEX for a given project. The responses to this question differ from the same information provided in the final list of project proposals because the survey asked for this information under the assumption that the infrastructure project would be at a minimum level of fuel throughput and scale, whereas actual project proposals vary in scope and scale. Also, the inclusion of more proposals solicited through non-survey forms of outreach cause final statistics and related percentages to shift, differing from those shown via survey results alone. Differences of this sort exist between the survey results and the final list of project proposals which include survey results and other outreach results combined. For complete results, refer to the project listings in Section IX as well as the Conclusions and Recommendations listed in Section VIII. This section shows results from the surveys alone and does not include additional insights yielded from other forms of outreach.

The remainder of this section focuses only on the key findings from both surveys. For more detailed survey results, and to see the associated figures and tables, view Appendix C.

Fleet Survey Results – Key Takeaways[XXVII]

Respondent Profiles

In total, 26 organizations responded to the fleet survey representing all three West Coast states. Respondents varied widely in the vocations they represented, including the following: drayage, transit refuse, school districts, food and beverage distribution, locomotive services, cargo handling, construction, regional government, air quality inspection and monitoring, road maintenance, airport shuttle services, marine cargo handling, utilities, and municipal street sweeping.

Fuel Type Preferences and Fuel Demand

Most of the vehicles currently operated by fleet respondents are gasoline or diesel at an average of 608 and 541 vehicles per respondent, respectively. CNG is the next in line at 38 vehicles per respondent, LNG at 9, LPG at 4, EV at 20, and H_2 at less than one (0.27) on average. When asked what alternative fuel type they are most interested in adding to their fleets in the next three-to-five years, most said EVs, followed by CNG, H_2, LNG, and LPG.

When asked to estimate the average annual fuel demand required for each alternative fuel type, fleet responses averaged out to the following amounts: 416,875 DGE of CNG per year, 54,542 DGE of LNG per year, 1,556 gallons of LPG per year, 2.14 MW of EV charging capacity. Respondents did not provide responses for annual H_2 fuel demand.

Funding Needs

Most fleet respondents (69%) stated that they will need funding support to purchase alternative fuel vehicles or equipment, while 15% said that they would not need funding, and 15% said that they did not know if funding would be need. Likewise, 73% of fleet respondents stated that they would need funding to purchase alternative fuel infrastructure, with 19% stating that they did not know if funding would be needed, and 8% stating that they would not need funding for infrastructure.

When asked how much funding would be needed to cover the cost of purchasing alternative fuel vehicles and infrastructure, 23% of fleets said that at least 50% of the total cost of an alternative fuel vehicle would need to be covered by funding assistance to justify the purchase. Similarly, 27% of fleets stated that 50% of CAPEX for developing alternative fuel infrastructure would need to be covered to justify the development. The second ranked answer to that question was 100% of CAPEX, with 23% of fleets responding with that answer.

Infrastructure Projects Underway

When asked whether fleets currently have alternative fuel infrastructure projects underway, a majority of respondents reported that they do (65%), while 27% do not, and 8% did not know if they had projects underway. Of those respondents that report having projects currently underway, 65% of them report having EV projects, 26% report CNG projects, 9% report LNG projects, 4% report H_2 projects, none reported LPG projects, and 22% report having other projects underway including RNG or renewable diesel. Of those respondents that do not have projects underway, 68% of them stated that funding support is

[XXVII] As stated above, this survey was administered before additional outreach was conducted which yielded additional information, and therefore the survey results in and of themselves are not a complete representation of the full results of this effort. Please refer to Sections VIII and IX for full and final results.

needed, 14% stated that no funding support is needed, and 18% stated that they did not know if funding support is needed.

Infrastructure Project Proposals

Fleets provided numerous infrastructure project proposals for which they would like to be considered for funding. Those listings are included in Section IX.

Fuel Provider Survey Results – Key Takeaways[XXVIII]

Respondent Profiles

In total, 31 fuel provider organizations responded to the survey, many of which operate in more than one West Coast state. Those organizations span all three states, with 66% of them operating in California, 63% of them operating in Washington, and 46% of them operating in Oregon.

Alternative Fuel Infrastructure Development Plans

When asked what plans each fuel provider respondent had to develop alternative fuel infrastructure in the three West Coast states within the next three to five years, respondents gave answers that varied by fuel type and by state. In California, 40% of respondents plan to develop EV stations, 23% plan to develop CNG stations, 17% plan to develop H_2 stations, 9% plan to develop LPG stations, 6% plan to develop LNG stations, and 34% report having no plans to develop alternative fuel infrastructure in California within the next three-to-five years. In Oregon, 20% plan to develop EV stations, 20% plan to develop CNG stations, 12% plan to develop H_2 stations, 8% plan to develop LNG stations, 8% plan to develop LPG stations, and 64% report having no plans to develop alternative fuel infrastructure in Oregon within the next three-to-five years. In Washington, 29% plan to develop EV stations, 17% plan to develop LPG stations, 17% plan to develop CNG stations, 13% plan to develop H_2 stations, 8% plan to develop LNG stations, and 46% report having no plans to develop alternative fuel infrastructure in Washington within the next three-to-five years.

Average Annual Fuel Demand Required for Station Development

When asked to describe the average annual fuel demand required to justify the development of a station that is on the lowest end of project size and scope, fuel providers gave the following responses: On average, respondents report that 249,333 DGE of CNG is required per year, 67,500 gallons of LPG is required per year, 30,000 kg of H_2 is required per year, and 2 MW of EV charging capacity is required. No responses were given for LNG stations.

Funding Needs for Station Development

Like fleets, fuel providers were asked to state what minimum level of funding assistance needed as the percentage of a station's total CAPEX to justify development. Twenty-five percent (25%) of respondents stated that at least 50% of station development CAPEX would need to be covered by funding assistance for them to justify implementation. The remaining responses to this question varied evenly, as 8% of respondents selected each of the following funding amount answer options: 0%, 20%, 30%, 40%, 60%,

[XXVIII] As stated above, this survey was administered before additional outreach was conducted which yielded additional information, and therefore the survey results in and of themselves are not a complete representation of the full results of this effort. Please refer to Sections VIII and IX for full and final results.

80%, 100%. Seventeen percent (17%) of respondents said that they did not know how much funding would be required to justify development of a station.

Infrastructure Projects Underway

When asked what infrastructure projects fuel providers currently have underway, they gave the following responses. In California, 21% of respondents report having CNG stations underway, 21% report having EV stations underway, 7% report having LPG stations underway, 7% report having H_2 stations underway, 0% report having LNG stations underway, and 50% report that they have no alternative fuel station projects underway. In Oregon, 14% of respondents report having either CNG or LPG stations underway, and 7% report having either LNG, H_2, or EV stations underway. 71% report that they have no alternative fuel station projects underway in Oregon. In Washington, 14% of respondents report having EV stations underway, 7% report having either CNG, LNG, LPG, or H_2 projects underway, and 64% report that they have no alternative fuel station projects underway. Please note that respondents were able to select multiple answer choices in these survey questions, so percentages need not add to 100%.

Of those respondents that did report having alternative fuel infrastructure projects underway in California, 43% report that they do not need funding support, 36% report that they do not know if they need funding support, and 21% report that they do need funding support. In Oregon, 67% report that they do not need funding support, 25% report that they do not know if they need funding support, and 8% report that they do need funding support. In Washington 58% report that they do not need funding support, 25% report that they do need funding support, and 17% report that they do not know if they need funding support.

Infrastructure Project Proposals

Fuel providers provided numerous infrastructure project proposals for which they would like to be considered for funding. Those listings are included in Section IX.

VIII. CONCLUSIONS AND RECOMMENDATIONS

A Note Regarding Section IX: List of Project Proposals and Readiness for Funding

Section IX includes a full listing of the alternative fuel infrastructure development projects proposed by survey and other outreach participants. The section also includes an assessment of each proposal's readiness for funding by the authors of this strategic plan, as well as maps showing the locations of each proposed project. Due to the length of Section IX, the authors of this document chose to place it behind the Conclusions and Recommendations section in order to maintain a steady flow throughout this document. As much of the Conclusions and Recommendations section relies upon the details in Section IX, the authors remind the reader to view it and see detailed descriptions of all 147 infrastructure proposals gathered through this effort.

Conclusions

The goal of the strategic development plan was to identify and prioritize a subset of alternative fuel infrastructure projects that may fill network gaps needed to enable adoption of alternative fuel medium- and heavy-duty vehicles (MHDVs) in California, Oregon, and Washington. After multiple years of research, stakeholder engagement, workgroup sessions, and industry surveying, AFICC has developed four main conclusions regarding alternative fuel infrastructure along the West Coast.

There is significant and proven demand for alternative fuel infrastructure in all three West Coast states: California, Oregon, and Washington.

First, CALSTART's surveying efforts found that all fleet respondents are interested in procuring alternative fuel vehicles within the next five years. This will increase the demand for alternative fueling stations throughout the West Coast. While fleet respondents showed interest in all alternative fuel types covered in this effort's purview, electricity was the most popular choice with 81% of respondents stating an interest in procuring EVs.

Likewise, fuel providers shared similar interests and plans to develop alternative fuel infrastructure throughout the West Coast. Most fuel provider survey respondents stated plans to develop alternative fuel infrastructure in California within the next three to five years. Of those planned projects, most were electric vehicle (EV) charging stations, followed closely by compressed natural gas (CNG) fueling stations, and less so for hydrogen (H_2), propane (LPG), and liquefied natural gas (LNG). Fuel providers did not express as much interest in developing stations in Oregon and Washington, with most stating that they do not have current plans to build alternative fuel infrastructure in those states. Those that do, however, are most interested in building EV stations.

As shown in Table 17, fleet and fuel provider respondents proposed 147 alternative fuel infrastructure projects for the West Coast states: 67 in California, 57 in Oregon, and 23 in Washington. Project proposals were received for all 5 fuel types within the AFICC planning scope: 62 EV charging stations, 36 CNG stations, 23 H_2 stations, 13 LPG stations, and 7 LNG stations. Some participants also proposed technologies outside the AFICC planning scope: catenary electric infrastructure projects, five in total; and, one proposed liquid biofuel station. All stations varied in terms of size, scope, cost, and readiness.

Table 17 Project Proposals by Fuel Type and State

	EV	H_2	LPG	CNG	LNG	Other[XXIX]	Totals
California	34	6	6	16	0	5	**67**
Oregon	15	14	5	17	5	1	**57**
Washington	13	3	2	3	2	0	**23**
Totals	**62**	**23**	**13**	**36**	**7**	**6**	**147**

Fleets and fuel providers alike have a significant need for funding assistance to develop both new alternative fuel infrastructure in West Coast states, and to expand current alternative fuel infrastructure projects.

Most fleet respondents stated that funding support is needed to purchase and install alternative fuel infrastructure: 73% of fleet respondents have a need for funding support to justify the decision to install such infrastructure, 8% stated that they do not need funding support, and 19% stated that they do not know if they need funding support. Likewise, most fleet respondents that are currently developing alternative fuel infrastructure have a need for additional funding support: 68% of respondents said that their current projects could use additional funding for a variety of uses, including but not limited to purchasing equipment and materials, adding gas compression capacity, and expanding project scope.

Regarding funding needs, CALSTART solicited information via fleet and fuel provider surveys as well as additional outreach via phone calls. When asked what percentage of the total capital expense (CAPEX) of installing an alternative fueling station must be covered for them to consider development, 28% of these combined outreach participants' infrastructure proposals stated that at least 50% of the CAPEX must be covered by external funding, followed by 14% of proposals that said 70% of CAPEX should be covered, and then a tie between 30% and 80% of CAPEX at 9% of proposals each. Less than 1% of proposals stated that 100% of the CAPEX must be covered by funding, and nearly 22% of proposals did not list a minimum funding need amount. The remaining ~17% of proposals stated other funding amounts needed at lower frequencies than those listed above. Effectively, about 77% of all proposals received through all channels of AFICC outreach would be viable for development with external funding assistance up to 80% of project CAPEX.

Alternative fuel infrastructure development is already underway in many locations throughout West Coast states, and many projects require support.

Most fleets surveyed stated that they currently have alternative fuel infrastructure projects underway: 65% of respondents fall into this category with projects that range in fuel type, fleet size, location and timeline. Of the projects underway, 65% are EV projects, 26% are CNG projects, and a smaller share are LNG and H_2 projects. Most projects are private access stations, likely located in our respondents' own facilities. These existing projects may well serve as starting points for alternative fuel infrastructure expansion on the West Coast, but given their private nature, more public and limited access stations would be needed to expand corridor fueling for MHD AFVs.

[XXIX] One participant in the outreach process proposed a liquid biofuel station in Redmond, Oregon. Other participants proposed five catenary electric truck infrastructure projects.

Survey respondents and other partners provided 147 specific proposals for alternative fuel infrastructure placement. These proposals likely represent only a portion of alternative fuel infrastructure development needs on the West Coast as of December 2019.

The contents of this plan detail 147 specific proposals for new and expanded alternative fuel infrastructure along the west coast. This represents the number of proposals made to the AFICC as of December 2019. To see all 147 proposals, along with maps of how they contribute to filling-in current gaps for alternative fuel infrastructure on major West Coast corridors, see Section IX of this plan.

As stated at the beginning of the document, the West Coast Collaborative believes that the infrastructure development project proposals listed in this document, captured through responses to surveys and other targeted outreach, only cover a small percentage of the full need for MHD alternative fuel infrastructure on the West Coast, and it welcomes feedback on additional infrastructure needs not reflected in this document.

CALSTART evaluated 127 of the 147 proposals on the criteria mentioned in Section VI of this strategic plan; all projects were evaluated and then grouped into three categories based on their readiness level. Table 18 and Table 19 show summaries of readiness category results by state and fuel type, respectively. Please note that twenty (20) proposals were unevaluated; five (5) of which were catenary electric truck infrastructure proposals that was out of scope for this plan, one (1) was a biofuel station proposal which was out of scope, and the remaining 14 did not contain enough information to properly evaluate them.

Table 18 Summary of Readiness Categories by State

	California	Oregon	Washington	Totals
Advanced	32	32	13	**77**
Emerging	13	14	3	**30**
Potential	15	1	4	**20**
Unevaluated	7	10	3	**20**
Totals	**67**	**57**	**23**	**147**

Table 19 Summary of Readiness Categories by Fuel Type

	EV	H_2	LPG	CNG	LNG	Catenary Electric	Other[xxx]	Totals
Advanced	37	9	13	15	3	0	0	**77**
Emerging	7	10	0	12	1	0	0	**30**
Potential	15	1	0	2	2	0	0	**20**
Unevaluated	3	3	0	7	1	5	1	**20**
Totals	**62**	**23**	**13**	**36**	**7**	**5**	**1**	**147**

[xxx] One survey respondent proposed a liquid biofuel station.

Estimated funding needed to build the 141 proposed stations for targeted alternative fuel technologies is $373,600,000.[xxxi]

The contents of this plan detail 141 proposed stations of various size, throughput, and level of construction for the targeted alternative fuel technologies (i.e., EV, H_2, LPG, CNG and LNG).[xxxi] Based on CALSTART's cost estimates, it would cost approximately $373,600,000 to fund the proposed stations in this plan assuming they were newly constructed sites, capable of accommodating MHD AFVs, and were of average size and capacity and throughput. Again, these 141 sites do not represent the total need for alternative fuel infrastructure across the West Coast, therefore $373,600,000 does not represent the total funding amount needed to provide comprehensive MHD alternative fuel infrastructure access in California, Oregon, and Washington. It only represents an estimate for the total cost of building the 141 proposed sites in this strategic plan.

Table 20 Estimated Funding Needed to Build Proposed Infrastructure Projects in This AFICC Effort [xxxii,xxxiii]

Fueling Type	Number of Sites Proposed by Outreach Participants	Average Assumptions for Each Station	Average Estimated CAPEX Per Station	Total Cost
EV	62	750kW-1MW Peak Capacity	$2,000,000	$124,000,000
H_2	23	1,000-4,800 kg/Day	$6,000,000	$138,000,000
LPG	13	1,000 gallons/Day	$1,700,000	$22,100,000
CNG	36	1,695-2,260 DGE/Day	$2,000,000	$72,000,000
LNG	7	1,695-2,260 DGE/Day	$2,500,000	$17,500,000
Total	**141**			**$373,600,000**

Table 21 Estimated Funding Needed to Build Proposed Infrastructure Projects by State

State	Number of Stations by Fuel Type					Total Cost
	EV	H2	LPG	CNG	LNG	
California	34	6	6	16	0	$146,200,000
Oregon	15	14	5	17	5	$169,000,000
Washington	13	3	2	3	2	$58,400,000
Total	62	23	13	36	7	**$373,600,000**

Recommendations for AFICC Partners

Given the highlighted demand for alternative fuel infrastructure across all three West Coast states, AFICC and broader WCC partners are well positioned to act on the findings from this effort in several ways. CALSTART offers the following recommendations and next steps to AFICC partners.

[xxxi] Cost estimate does not include catenary electric, or liquid biofuel infrastructure proposals (6 projects omitted).
[xxxii] The Total Cost estimate does not represent the total funding needed to deploy comprehensive MHD alternative fueling infrastructure in California, Oregon, and Washington; it only includes proposals obtained through AFICC outreach.
[xxxiii] Table does not include catenary electric, or liquid biofuel infrastructure proposals (6 projects omitted) as these technologies are outside the AFICC planning scope.

Take the learnings from this plan document and develop targeted investment plans per state.

Knowing several locations where alternative fuel infrastructure is needed in each state, AFICC partners are well positioned to start a process of developing more targeted investment plans for each state. With 67 proposed stations in California, 57 in Oregon, and 23 in Washington, partners now have a starting point in the effort of filling alternative fuel infrastructure gaps in each state. Further, it is important to note that the 147 projects listed in this plan are only those suggested by survey respondents and outreach participants, and do not reflect an exhaustive list of infrastructure needs across West Coast states. It is highly likely that other fleets and fuel providers who did not participate in this effort also have an interest in adopting MHD alternative fuel vehicles, and therefore have a need for MHD-accessible alternative fuel infrastructure. Partners within the WCC, via the AFICC, may now take the learnings from this document and start to develop strategies for filling infrastructure gaps in each of their states.

Examine, in more detail, the policy barriers to alternative fuel infrastructure development, and develop policies that support accelerated MHD infrastructure implementation in California, Oregon, and Washington.

As mentioned previously in this plan, while each state has existing policies to incentivize and advance alternative fuel vehicle adoption and alternative fuel infrastructure development, it may not be sufficient to meet future demand for these technologies. In some cases, state policies are a barrier to alternative fuel deployment, and in other cases the lack of state policies and incentives are barriers. All three states have varying approaches to reducing transportation emissions and encouraging alternative fuels. In all states, however, there is a need to increase funding specifically for MHD alternative fuel infrastructure development. AFICC partners are well positioned to support the development of such policies, using the findings from this plan as a basis for championing such work.

Share the information in this strategic plan document with partners external and tangential to the West Coast Collaborative.

AFICC partners have an extensive stakeholder base spanning multiple commercial vocations. Among the AFICC's ranks are Clean Cities Coalitions, fleets, original equipment manufacturers, fuel and infrastructure providers, government agencies, trade associations, ports, and more. Spreading the learnings from this effort would send two primary signals to partners who are external and tangential to the AFICC: 1) significant demand for MHD alternative fuel infrastructure exists,[XXXIV] and 2) funding support is needed to meet that demand. One barrier that persists within the issue of alternative fuel vehicles and infrastructure is the chicken and egg problem: fleets are hesitant to purchase alternative fuel vehicles for lack of infrastructure, and fuel providers are hesitant to develop alternative fuel infrastructure for lack of fleet users. By spreading the word that demand for both vehicles and infrastructure exists, the AFICC may serve to alleviate some concerns that both fleets and fuel providers may have with respect to infrastructure.

[XXXIV] As highlighted previously in the strategic plan, the 147 proposed infrastructure projects reported by participants of this plan's study efforts likely represent only a small fraction of the total need for alternative fuel infrastructure and associated funding assistance throughout the West Coast.

West Coast Collaborative Partners are well positioned to both fundraise for MHD alternative fuel infrastructure development and to petition for increased public funding support.

As mentioned in the recommendation to develop more supportive policies, AFICC partners are well positioned to leverage their networks in also petitioning for increased alternative fuel infrastructure development funding support. With this document serving as a partial basis for demonstrating MHD alternative fuel infrastructure demand, and that funding is required to meet related public policy goals on the West Coast, AFICC partners may work with policymakers to develop federal, state and/or local funding mechanisms. As a next step in this process, it will be valuable to assess how much funding may be needed by state and by fuel type.

This effort sought out to identify the need for MHD alternative fuel infrastructure in California, Oregon, and Washington, and to identify potential projects to develop such infrastructure. After three years of research and outreach, the WCC AFICC with support from CALSTART has identified 147 proposed MHD alternative fuel infrastructure projects across all three states and all five fuel types in this plan's purview. The demand for MHD infrastructure is clear, as is the need for increased funding to support infrastructure development. The AFICC is well positioned to take these findings and champion programs to start the development of these projects and others that may also need funding and support.

All parties interested in developing alternative fuel infrastructure are encouraged to leverage the partnership contacts gathered through this effort for purposes of implementing the projects listed within this plan.

Through the research conducted to develop this strategic plan, CALSTART and other AFICC partners collected a significant database of stakeholder contact information. From fleets to fuel providers to government agencies, the contact information of partners interested in carrying forward such infrastructure development is on hand and ready to be leveraged if and when funding for MHD station development becomes available. The AFICC aims to accelerate MHD-accessible alternative fuel infrastructure development for both the projects listed in this document and any other MHD alternative fuel infrastructure projects on the West Coast that support the WCC's mission to reduce diesel emissions. As a next step in acting upon the findings of this plan, CALSTART encourages WCC partners and other interested stakeholders to build capacity for project development through strategic partnerships, including but not limited to the contacts made through this effort. California, Oregon and Washington State Transportation Agencies and Regional Metropolitan Planning Organizations are encouraged to use the Strategic Development Plan to help advance MHD infrastructure development and support implementation of the projects identified in this document.

Infrastructure development in environmental justice communities should be prioritized where there is synergy with alternative fuel demand.

As described in previous sections, promoting environmental justice and community involvement with the development and expansion of alternative fuel corridors are important to build support and inclusiveness for project initiatives that can benefit impacted communities. AFICC partners should evaluate opportunities to engage through tools and resources to build meaningful partnerships with communities

to understand needs and collaborate on programs that improve air quality and public health. Raising awareness on the benefits of alternative fuel technologies is important to help build acceptance, buy-in and encourage communities to collaborate with industry to advance solutions that are better for business and the environment. By engaging communities with alternative fuel corridor development where there is synergy with alternative fuel demand, AFICC partners will be enhancing long-term program sustainability.

Consider workforce development opportunities which are likely to arise as a result of MHD alternative fuel infrastructure development on the West Coast.

As highlighted in this plan, an opportunity exists to leverage the trends toward MHD alternative fuel vehicle adoption and infrastructure deployment for purposes of workforce development. Partners acting to develop MHD infrastructure should consider the workforce implications of such development and should highlight it in applications for funding.

The partnerships formed between West Coast Collaborative Alternative Fuel Infrastructure Corridor Coalition partners should be sustained and leveraged for ongoing coordination on corridor planning, and other geographic regions are encouraged to replicate the WCC AFICC through similar regional partnerships across the United States.

To continue the meaningful partnership developed through AFICC, the West Coast Collaborative should: discuss opportunities to continue coordination, identify funding sources to support proposed project sites, help encourage projects for further development, leverage partnership opportunities along corridors exploring similar fuels, and have an entity that is responsible for ongoing follow up and status review of projects proposed under this plan to ensure long-term implementation success. As an example, CALSTART has established a Funders Forum, bringing together key funding agencies across California, and an Infrastructure Working Group, bringing together key infrastructure partners across California, for ongoing coordination on various topics including alternative fuel infrastructure corridor planning. Similar working groups may benefit stakeholders in Oregon and Washington and would serve the west coast as a whole as stakeholders strive to build-out alternative fuel corridors in the region. The information provided in this strategic plan offers a robust starting point which stakeholders in all three states may use to form tighter partnerships centered around alternative fuel corridors, and through continued collaborative efforts partners may build upon the results herein and advance the goals of the West Coast Collaborative.

As stated multiple times in this document, the authors believe that the 147 proposals herein represent a small fraction of the total need across the West Coast. As such, the WCC intends to create a web-based submission form on its website (www.westcoastcollaborative.org) to solicit additional MHD alternative fuel infrastructure proposals from partners seeking incentives and partnerships to support implementation. Additionally, other regions of the United States are encouraged to visit the link above to learn more about the WCC AFICC and use it as a model for similar regional partnership formations across the United States.

IX. LIST OF PROJECT PROPOSALS AND READINESS FOR FUNDING

CALSTART took the survey results it received from both fleets and fuel providers and evaluated the projects using the readiness criteria described in Section VI above. In total, survey respondents and other partners provided 147 project proposals. All 147 projects vary by fuel type, location, capacity, and maturity. While some projects are already underway and could use additional funding, other projects have not started and only capture respondents' needs and recommendations for future alternative fuel infrastructure.[xxxv]

The following lists present each project that was provided to CALSTART through its survey efforts, along with its readiness categories based on the criteria described in Section VI above. To adequately validate the infrastructure development project proposals received, CALSTART determined it was best to assess the proposals in two ways. First, all project proposals are listed with no readiness category whatsoever. The purpose for this is to highlight the large number of alternative fuel infrastructure project proposals which represent significant demand for investment. Naturally, some project proposals are more mature than others, but projects which are less mature are still viable for funding to support the WCC AFICC's objective to build a robust network of MHD alternative fuel infrastructure along the West Coast. Therefore, to not discount any project proposals, CALSTART first lists all proposals with no evaluation. Second, to assess project readiness and neat-term viability, CALSTART developed a standard set of readiness criteria by which it measured each proposal on its readiness to start development if funding were to become available, as well as its viability in meeting the need for MHD alternative fuel infrastructure in West Coast states. The proposals are bundled into three categories based on the evaluation criteria listed in Section VI: Advanced Site, Emerging Site, and Potential Site. For a description of these three categories, revisit Section VI. For more detail, the proposals are also disaggregated and listed by fuel type and by state.

Table 22 shows all 147 project proposals by fuel type and state.

Table 22 Project Proposal Numbers by Fuel Type and State

	EV	H_2	LPG	CNG	LNG	Other[xxxvi]	Totals
California	34	6	6	16	0	5	**67**
Oregon	15	14	5	17	5	1	**57**
Washington	13	3	2	3	2	0	**23**
Totals	**62**	**23**	**13**	**36**	**7**	**6**	**147**

[xxxv] The West Coast Collaborative believes that the infrastructure development project proposals listed in this document only cover a small percentage of the demand for MHD alternative fuel infrastructure on the West Coast, and it welcomes feedback on additional infrastructure needs not reflected in this document.

[xxxvi] This column includes: 5 catenary electric infrastructure projects proposed in California, and 1 liquid biofuel station proposed in Redmond, Oregon. These proposals were not evaluated as they are outside the technological scope of this plan.

Proposal Listings by State

California Only

The following table shows all of the proposed projects within the State of California.

Table 23 California Proposed Alternative Fuel Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
1	EV	CA	Bakersfield	N/A	70 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	0%
2	EV	CA	Bakersfield	Bakersfield, CA	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
3	EV	CA	Banta	I-5 / I-205	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
4	EV	CA	Barstow	2825 W. Main St. Barstow, CA 92311	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
5	EV	CA	Barstow	I-15 / I-40	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
6	EV	CA	Between Los Angeles & Santa Barbara	US-101	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
7	EV	CA	Between Sacramento & San Francisco	I-80	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
8	EV	CA	Blythe	I-10 / CA-78	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
9	EV	CA	Fresno	CA-99 / CA-41	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
10	EV	CA	Grapevine	I-5 & Edmonston Pumping Plant Road	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
11	EV	CA	Hamburg Farms	I-5 / CA-165	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
12	EV	CA	Inland Empire	I-15	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
13	EV	CA	Inland Empire	Warehouse Districts Around Inland Empire	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
14	EV	CA	Long Beach	Port of Long Beach	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
15	EV	CA	Long Beach	301 Mediterranean Way, Long Beach CA	50 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	30%
16	EV	CA	Long Beach	Port of Long Beach Terminal	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
17	EV	CA	Long Beach	Port of Long Beach Terminal	N/A	Limited Access	$2,250,000	90%
18	EV	CA	Los Angeles	I-10	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
19	EV	CA	Los Angeles	Warehouse Districts Around Los Angeles	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
20	EV	CA	Los Angeles	Port of Los Angeles	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
21	EV	CA	Los Angeles / Hobart	4000 East Sheila St Los Angeles, CA 90023	10 electric hostlers, 1 electric service truck	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
22	EV	CA	National City	I-5 & CA-54	200 truck trips a day	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
23	EV	CA	Near Coalinga	I-5 & CA-198	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
24	EV	CA	Near Los Banos	I-5 & CA-152	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
25	EV	CA	Red Bluff	I-5 & CA-36	6 vehicles	Public	$100,000	50%
26	EV	CA	Redding	I-5 & CA-44	6 vehicles	Public	$100,000	50%
27	EV	CA	Sacramento	I-80 / US-50	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
28	EV	CA	San Bernardino	1535 West 4th St San Bernardino, CA 92411	7 electric hostlers, 2 electric service trucks, 1 hybrid RTG, 1 electric side loader, 1 electric drayage truck	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
29	EV	CA	San Diego	I-5 & I-8	200 truck trips a day	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
30	EV	CA	Stockton	6450 South Austin Rd. Stockton, CA 95215	6 electric hostlers, 1 hybrid RTG	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
31	EV	CA	Weaverville	CA-299 & CA-44	6 vehicles	Public	$100,000	50%
32	EV	CA	Williams	I-5 / CA-20	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
33	EV	CA	Willow Creek	CA-299 & CA-96	6 vehicles	Public	$100,000	50%
34	EV	CA	Willows	I-5 & CA-162	6 vehicles	Public	$100,000	50%
35	H_2	CA	Long Beach	I-710 & I-405	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	20%
36	H_2	CA	Long Beach	1926 East Pacific Coast Highway	547,500 kg/year (12 vehicles)	Private	$10,000,000	80-85%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
37	H2	CA	Ontario	4325 East Guasti Road	547,500 kg/year (12 vehicles)	Public	$10,000,000	80-85%
38	H2	CA	Redding	I-5 & CA-44	365,000 kg/year	Public	$4,000,000	30-100%
39	H2	CA	Sacramento	N/A	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
40	H2	CA	Sacramento	N/A	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
41	LPG	CA	Corona	CA-91 & I-15	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
42	LPG	CA	Duarte	I-605 & I-210	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
43	LPG	CA	Hawthorne	N/A	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
44	LPG	CA	Norwalk	I-605 & I-105	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
45	LPG	CA	Ontario	I-10 & I-15	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
46	LPG	CA	Sherman Oaks	US-101 & I-405	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
47	CNG	CA	Bakersfield	Bakersfield, CA	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
48	CNG	CA	Barstow	I-15 & Lenwood Road	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
49	CNG	CA	Bellflower	15330 Woodruff Ave., Bellflower, CA 90706	791,000 DGE	Public and 35 Limited Access	$2,750,000	20%
50	CNG	CA	Coachella	I-10 & Dillon Road	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%
51	CNG	CA	Gardena	14800 South Spring St., Gardena CA 90248	60 CNG tractors	Public and Private	$4,000,000	80%
52	CNG	CA	Lost Hills	I-5 & CA-46	N/A	Public	$1,000,000	N/A
53	CNG	CA	Lost Hills	I-5 & CA-46	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%
54	CNG	CA	Near Bakersfield	I-5 & CA-119	N/A	Public	$1,000,000	N/A
55	CNG	CA	Near Kettleman City	I-5 & CA-41	N/A	Public	$1,000,000	N/A
56	CNG	CA	Riverside County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
57	CNG	CA	Riverside County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
58	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
59	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
60	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
61	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
62	CNG	CA	Tehachapi	CA-58 & CA-58B	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%
63	Catenary Electric	CA	Between East Los Angeles and Riverside	CA-60 (East LA to Riverside)	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%
64	Catenary Electric	CA	Between Los Angeles and Las Vegas	I-15 Los Angeles to Las Vegas	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%
65	Catenary Electric	CA	Between Mettler and Sacramento	CA-99 (Mettler to Sacramento)	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%
66	Catenary Electric	CA	Between San Diego and Redding	I-5 (San Diego to Redding)	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
67	Catenary Electric	CA	I-710	I-710	14,000 trucks per day and direction	Public	$8.7m /mile	0%

Oregon Only

The following table shows all of the proposed projects within the State of Oregon.

Table 24 Oregon Proposed Alternative Fuel Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
1	EV	OR	Bend	US-20 / US-97	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
2	EV	OR	Bend	US-97 & US-20	500 vehicles @ 350kW	Public	$100,000	70%
3	EV	OR	Boardman	I-84 & South Main Street	500 vehicles @ 350kW	Public	$100,000	70%
4	EV	OR	Eugene	I-5 & OR-126	500 vehicles @ 350kW	Public	$100,000	70%
5	EV	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
6	EV	OR	Hood River County	N/A	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
7	EV	OR	Josephine County	N/A	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
8	EV	OR	La Grande	I-84 & OR-82	500 vehicles @ 350kW	Public	$100,000	70%
9	EV	OR	Medford	I-5 & OR-62	500 vehicles @ 350kW	Public	$100,000	70%
10	EV	OR	Ontario	I-84 & US-30	500 vehicles @ 350kW	Public	$100,000	70%
11	EV	OR	Pendleton	I-84 & US-395	500 vehicles @ 350kW	Public	$100,000	70%
12	EV	OR	Portland	I-84 & I-205	30 vehicles	Public and Private	$2,000,000	50%
13	EV	OR	Portland	I-5 & I-405	500 vehicles @ 350kW	Public	$100,000	70%
14	EV	OR	Salem	I-5 & OR-22	500 vehicles @ 350kW	Public	$100,000	70%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
15	EV	OR	The Dalles	I-84 & US-197	500 vehicles @ 350kW	Public	$100,000	70%
16	H2	OR	Bend	US-97 & US-20	222,650 kg/year	Public	$4,000,000	80%
17	H2	OR	Boardman	I-84 & South Main Street	222,650 kg/year	Public	$4,000,000	80%
18	H2	OR	Eugene	I-5 & I-105	365,000 kg	Public	$4,000,000	30-100%
19	H2	OR	Eugene	I-5 & OR-126	222,650 kg/year	Public	$4,000,000	80%
20	H2	OR	Grants Pass	I-5 & CA-99	365,000 kg	Public	$4,000,000	30-100%
21	H2	OR	La Grande	I-84 & OR-82	222,650 kg/year	Public	$4,000,000	80%
22	H2	OR	Medford	I-5 & OR-62	222,650 kg/year	Public	$4,000,000	80%
23	H2	OR	Ontario	I-84 & US-30	222,650 kg/year	Public	$4,000,000	80%
24	H2	OR	Pendleton	I-84 & US-395	222,650 kg/year	Public	$4,000,000	80%
25	H2	OR	Portland	I-5 & I-84	365,000 kg/year	Public	$4,000,000	30-100%
26	H2	OR	Portland	I-5 & I-405	222,650 kg/year (assuming 365 days)	Public	$4,000,000	80%
27	H2	OR	Portland	N/A	N/A	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
28	H2	OR	Salem	I-5 & OR-22	222,650 kg/year	Public	$4,000,000	80%
29	H2	OR	The Dalles	I-84 & US-197	222,650 kg/year	Public	$4,000,000	80%
30	LPG	OR	Boardman	I-84 & South Main Street	3000 DGE/Hour	Public	$100,000	50-60%
31	LPG	OR	Ontario	I-84 & US-30	3000 DGE/Hour	Public	$100,000	50-60%
32	LPG	OR	Pendleton	I-84 & US-395	3000 DGE/Hour	Public	$100,000	50-60%
33	LPG	OR	Roseburg	I-5 & SE Oak Avenue	3000 DGE/Hour	Public	$100,000	50-60%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
34	LPG	OR	The Dalles	I-84 & US-197	3000 DGE/Hour	Public	$100,000	50-60%
35	CNG	OR	Baker City	N/A	30 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	70%
36	CNG	OR	Bend	US-97 & US-20	500 DGE/Hour	Public	$1,500,000	70%
37	CNG	OR	Boardman	I-84 & South Main Street	500 DGE/Hour	Public	$1,500,000	70%
38	CNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
39	CNG	OR	Eugene/Portland	I-5 Corridor	N/A	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
40	CNG	OR	La Grande	I-84 & OR-82	500 DGE/Hour	Public	$1,500,000	70%
41	CNG	OR	Medford	N/A	30 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	70%
42	CNG	OR	Ontario	I-84 & US-30	500 DGE/Hour	Public	$1,500,000	70%
43	CNG	OR	Pendleton	I-84 & US-395	500 DGE/Hour	Public	$1,500,000	70%
44	CNG	OR	Portland	I-205 & Sandy Boulevard	40 vehicles	Public and Private	$1,000,000	50-70%
45	CNG	OR	Portland	I-5 & I-405	500 DGE/Hour	Public	$1,500,000	70%
46	CNG	OR	Portland	N/A	N/A	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
47	CNG	OR	Salem	I-5 & OR-22	500 DGE/Hour	Public	$1,500,000	70%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
48	CNG	OR	SE Portland	I-5 Corridor	33,900 DGE	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
49	CNG	OR	The Dalles	I-84 & US-197	500 DGE/Hour	Public	$1,500,000	70%
50	CNG	OR	Umatilla	I-82 & US-730	30 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	70%
51	CNG	OR	Woodburn	OR-214 & I-5	40 vehicles	Private	$1,000,000	50-70%
52	LNG	OR	Eugene	I-5 & OR-58	5 vehicles	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
53	LNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
54	LNG	OR	Hermiston	I-82 & I-84	5 vehicles	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
55	LNG	OR	Portland	N/A	7,352 DGE (5 vehicles/year)	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
56	LNG	OR	Portland	I-205 & I-84	5 vehicles	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
57	Biofuel	OR	Redmond	N/A	3-5 Million Gallons	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A

Washington Only

The following table shows all of the proposed projects within the State of Washington.

Table 25 Washington Proposed Alternative Fuel Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
1	EV	WA	Bellevue	I-405 & I-5	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
2	EV	WA	Ellensburg	Main and Washington	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
3	EV	WA	Everett	Cedar and Wentworth	N/A	Public	MHD station not reported by participant; See Table 7 for estimated average CAPEX	0%
4	EV	WA	Everett	Cedar and Pacific	N/A	Public	MHD station not reported by participant; See Table 7 for estimated average CAPEX	0%
5	EV	WA	Everett	Cedar and Pacific	10 buses, 5 small vehicles	Public	$292,000	50%
6	EV	WA	Kennewick	I-82 / US-395	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
7	EV	WA	Olympia	Capital & Jefferson	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
8	EV	WA	Seattle	Port of Seattle	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
9	EV	WA	Spokane	Division & Mission	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
10	EV	WA	Tacoma	Tacoma	15 vehicles	Private	$500,000	100%
11	EV	WA	Tacoma	Market & Pacific Avenue	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
12	EV	WA	Yakima	Yakima & 4th	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
13	EV	WA	Yakima	Nob Hill & 1st	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
14	H_2	WA	Seattle	I-5 & I-90	365,000 kg/year	Public	$4,000,000	30-100%
15	H_2	WA	Tacoma	Tacoma	10,000 kg/day with electrolyzer production	Public and Private	$90,000,000[XXXVII]	10%
16	H_2	WA	Tacoma	I-5 & WA-7	365,000 kg/year	Public	$4,000,000	30-100%
17	LPG	WA	Ellensburg	I-90 & I-82	360,000 Gallons	Public	$1,700,000	25-50%
18	LPG	WA	Ritzville	I-90 & WA-261	360,000 Gallons	Public	$1,700,000	25-50%
19	CNG	WA	Clark County	I-5 Corridor	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
20	CNG	WA	Vancouver	I-5 Corridor	113,000 DGE	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A

[XXXVII] This proposal is for a 35 MW electrolysis station with an expected capacity of 10,000 kg/day. A hydrogen fueling station may or may not be included in the project. CAPEX estimate includes but is not limited to an electrolyzer, electrical connections to substations, transportation infrastructure, liquefaction, and storage.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
21	CNG	WA	Washington State	I-5 Corridor	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
22	LNG	WA	Seattle	N/A	7,352 DGE (5 vehicles)	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
23	LNG	WA	Spokane	N/A	7,352 DGE (5 vehicles)	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A

Proposal Listings by Fuel Type

Electric Vehicle Charging

The following table shows all proposed EV projects.

Table 26 Proposed EV Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
EV-1	EV	CA	Bakersfield	N/A	70 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	0%
EV-2	EV	CA	Bakersfield	Bakersfield, CA	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-3	EV	CA	Banta	I-5 / I-205	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-4	EV	CA	Barstow	2825 W. Main St. Barstow, CA 92311	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-5	EV	CA	Barstow	I-15 / I-40	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-6	EV	CA	Between Los Angeles & Santa Barbara	US-101	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-7	EV	CA	Between Sacramento & San Francisco	I-80	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-8	EV	CA	Blythe	I-10 / CA-78	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
EV-9	EV	CA	Fresno	CA-99 / CA-41	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-10	EV	CA	Grapevine	I-5 & Edmonston Pumping Plant Road	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-11	EV	CA	Hamburg Farms	I-5 / CA-165	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-12	EV	CA	Inland Empire	I-15	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-13	EV	CA	Inland Empire	Warehouse Districts Around Inland Empire	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-14	EV	CA	Long Beach	Port of Long Beach	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-15	EV	CA	Long Beach	301 Mediterranean Way, Long Beach CA	50 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	30%
EV-16	EV	CA	Long Beach	Port of Long Beach Terminal	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
EV-17	EV	CA	Long Beach	Port of Long Beach Terminal	N/A	Limited Access	$2,250,000	90%
EV-18	EV	CA	Los Angeles	I-10	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
EV-19	EV	CA	Los Angeles	Warehouse Districts Around Los Angeles	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-20	EV	CA	Los Angeles	Port of Los Angeles	N/A	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-21	EV	CA	Los Angeles / Hobart	4000 East Sheila St Los Angeles, CA 90023	10 electric hostlers, 1 electric service truck	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-22	EV	CA	National City	I-5 & CA-54	200 truck trips a day	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-23	EV	CA	Near Coalinga	I-5 & CA-198	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-24	EV	CA	Near Los Banos	I-5 & CA-152	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-25	EV	CA	Red Bluff	I-5 & CA-36	6 vehicles	Public	$100,000	50%
EV-26	EV	CA	Redding	I-5 & CA-44	6 vehicles	Public	$100,000	50%
EV-27	EV	CA	Sacramento	I-80 / US-50	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-28	EV	CA	San Bernardino	1535 West 4th St San Bernardino, CA 92411	7 electric hostlers, 2 electric service trucks, 1 hybrid RTG, 1 electric side loader, 1 electric drayage truck	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
EV-29	EV	CA	San Diego	I-5 & I-8	200 truck trips a day	Public	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-30	EV	CA	Stockton	6450 South Austin Rd. Stockton, CA 95215	6 electric hostlers, 1 hybrid RTG	Private	Not reported by participant; See Table 7 for estimated average CAPEX	50%
EV-31	EV	CA	Weaverville	CA-299 & CA-44	6 vehicles	Public	$100,000	50%
EV-32	EV	CA	Williams	I-5 / CA-20	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-33	EV	CA	Willow Creek	CA-299 & CA-96	6 vehicles	Public	$100,000	50%
EV-34	EV	CA	Willows	I-5 & CA-162	6 vehicles	Public	$100,000	50%
EV-35	EV	OR	Bend	US-20 / US-97	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-36	EV	OR	Bend	US-97 & US-20	500 vehicles @ 350kW	Public	$100,000	70%
EV-37	EV	OR	Boardman	I-84 & South Main Street	500 vehicles @ 350kW	Public	$100,000	70%
EV-38	EV	OR	Eugene	I-5 & OR-126	500 vehicles @ 350kW	Public	$100,000	70%
EV-39	EV	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-40	EV	OR	Hood River County	N/A	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-41	EV	OR	Josephine County	N/A	N/A	Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
EV-42	EV	OR	La Grande	I-84 & OR-82	500 vehicles @ 350kW	Public	$100,000	70%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
EV-43	EV	OR	Medford	I-5 & OR-62	500 vehicles @ 350kW	Public	$100,000	70%
EV-44	EV	OR	Ontario	I-84 & US-30	500 vehicles @ 350kW	Public	$100,000	70%
EV-45	EV	OR	Pendleton	I-84 & US-395	500 vehicles @ 350kW	Public	$100,000	70%
EV-46	EV	OR	Portland	I-84 & I-205	30 vehicles	Public and Private	$2,000,000	50%
EV-47	EV	OR	Portland	I-5 & I-405	500 vehicles @ 350kW	Public	$100,000	70%
EV-48	EV	OR	Salem	I-5 & OR-22	500 vehicles @ 350kW	Public	$100,000	70%
EV-49	EV	OR	The Dalles	I-84 & US-197	500 vehicles @ 350kW	Public	$100,000	70%
EV-50	EV	WA	Bellevue	I-405 & I-5	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
EV-51	EV	WA	Ellensburg	Main and Washington	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
EV-52	EV	WA	Everett	Cedar and Wentworth	N/A	Public	MHD station not reported by participant; See Table 7 for estimated average CAPEX	0%
EV-53	EV	WA	Everett	Cedar and Pacific	N/A	Public	MHD station not reported by participant; See Table 7 for estimated average CAPEX	0%
EV-54	EV	WA	Everett	Cedar and Pacific	10 buses, 5 small vehicles	Public	$292,000	50%
EV-55	EV	WA	Kennewick	I-82 / US-395	750 kW minimum (1 MW ideal)	Public	$2,017,499	50%
EV-56	EV	WA	Olympia	Capital & Jefferson	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
EV-57	EV	WA	Seattle	Port of Seattle	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
EV-58	EV	WA	Spokane	Division & Mission	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
EV-59	EV	WA	Tacoma	Tacoma	15 vehicles	Private	$500,000	100%
EV-60	EV	WA	Tacoma	Market & Pacific Avenue	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
EV-61	EV	WA	Yakima	Yakima & 4th	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%
EV-62	EV	WA	Yakima	Nob Hill & 1st	200 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	60-80%

Hydrogen

The following table shows all proposed H_2 projects.

Table 27 Proposed H_2 Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
H_2-1	H_2	CA	Long Beach	I-710 & I-405	N/A	Public	Not reported by participant; See Table 7 for estimated average CAPEX	20%
H_2-2	H_2	CA	Long Beach	1926 East Pacific Coast Highway	547,500 kg/year (12 vehicles)	Private	$10,000,000	80-85%
H_2-3	H_2	CA	Ontario	4325 East Guasti Road	547,500 kg/year (12 vehicles)	Public	$10,000,000	80-85%
H_2-4	H_2	CA	Redding	I-5 & CA-44	365,000 kg/year	Public	$4,000,000	30-100%
H_2-5	H_2	CA	Sacramento	N/A	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
H_2-6	H_2	CA	Sacramento	N/A	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
H_2-7	H_2	OR	Bend	US-97 & US-20	222,650 kg/year	Public	$4,000,000	80%
H_2-8	H_2	OR	Boardman	I-84 & South Main Street	222,650 kg/year	Public	$4,000,000	80%
H_2-9	H_2	OR	Eugene	I-5 & I-105	365,000 kg/year	Public	$4,000,000	30-100%
H_2-10	H_2	OR	Eugene	I-5 & OR-126	222,650 kg/year	Public	$4,000,000	80%
H_2-11	H_2	OR	Grants Pass	I-5 & CA-99	365,000 kg/year	Public	$4,000,000	30-100%
H_2-12	H_2	OR	La Grande	I-84 & OR-82	222,650 kg/year	Public	$4,000,000	80%
H_2-13	H_2	OR	Medford	I-5 & OR-62	222,650 kg/year	Public	$4,000,000	80%
H_2-14	H_2	OR	Ontario	I-84 & US-30	222,650 kg/year	Public	$4,000,000	80%
H_2-15	H_2	OR	Pendleton	I-84 & US-395	222,650 kg/year	Public	$4,000,000	80%
H_2-16	H_2	OR	Portland	I-5 & I-84	365,000 kg/year	Public	$4,000,000	30-100%
H_2-17	H_2	OR	Portland	I-5 & I-405	222,650 kg/year	Public	$4,000,000	80%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
H2-18	H2	OR	Portland	N/A	N/A	Not Reported	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
H2-19	H2	OR	Salem	I-5 & OR-22	222,650 kg/year	Public	$4,000,000	80%
H2-20	H2	OR	The Dalles	I-84 & US-197	222,650 kg/year	Public	$4,000,000	80%
H2-21	H2	WA	Seattle	I-5 & I-90	365,000 kg	Public	$4,000,000	30-100%
H2-22	H2	WA	Tacoma	Tacoma	10,000 kg/day with electrolyzer production	Public and Private	$90,000,000[XXXVIII]	10%
H2-23	H2	WA	Tacoma	I-5 & WA-7	365,000 kg	Public	$4,000,000	30-100%

[XXXVIII] This proposal is for a 35 MW electrolysis station with an expected capacity of 10,000 kg/day. A hydrogen fueling station may or may not be included in the project. CAPEX estimate includes but is not limited to an electrolyzer, electrical connections to substations, transportation infrastructure, liquefaction, and storage.

Liquefied Petroleum Gas (Propane)

The following table shows all proposed LPG projects.

Table 28 Proposed LPG Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
LPG-1	LPG	CA	Corona	CA-91 & I-15	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
LPG-2	LPG	CA	Duarte	I-605 & I-210	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
LPG-3	LPG	CA	Hawthorne	N/A	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
LPG-4	LPG	CA	Norwalk	I-605 & I-105	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
LPG-5	LPG	CA	Ontario	I-10 & I-15	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
LPG-6	LPG	CA	Sherman Oaks	US-101 & I-405	200,000 Gallons (50-60 vehicles)	Public	$110,000	30-40%
LPG-7	LPG	OR	Boardman	I-84 & South Main Street	3000 DGE/Hour	Public	$100,000	50-60%
LPG-8	LPG	OR	Ontario	I-84 & US-30	3000 DGE/Hour	Public	$100,000	50-60%
LPG-9	LPG	OR	Pendleton	I-84 & US-395	3000 DGE/Hour	Public	$100,000	50-60%
LPG-10	LPG	OR	Roseburg	I-5 & SE Oak Avenue	3000 DGE/Hour	Public	$100,000	50-60%
LPG-11	LPG	OR	The Dalles	I-84 & US-197	3000 DGE/Hour	Public	$100,000	50-60%
LPG-12	LPG	WA	Ellensburg	I-90 & I-82	360,000 Gallons	Public	$1,700,000	25-50%
LPG-13	LPG	WA	Ritzville	I-90 & WA-261	360,000 Gallons	Public	$1,700,000	25-50%

Compressed Natural Gas

The following table shows all proposed CNG projects.

Table 29 Proposed CNG Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
CNG-1	CNG	CA	Bakersfield	Bakersfield, CA	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
CNG-2	CNG	CA	Barstow	I-15 & Lenwood Road	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%
CNG-3	CNG	CA	Bellflower	15330 Woodruff Ave., Bellflower, CA 90706	791,000 DGE	Public and 35 Limited Access	$2,750,000	20%
CNG-4	CNG	CA	Coachella	I-10 & Dillon Road	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%
CNG-5	CNG	CA	Gardena	14800 South Spring St., Gardena CA 90248	60 CNG tractors	Public and Private	$4,000,000	80%
CNG-6	CNG	CA	Lost Hills	I-5 & CA-46	N/A	Public	$1,000,000	N/A
CNG-7	CNG	CA	Lost Hills	I-5 & CA-46	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%
CNG-8	CNG	CA	Near Bakersfield	I-5 & CA-119	N/A	Public	$1,000,000	N/A
CNG-9	CNG	CA	Near Kettleman City	I-5 & CA-41	N/A	Public	$1,000,000	N/A
CNG-10	CNG	CA	Riverside County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
CNG-11	CNG	CA	Riverside County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
CNG-12	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
CNG-13	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
CNG-14	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
CNG-15	CNG	CA	San Bernardino County	N/A	225 vehicles	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	50%
CNG-16	CNG	CA	Tehachapi	CA-58 & CA-58B	339,000 DGE (8-10 vehicles)	Public	Not reported by participant; See Table 7 for estimated average CAPEX	40-60%
CNG-17	CNG	OR	Baker City	N/A	30 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	70%
CNG-18	CNG	OR	Bend	97 & 20	500 DGE/Hour	Public	$1,500,000	70%
CNG-19	CNG	OR	Boardman	I-84 & South Main Street	500 DGE/Hour	Public	$1,500,000	70%
CNG-20	CNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
CNG-21	CNG	OR	Eugene/Portland	I-5 Corridor	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
CNG-22	CNG	OR	La Grande	I-84 & 82	500 DGE/Hour	Public	$1,500,000	70%
CNG-23	CNG	OR	Medford	N/A	30 vehicles	Public	N/A	70%
CNG-24	CNG	OR	Ontario	I-84 & US-30	500 DGE/Hour	Public	$1,500,000	70%
CNG-25	CNG	OR	Pendleton	I-84 & US-395	500 DGE/Hour	Public	$1,500,000	70%

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
CNG-26	CNG	OR	Portland	I-205 & Sandy Boulevard	40 vehicles	Public and Private	$1,000,000	50-70%
CNG-27	CNG	OR	Portland	I-5 & I-405	500 DGE/Hour	Public	$1,500,000	70%
CNG-28	CNG	OR	Portland	N/A	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
CNG-29	CNG	OR	Salem	I-5 & OR-22	500 DGE/Hour	Public	$1,500,000	70%
CNG-30	CNG	OR	SE Portland	I-5 Corridor	33,900 DGE	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
CNG-31	CNG	OR	The Dalles	I-84 & US-197	500 DGE/Hour	Public	$1,500,000	70%
CNG-32	CNG	OR	Umatilla	I-82 & US-730	30 vehicles	Public	Not reported by participant; See Table 7 for estimated average CAPEX	70%
CNG-33	CNG	OR	Woodburn	OR-214 & I-5	40 vehicles	Private	$1,000,000	50-70%
CNG-34	CNG	WA	Clark County	I-5 Corridor	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
CNG-35	CNG	WA	Vancouver	I-5 Corridor	113,000 DGE	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
CNG-36	CNG	WA	Washington State	I-5 Corridor	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A

Liquefied Natural Gas

The following table shows all proposed LNG projects.

Table 30 Proposed LNG Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
LNG-1	LNG	OR	Eugene	I-5 & OR-58	5 vehicles	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
LNG-2	LNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	N/A	N/A	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
LNG-3	LNG	OR	Hermiston	I-82 & I-84	5 vehicles	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
LNG-4	LNG	OR	Portland	N/A	7,352 DGE (5 vehicles)	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
LNG-5	LNG	OR	Portland	I-205 & I-84	5 vehicles	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
LNG-6	LNG	WA	Seattle	N/A	7,352 DGE (5 vehicles)	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A
LNG-7	LNG	WA	Spokane	N/A	7,352 DGE (5 vehicles)	Public and Private	Not reported by participant; See Table 7 for estimated average CAPEX	N/A

Other Fuel Types

The following table shows all proposed infrastructure projects for other fuel types.

Table 31 Other Proposed Infrastructure Projects (Readiness Categories not Shown)

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Estimated Annual Fuel Throughput / # of Vehicles the Station Would Serve	Public, Private, or Limited Access	Reported CAPEX Estimate	Funding Needed (Percentage of CAPEX)
Biofuel-1	Biofuel	OR	Redmond	N/A	3-5 Million Gallons	Not Reported	N/A	N/A
Catenary Electric-1	Catenary Electric	CA	Between East Los Angeles and Riverside	CA-60 (East LA to Riverside)	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%
Catenary Electric-2	Catenary Electric	CA	Between Los Angeles and Las Vegas	I-15 Los Angeles to Las Vegas	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%
Catenary Electric-3	Catenary Electric	CA	Between Mettler and Sacramento	CA-99 (Mettler to Sacramento)	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%
Catenary Electric-4	Catenary Electric	CA	Between San Diego and Redding	I-5 (San Diego to Redding)	6000 trucks per day per direction	Public	$5-8.7m /Mile	0%
Catenary Electric-5	Catenary Electric	CA	I-710	I-710	14,000 trucks per day and direction	Public	$8.7m/mile	0%

Proposal Readiness Listing by State

All project proposals were evaluated by a common set of criteria (see Section VI). These projects were then bundled into one of three categories based on their level of readiness for funding, of which the cut-offs between them were qualitatively assessed. Table 32 and Table 33 show summaries of readiness evaluation results by state and by fuel type, respectively. Table 34 through Table 36 show all readiness listings by state, and Table 37 through Table 43 show all readiness listings by fuel type. Please note that twenty (20) proposals were unevaluated; five (5) catenary electric infrastructure proposals that was out of scope for this report, one (1) liquid biofuel station proposal which was out of scope, and the remaining 14 did not contain enough information to properly evaluate them.

Table 32 Proposal Readiness by State

	California	Oregon	Washington	Totals
Advanced	32	32	13	**77**
Emerging	13	14	3	**30**
Potential	15	1	4	**20**
Unevaluated	7	10	3	**20**
Totals	**67**	**57**	**23**	**147**

Table 33 Proposal Readiness by Fuel Type

	EV	H_2	LPG	CNG	LNG	Catenary Electric	Other[xxxix]	Totals
Advanced	37	9	13	15	3	0	0	**77**
Emerging	7	10	0	12	1	0	0	**30**
Potential	15	1	0	2	2	0	0	**20**
Unevaluated	3	3	0	7	1	5	1	**20**
Totals	**62**	**23**	**13**	**36**	**7**	**5**	**1**	**147**

[xxxix] One study participant proposed a biofuel station.

California

The following table shows all project proposals in California.

Table 34 California Proposed Infrastructure Project Readiness Listing[XL]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
CA-1	EV	CA	Banta	I-5 & I-205	Advanced
CA-2	EV	CA	Barstow	I-15 & I-40	Advanced
CA-3	EV	CA	Blythe	I-10 & CA-78	Advanced
CA-4	EV	CA	Fresno	CA-99 & CA-41	Advanced
CA-5	EV	CA	Hamburg Farms	I-5 & CA-165	Advanced
CA-6	EV	CA	Long Beach	301 Mediterranean Way, Long Beach CA	Advanced
CA-7	EV	CA	Long Beach	Port of Long Beach Terminal	Advanced
CA-8	EV	CA	National City	I-5 & CA-54	Advanced
CA-9	EV	CA	Red Bluff	I-5 & CA-36	Advanced
CA-10	EV	CA	Redding	I-5 & CA-44	Advanced
CA-11	EV	CA	Sacramento	I-80 & US-50	Advanced
CA-12	EV	CA	San Bernardino	1535 West 4th St San Bernardino, CA 92411	Advanced
CA-13	EV	CA	San Diego	I-5 & I-8	Advanced
CA-14	EV	CA	Weaverville	CA-299 & CA-44	Advanced
CA-15	EV	CA	Williams	I-5 & CA-20	Advanced
CA-16	EV	CA	Willow Creek	CA-299 & CA-96	Advanced
CA-17	EV	CA	Willows	I-5 & CA-162	Advanced
CA-18	H_2	CA	Long Beach	1926 East Pacific Coast Highway	Advanced
CA-19	H_2	CA	Ontario	4325 East Guasti Road	Advanced
CA-20	H_2	CA	Redding	I-5 & CA-44	Advanced
CA-21	LPG	CA	Corona	CA-91 & I-15	Advanced
CA-22	LPG	CA	Duarte	I-605 & I-210	Advanced
CA-23	LPG	CA	Hawthorne	N/A	Advanced
CA-24	LPG	CA	Norwalk	I-605 & I-105	Advanced
CA-25	LPG	CA	Ontario	I-10 & I-15	Advanced
CA-26	LPG	CA	Sherman Oaks	US-101 & I-405	Advanced
CA-27	CNG	CA	Bellflower	15330 Woodruff Ave., Bellflower, CA 90706	Advanced
CA-28	CNG	CA	Gardena	14800 South Spring St., Gardena CA 90248	Advanced
CA-29	CNG	CA	Lost Hills	I-5 & CA-46	Advanced
CA-30	CNG	CA	Lost Hills	I-5 & CA-46	Advanced

[XL] This listing includes seven proposals which were unevaluated, five catenary electric proposals and two hydrogen proposals. The catenary electric proposals were unevaluated as they were outside of the technological scope of this plan. The hydrogen proposals were unevaluated due to a lack of information necessary to evaluate them.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
CA-31	CNG	CA	Near Kettleman City	I-5 & CA-41	Advanced
CA-32	CNG	CA	Tehachapi	CA-58 & CA-58B	Advanced
CA-33	EV	CA	Bakersfield	N/A	Emerging
CA-34	EV	CA	Barstow	2825 W. Main St. Barstow, CA 92311	Emerging
CA-35	EV	CA	Los Angeles / Hobart	4000 East Sheila St Los Angeles, CA 90023	Emerging
CA-36	EV	CA	Stockton	6450 South Austin Rd. Stockton, CA 95215	Emerging
CA-37	CNG	CA	Barstow	I-15 & Lenwood Road	Emerging
CA-38	CNG	CA	Coachella	I-10 & Dillon Road	Emerging
CA-39	CNG	CA	Near Bakersfield	I-5 & CA-119	Emerging
CA-40	CNG	CA	Riverside County	N/A	Emerging
CA-41	CNG	CA	Riverside County	N/A	Emerging
CA-42	CNG	CA	San Bernardino County	N/A	Emerging
CA-43	CNG	CA	San Bernardino County	N/A	Emerging
CA-44	CNG	CA	San Bernardino County	N/A	Emerging
CA-45	CNG	CA	San Bernardino County	N/A	Emerging
CA-46	EV	CA	Bakersfield	Bakersfield, CA	Potential
CA-47	EV	CA	Between Los Angeles & Santa Barbara	US-101	Potential
CA-48	EV	CA	Between Sacramento & San Francisco	I-80	Potential
CA-49	EV	CA	Grapevine	I-5 & Edmonston Pumping Plant Road	Potential
CA-50	EV	CA	Inland Empire	I-15	Potential
CA-51	EV	CA	Inland Empire	Warehouse Districts Around Inland Empire	Potential
CA-52	EV	CA	Long Beach	Port of Long Beach	Potential
CA-53	EV	CA	Long Beach	Port of Long Beach Terminal	Potential
CA-54	EV	CA	Los Angeles	I-10	Potential
CA-55	EV	CA	Los Angeles	Warehouse Districts Around Los Angeles	Potential
CA-56	EV	CA	Los Angeles	Port of Los Angeles	Potential
CA-57	EV	CA	Near Coalinga	I-5 & CA-198	Potential
CA-58	EV	CA	Near Los Banos	I-5 & CA-152	Potential
CA-59	H_2	CA	Long Beach	I-710 & I-405	Potential

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
CA-60	CNG	CA	Bakersfield	Bakersfield, CA	Potential
CA-61	H_2	CA	Sacramento	N/A	Unevaluated
CA-62	H_2	CA	Sacramento	N/A	Unevaluated
CA-63	Catenary Electric	CA	Between East Los Angeles and Riverside	CA-60 (East LA to Riverside)	Unevaluated
CA-64	Catenary Electric	CA	Between Los Angeles and Las Vegas	I-15 Los Angeles to Las Vegas	Unevaluated
CA-65	Catenary Electric	CA	Between Mettler and Sacramento	CA-99 (Mettler to Sacramento)	Unevaluated
CA-66	Catenary Electric	CA	Between San Diego and Redding	I-5 (San Diego to Redding)	Unevaluated
CA-67	Catenary Electric	CA	Los Angeles County	I-710	Unevaluated

Oregon

The following table shows all project proposals in Oregon.

Table 35 Oregon Proposed Infrastructure Project Readiness Listing[XLI]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
OR-1	EV	OR	Bend	US-20 & US-97	Advanced
OR-2	EV	OR	Bend	US-97 & US-20	Advanced
OR-3	EV	OR	Boardman	I-84 & South Main Street	Advanced
OR-4	EV	OR	Eugene	I-5 & OR-126	Advanced
OR-5	EV	OR	La Grande	I-84 & OR-82	Advanced
OR-6	EV	OR	Medford	I-5 & OR-62	Advanced
OR-7	EV	OR	Ontario	I-84 & US-30	Advanced
OR-8	EV	OR	Pendleton	I-84 & US-395	Advanced
OR-9	EV	OR	Portland	I-84 & I-205	Advanced
OR-10	EV	OR	Portland	I-5 & I-405	Advanced
OR-11	EV	OR	Salem	I-5 & OR-22	Advanced
OR-12	EV	OR	The Dalles	I-84 & US-197	Advanced
OR-13	H_2	OR	Eugene	I-5 & I-105	Advanced
OR-14	H_2	OR	Grants Pass	I-5 & CA-99	Advanced
OR-15	H_2	OR	Portland	I-5 & I-84	Advanced
OR-16	LPG	OR	Boardman	I-84 & South Main Street	Advanced
OR-17	LPG	OR	Ontario	I-84 & US-30	Advanced
OR-18	LPG	OR	Pendleton	I-84 & US-395	Advanced
OR-19	LPG	OR	Roseburg	I-5 & SE Oak Avenue	Advanced

[XLI] The proposals marked "Unevaluated" did not contain enough data to properly evaluate those proposals.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
OR-20	LPG	OR	The Dalles	I-84 & US-197	Advanced
OR-21	CNG	OR	Bend	US-97 & US-20	Advanced
OR-22	CNG	OR	Boardman	I-84 & South Main Street	Advanced
OR-23	CNG	OR	La Grande	I-84 & OR-82	Advanced
OR-24	CNG	OR	Ontario	I-84 & US-30	Advanced
OR-25	CNG	OR	Pendleton	I-84 & US-395	Advanced
OR-26	CNG	OR	Portland	I-205 & Sandy Boulevard	Advanced
OR-27	CNG	OR	The Dalles	I-84 & US-197	Advanced
OR-28	CNG	OR	Umatilla	I-82 & US-730	Advanced
OR-29	CNG	OR	Woodburn	OR-214 & I-5	Advanced
OR-30	LNG	OR	Eugene	I-5 & OR-58	Advanced
OR-31	LNG	OR	Portland	N/A	Advanced
OR-32	LNG	OR	Portland	I-205 & I-84	Advanced
OR-33	H_2	OR	Bend	US-97 & US-20	Emerging
OR-34	H_2	OR	Boardman	I-84 & South Main Street	Emerging
OR-35	H_2	OR	Eugene	I-5 & OR-126	Emerging
OR-36	H_2	OR	La Grande	I-84 & OR-82	Emerging
OR-37	H_2	OR	Medford	I-5 & OR-62	Emerging
OR-38	H_2	OR	Ontario	I-84 & US-30	Emerging
OR-39	H_2	OR	Pendleton	I-84 & US-395	Emerging
OR-40	H_2	OR	Portland	I-5 & I-405	Emerging
OR-41	H_2	OR	Salem	I-5 & OR-22	Emerging
OR-42	H_2	OR	The Dalles	I-84 & US-197	Emerging
OR-43	CNG	OR	Baker City	N/A	Emerging
OR-44	CNG	OR	Portland	I-5 & I-405	Emerging
OR-45	CNG	OR	Salem	I-5 & OR-22	Emerging
OR-46	LNG	OR	Hermiston	I-82 & I-84	Emerging
OR-47	CNG	OR	Medford	N/A	Potential
OR-48	EV	OR	Eugene	3500 E 17th Ave Eugene OR 97403	Unevaluated
OR-49	EV	OR	Hood River County	N/A	Unevaluated
OR-50	EV	OR	Josephine County	N/A	Unevaluated
OR-51	H_2	OR	Portland	N/A	Unevaluated
OR-52	CNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	Unevaluated
OR-53	CNG	OR	Eugene/Portland	I-5 Corridor	Unevaluated
OR-54	CNG	OR	Portland	N/A	Unevaluated
OR-55	CNG	OR	SE Portland	I-5 Corridor	Unevaluated
OR-56	LNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	Unevaluated
OR-57	Biofuel	OR	Redmond	N/A	Unevaluated

Washington

The following table shows all project proposals in Washington.

Table 36 Washington Proposed Infrastructure Project Readiness Listing[XLII]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
WA-1	EV	WA	Bellevue	I-405 & I-5	Advanced
WA-2	EV	WA	Ellensburg	Main and Washington	Advanced
WA-3	EV	WA	Kennewick	I-82 & US-395	Advanced
WA-4	EV	WA	Olympia	Capital & Jefferson	Advanced
WA-5	EV	WA	Spokane	Division & Mission	Advanced
WA-6	EV	WA	Tacoma	Market & Pacific Avenue	Advanced
WA-7	EV	WA	Yakima	Yakima & 4th	Advanced
WA-8	EV	WA	Yakima	Nob Hill & 1st	Advanced
WA-9	H_2	WA	Seattle	I-5 & I-90	Advanced
WA-10[XLIII]	H_2	WA	Tacoma	Tacoma	Advanced
WA-11	H_2	WA	Tacoma	I-5 & WA-7	Advanced
WA-12	LPG	WA	Ellensburg	I-90 & I-82	Advanced
WA-13	LPG	WA	Ritzville	I-90 & WA-261	Advanced
WA-14	EV	WA	Everett	Cedar and Wentworth	Emerging
WA-15	EV	WA	Everett	Cedar and Pacific	Emerging
WA-16	EV	WA	Everett	Cedar and Pacific	Emerging
WA-17	EV	WA	Seattle	Port of Seattle	Potential
WA-18	EV	WA	Tacoma	Tacoma	Potential
WA-19	LNG	WA	Seattle	N/A	Potential
WA-20	LNG	WA	Spokane	N/A	Potential
WA-21	CNG	WA	Clark County	I-5 Corridor	Unevaluated
WA-22	CNG	WA	Vancouver	I-5 Corridor	Unevaluated
WA-23	CNG	WA	Washington State	I-5 Corridor	Unevaluated

[XLII] The proposals marked "Unevaluated" did not contain enough data to properly evaluate those proposals.
[XLIII] This proposal is for a 35 MW electrolysis station with an expected capacity of 10,000 kg/day. A hydrogen fueling station may or may not be included in the project.

Proposal Readiness Listing by Fuel Type

Electric Vehicle Charging

The following table shows all EV project proposals.

Table 37 Proposed EV Infrastructure Project Readiness Listing[XLIV]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
EV-1	EV	CA	Banta	I-5 & I-205	Advanced
EV-2	EV	CA	Barstow	I-15 & I-40	Advanced
EV-3	EV	CA	Blythe	I-10 & CA-78	Advanced
EV-4	EV	CA	Fresno	CA-99 & CA-41	Advanced
EV-5	EV	CA	Hamburg Farms	I-5 & CA-165	Advanced
EV-6	EV	CA	Long Beach	301 Mediterranean Way, Long Beach CA	Advanced
EV-7	EV	CA	Long Beach	Port of Long Beach Terminal	Advanced
EV-8	EV	CA	National City	I-5 & CA-54	Advanced
EV-9	EV	CA	Red Bluff	I-5 & CA-36	Advanced
EV-10	EV	CA	Redding	I-5 & CA-44	Advanced
EV-11	EV	CA	Sacramento	I-80 & US-50	Advanced
EV-12	EV	CA	San Bernardino	1535 West 4th St San Bernardino, CA 92411	Advanced
EV-13	EV	CA	San Diego	I-5 & I-8	Advanced
EV-14	EV	CA	Weaverville	CA-299 & CA-44	Advanced
EV-15	EV	CA	Williams	I-5 & CA-20	Advanced
EV-16	EV	CA	Willow Creek	CA-299 & CA-96	Advanced
EV-17	EV	CA	Willows	I-5 & CA-162	Advanced
EV-18	EV	OR	Bend	US-20 & US-97	Advanced
EV-19	EV	OR	Bend	US-97 & US-20	Advanced
EV-20	EV	OR	Boardman	I-84 & South Main Street	Advanced
EV-21	EV	OR	Eugene	I-5 & OR-126	Advanced
EV-22	EV	OR	La Grande	I-84 & OR-82	Advanced
EV-23	EV	OR	Medford	I-5 & OR-62	Advanced
EV-24	EV	OR	Ontario	I-84 & US-30	Advanced
EV-25	EV	OR	Pendleton	I-84 & US-395	Advanced
EV-26	EV	OR	Portland	I-84 & I-205	Advanced
EV-27	EV	OR	Portland	I-5 & I-405	Advanced
EV-28	EV	OR	Salem	I-5 & OR-22	Advanced
EV-29	EV	OR	The Dalles	I-84 & US-197	Advanced
EV-30	EV	WA	Bellevue	I-405 & I-5	Advanced
EV-31	EV	WA	Ellensburg	Main and Washington	Advanced

[XLIV] The proposals marked "Unevaluated" did not contain enough data to properly evaluate those proposals.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
EV-32	EV	WA	Kennewick	I-82 & US-395	Advanced
EV-33	EV	WA	Olympia	Capital & Jefferson	Advanced
EV-34	EV	WA	Spokane	Division & Mission	Advanced
EV-35	EV	WA	Tacoma	Market & Pacific Avenue	Advanced
EV-36	EV	WA	Yakima	Yakima & 4th	Advanced
EV-37	EV	WA	Yakima	Nob Hill & 1st	Advanced
EV-38	EV	CA	Bakersfield	N/A	Emerging
EV-39	EV	CA	Barstow	2825 W. Main St. Barstow, CA 92311	Emerging
EV-40	EV	CA	Los Angeles / Hobart	4000 East Sheila St Los Angeles, CA 90023	Emerging
EV-41	EV	CA	Stockton	6450 South Austin Rd. Stockton, CA 95215	Emerging
EV-42	EV	WA	Everett	Cedar and Wentworth	Emerging
EV-43	EV	WA	Everett	Cedar and Pacific	Emerging
EV-44	EV	WA	Everett	Cedar and Pacific	Emerging
EV-45	EV	CA	Bakersfield	Bakersfield, CA	Potential
EV-46	EV	CA	Between Los Angeles & Santa Barbara	US-101	Potential
EV-47	EV	CA	Between Sacramento & San Francisco	I-80	Potential
EV-48	EV	CA	Grapevine	I-5 & Edmonston Pumping Plant Road	Potential
EV-49	EV	CA	Inland Empire	I-15	Potential
EV-50	EV	CA	Inland Empire	Warehouse Districts Around Inland Empire	Potential
EV-51	EV	CA	Long Beach	Port of Long Beach	Potential
EV-52	EV	CA	Long Beach	Port of Long Beach Terminal	Potential
EV-53	EV	CA	Los Angeles	I-10	Potential
EV-54	EV	CA	Los Angeles	Warehouse Districts Around Los Angeles	Potential
EV-55	EV	CA	Los Angeles	Port of Los Angeles	Potential
EV-56	EV	CA	Near Coalinga	I-5 & CA-198	Potential
EV-57	EV	CA	Near Los Banos	I-5 & CA-152	Potential
EV-58	EV	WA	Seattle	Port of Seattle	Potential
EV-59	EV	WA	Tacoma	Tacoma	Potential
EV-60	EV	OR	Eugene	3500 E 17th Ave Eugene OR 97403	Unevaluated
EV-61	EV	OR	Hood River County	N/A	Unevaluated
EV-62	EV	OR	Josephine County	N/A	Unevaluated

Hydrogen

The following table shows all H_2 project proposals.

Table 38 Proposed H2 Infrastructure Project Readiness Listing[XLV]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
H_2-1	H_2	CA	Long Beach	1926 East Pacific Coast Highway	Advanced
H_2-2	H_2	CA	Ontario	4325 East Guasti Road	Advanced
H_2-3	H_2	CA	Redding	I-5 & CA-44	Advanced
H_2-4	H_2	OR	Eugene	I-5 & I-105	Advanced
H_2-5	H_2	OR	Grants Pass	I-5 & CA-99	Advanced
H_2-6	H_2	OR	Portland	I-5 & I-84	Advanced
H_2-7	H_2	WA	Seattle	I-5 & I-90	Advanced
H_2-8[XLVI]	H_2	WA	Tacoma	Tacoma	Advanced
H_2-9	H_2	WA	Tacoma	I-5 & WA-7	Advanced
H_2-10	H_2	OR	Bend	US-97 & US-20	Emerging
H_2-11	H_2	OR	Boardman	I-84 & South Main Street	Emerging
H_2-12	H_2	OR	Eugene	I-5 & OR-126	Emerging
H_2-13	H_2	OR	La Grande	I-84 & OR-82	Emerging
H_2-14	H_2	OR	Medford	I-5 & OR-62	Emerging
H_2-15	H_2	OR	Ontario	I-84 & US-30	Emerging
H_2-16	H_2	OR	Pendleton	I-84 & US-395	Emerging
H_2-17	H_2	OR	Portland	I-5 & I-405	Emerging
H_2-18	H_2	OR	Salem	I-5 & OR-22	Emerging
H_2-19	H_2	OR	The Dalles	I-84 & US-197	Emerging
H_2-20	H_2	CA	Long Beach	I-710 & I-405	Potential
H_2-21	H_2	CA	Sacramento	N/A	Unevaluated
H_2-22	H_2	CA	Sacramento	N/A	Unevaluated
H_2-23	H_2	OR	Portland	N/A	Unevaluated

[XLV] The proposals marked "Unevaluated" did not contain enough data to properly evaluate those proposals.

[XLVI] This proposal is for a 35 MW electrolysis station with an expected capacity of 10,000 kg/day. A hydrogen fueling station may or may not be included in the project.

Liquefied Petroleum Gas (Propane)

The following table shows all LPG project proposals.

Table 39 Proposed LPG Infrastructure Project Readiness Listing

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
LPG-1	LPG	CA	Corona	CA-91 & I-15	Advanced
LPG-2	LPG	CA	Duarte	I-605 & I-210	Advanced
LPG-3	LPG	CA	Hawthorne	N/A	Advanced
LPG-4	LPG	CA	Norwalk	I-605 & I-105	Advanced
LPG-5	LPG	CA	Ontario	I-10 & I-15	Advanced
LPG-6	LPG	CA	Sherman Oaks	US-101 & I-405	Advanced
LPG-7	LPG	OR	Boardman	I-84 & South Main Street	Advanced
LPG-8	LPG	OR	Ontario	I-84 & US-30	Advanced
LPG-9	LPG	OR	Pendleton	I-84 & US-395	Advanced
LPG-10	LPG	OR	Roseburg	I-5 & SE Oak Avenue	Advanced
LPG-11	LPG	OR	The Dalles	I-84 & US-197	Advanced
LPG-12	LPG	WA	Ellensburg	I-90 & I-82	Advanced
LPG-13	LPG	WA	Ritzville	I-90 & WA-261	Advanced

Compressed Natural Gas

The following table shows all CNG project proposals.

Table 40 Proposed CNG Infrastructure Project Readiness Listing[XLVII]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
CNG-1	CNG	CA	Bellflower	15330 Woodruff Ave., Bellflower, CA 90706	Advanced
CNG-2	CNG	CA	Gardena	14800 South Spring St., Gardena CA 90248	Advanced
CNG-3	CNG	CA	Lost Hills	I-5 & CA-46	Advanced
CNG-4	CNG	CA	Lost Hills	I-5 & CA-46	Advanced
CNG-5	CNG	CA	Near Kettleman City	I-5 & CA-41	Advanced
CNG-6	CNG	CA	Tehachapi	CA-58 & CA-58B	Advanced
CNG-7	CNG	OR	Bend	US-97 & US-20	Advanced
CNG-8	CNG	OR	Boardman	I-84 & South Main Street	Advanced
CNG-9	CNG	OR	La Grande	I-84 & OR-82	Advanced
CNG-10	CNG	OR	Ontario	I-84 & US-30	Advanced
CNG-11	CNG	OR	Pendleton	I-84 & US-395	Advanced
CNG-12	CNG	OR	Portland	I-205 & Sandy Boulevard	Advanced
CNG-13	CNG	OR	The Dalles	I-84 & US-197	Advanced
CNG-14	CNG	OR	Umatilla	I-82 & US-730	Advanced
CNG-15	CNG	OR	Woodburn	OR-214 & I-5	Advanced
CNG-16	CNG	CA	Barstow	I-15 & Lenwood Road	Emerging
CNG-17	CNG	CA	Coachella	I-10 & Dillon Road	Emerging
CNG-18	CNG	CA	Near Bakersfield	I-5 & CA-119	Emerging
CNG-19	CNG	CA	Riverside County	N/A	Emerging
CNG-20	CNG	CA	Riverside County	N/A	Emerging
CNG-21	CNG	CA	San Bernardino County	N/A	Emerging
CNG-22	CNG	CA	San Bernardino County	N/A	Emerging
CNG-23	CNG	CA	San Bernardino County	N/A	Emerging
CNG-24	CNG	CA	San Bernardino County	N/A	Emerging
CNG-25	CNG	OR	Baker City	N/A	Emerging
CNG-26	CNG	OR	Portland	I-5 & I-405	Emerging
CNG-27	CNG	OR	Salem	I-5 & OR-22	Emerging
CNG-28	CNG	CA	Bakersfield	Bakersfield, CA	Potential
CNG-29	CNG	OR	Medford	N/A	Potential
CNG-30	CNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	Unevaluated

[XLVII] The proposals marked “Unevaluated” did not contain enough data to properly evaluate those proposals.

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
CNG-31	CNG	OR	Eugene/Portland	I-5 Corridor	Unevaluated
CNG-32	CNG	OR	Portland	N/A	Unevaluated
CNG-33	CNG	OR	SE Portland	I-5 Corridor	Unevaluated
CNG-34	CNG	WA	Clark County	I-5 Corridor	Unevaluated
CNG-35	CNG	WA	Vancouver	I-5 Corridor	Unevaluated
CNG-36	CNG	WA	Washington State	I-5 Corridor	Unevaluated

Liquefied Natural Gas

The following table shows all LNG project proposals.

Table 41 Proposed LNG Infrastructure Project Readiness Listing[XLVIII]

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
LNG-1	LNG	OR	Eugene	I-5 & OR-58	Advanced
LNG-2	LNG	OR	Portland	N/A	Advanced
LNG-3	LNG	OR	Portland	I-205 & I-84	Advanced
LNG-4	LNG	OR	Hermiston	I-82 & I-84	Emerging
LNG-5	LNG	WA	Seattle	N/A	Potential
LNG-6	LNG	WA	Spokane	N/A	Potential
LNG-7	LNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	Unevaluated

[XLVIII] The proposals marked "Unevaluated" did not contain enough data to properly evaluate those proposals.

Other Fuel Types

Catenary Electric

The following table shows all Catenary Electric project proposals. As catenary electric projects are not within the technological scope of this project, they were not included in the readiness evaluations.

Table 42 Proposed Catenary EV Infrastructure Project Readiness Listing

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
Catenary Electric-1	Catenary Electric	CA	Between East Los Angeles and Riverside	CA-60 (East LA to Riverside)	Unevaluated
Catenary Electric-2	Catenary Electric	CA	Between Los Angeles and Las Vegas	I-15 Los Angeles to Las Vegas	Unevaluated
Catenary Electric-3	Catenary Electric	CA	Between Mettler and Sacramento	CA-99 (Mettler to Sacramento)	Unevaluated
Catenary Electric-4	Catenary Electric	CA	Between San Diego and Redding	I-5 (San Diego to Redding)	Unevaluated
Catenary Electric-5	Catenary Electric	CA	Los Angeles County	I-710	Unevaluated

Liquid Biofuel

The following table shows one other project proposal received for a biofuel station. As biofuel projects are not within the technological scope of this project, this one was not included in the readiness evaluations.

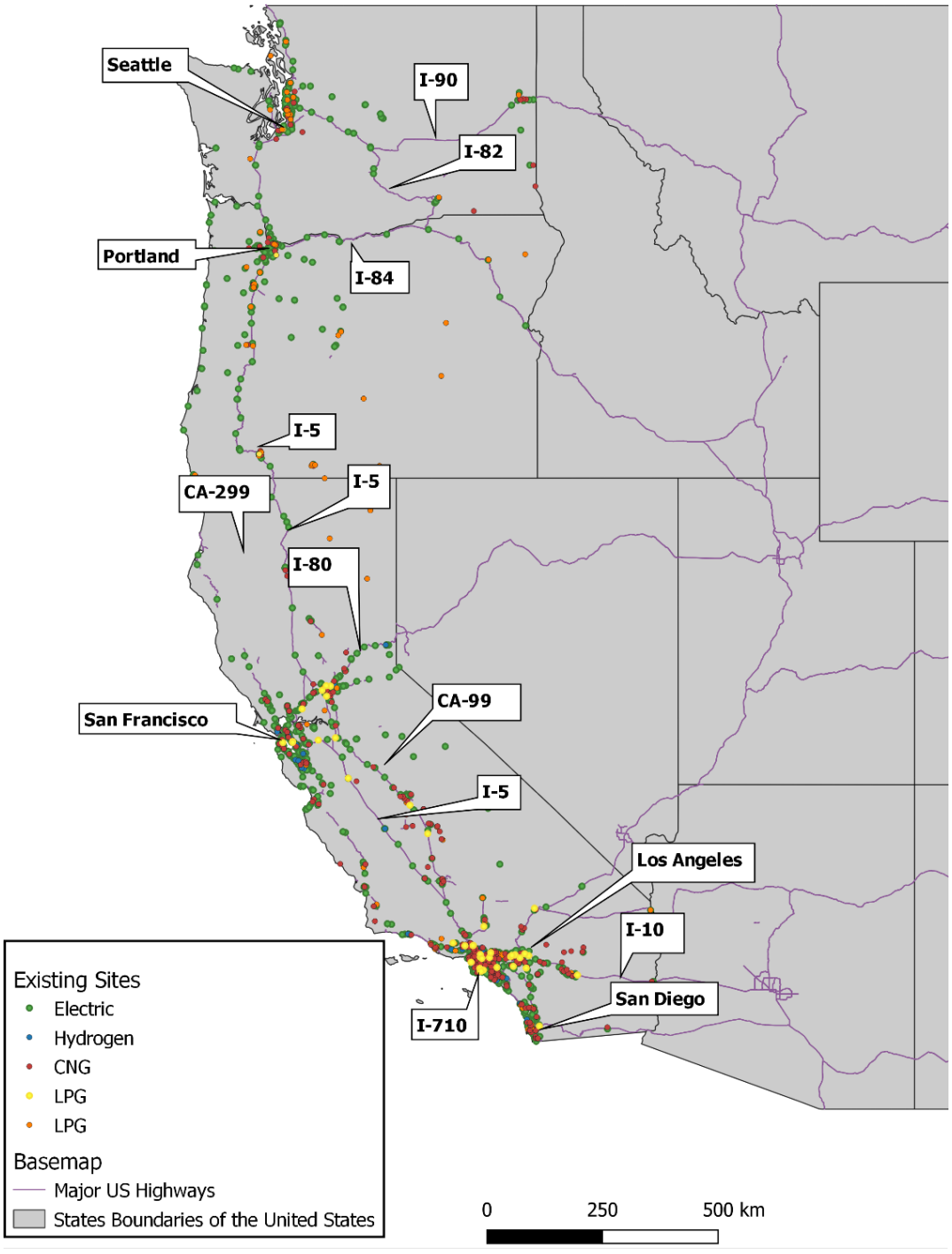
Table 43 Proposed Liquid Biofuel Infrastructure Project Readiness Listing

Number	Fuel Type	Proposed State	Proposed City or County	Proposed Address or Interchange	Readiness Category
Biofuel-1	Biofuel	OR	Redmond	N/A	Unevaluated

Existing and Proposed Infrastructure Maps

Figure 9 shows all existing EV, H_2, LPG, CNG, and LNG sites in California, Oregon, and Washington. It is important to note that this map includes light-duty as well as MHD fueling stations. The FHWA Alternative Fuel Corridor designation program served as the data source for existing alternative fuel station locations. FHWA counts all existing stations regardless of its ability to service light-duty, medium-duty, or heavy-duty vehicles. Further, at the time of writing this strategic development plan, the FHWA's corridor maps do not offer an apparent method for disaggregating light-duty only stations from MHD-accessible stations. Therefore, it could not be determined from these maps alone whether each given existing station services light-duty, medium-duty, and/or heavy-duty vehicles. Given the current state of MHD alternative fuel vehicle technology, however, it is likely that many EV and H_2 stations shown are only accessible by light-duty vehicles. Despite this, the FHWA's Alternative Fuel Corridor designation program and its associated data on existing alternative fuel station locations provide a valuable starting point in assessing the gaps in alternative fuel vehicle infrastructure on the West Coast. Further refining of these maps to show existing stations which service only MHDVs is a needed next step to accurately assess these gaps, and to identify how the infrastructure projects proposed in this strategic plan might fill-in those gaps.

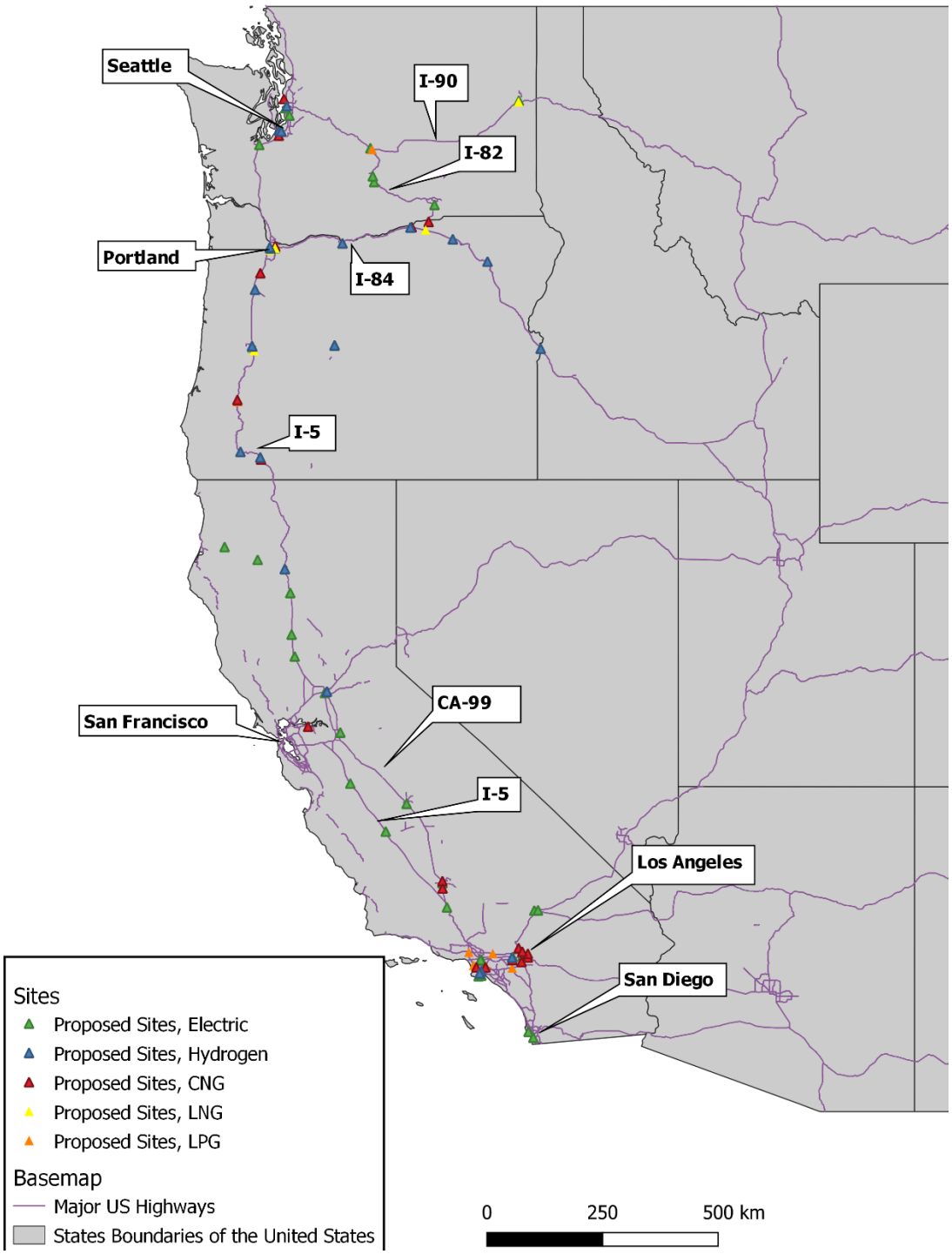
Figure 9: Existing Alternative Fuel Stations in California, Oregon, and Washington[XLIX]



[XLIX] Readers should assume that this map shows light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

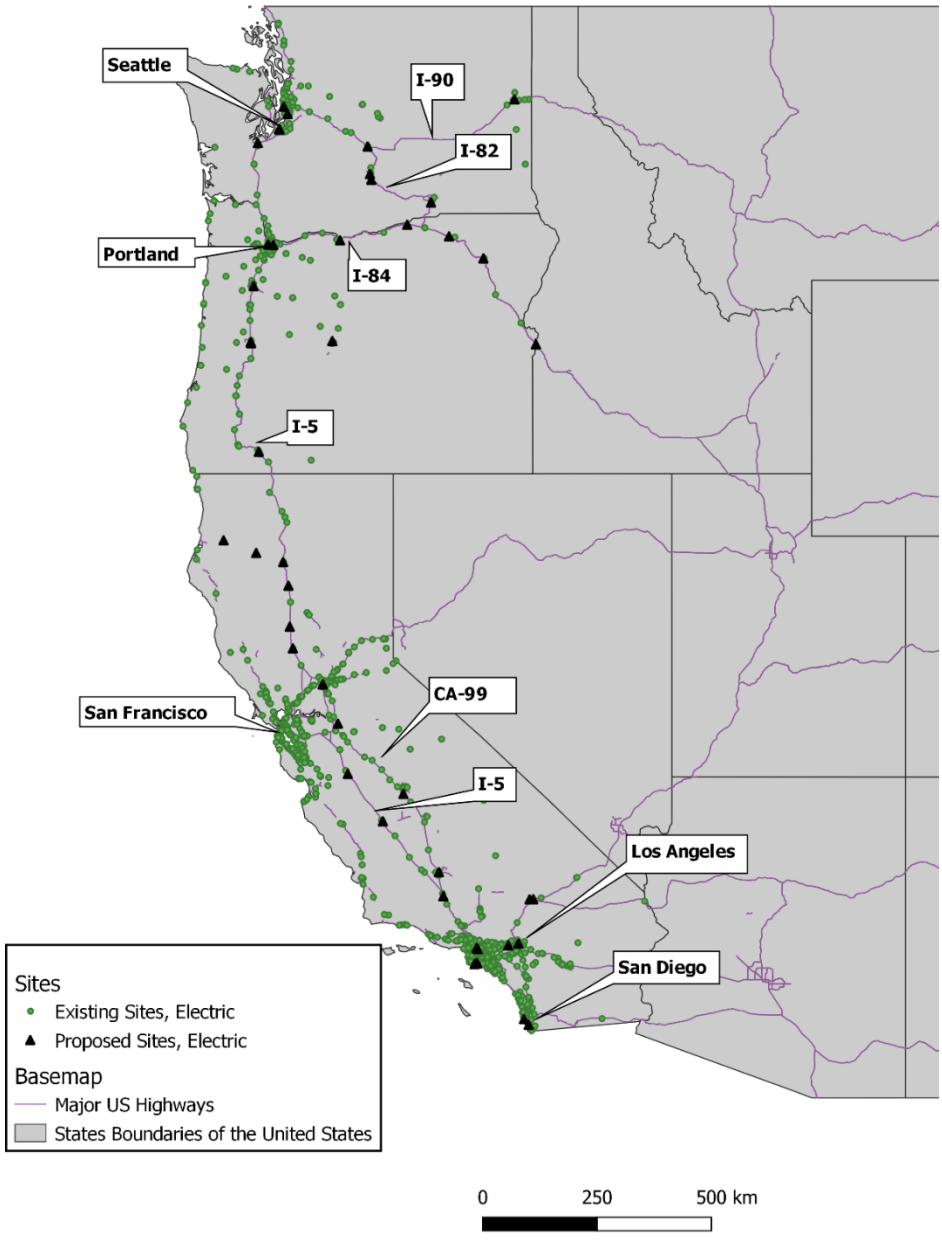
The next map (Figure 10) shows the location of all the proposed alternative fuel stations.

Figure 10: Proposed MHD Alternative Fuel Stations in California, Oregon, and Washington



The following map (Figure 11) shows existing and proposed electric charging stations. While many proposed stations are in Seattle, San Francisco, and Los Angeles, several are located in northern California along the I-5 and away from major metro areas. Likewise, a couple stations are suggested in Washington away from Seattle.

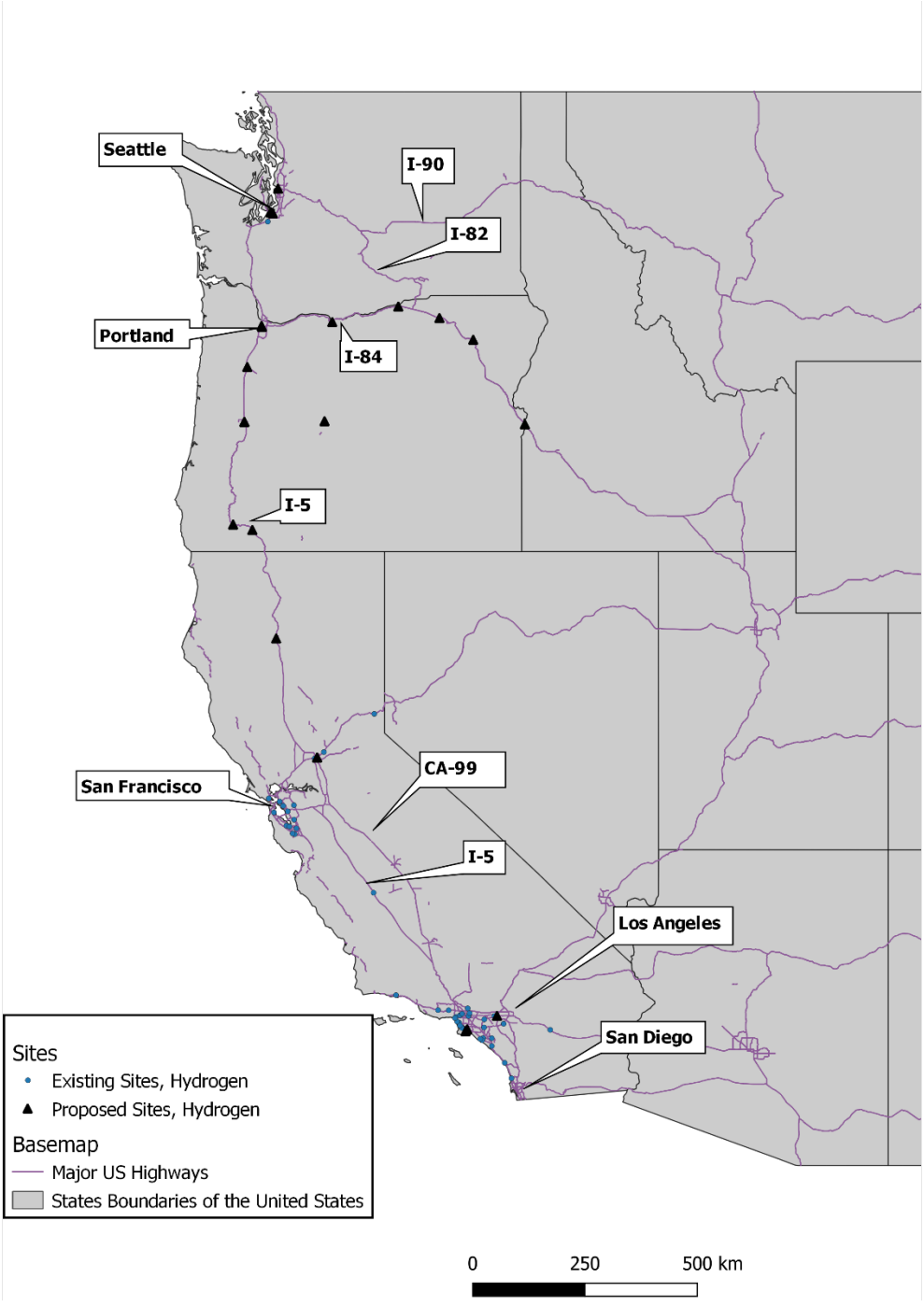
Figure 11: Existing and Proposed Electric Charging Stations in California, Oregon, and Washington[L]



[L] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

Figure 12 shows existing and proposed Hydrogen stations.

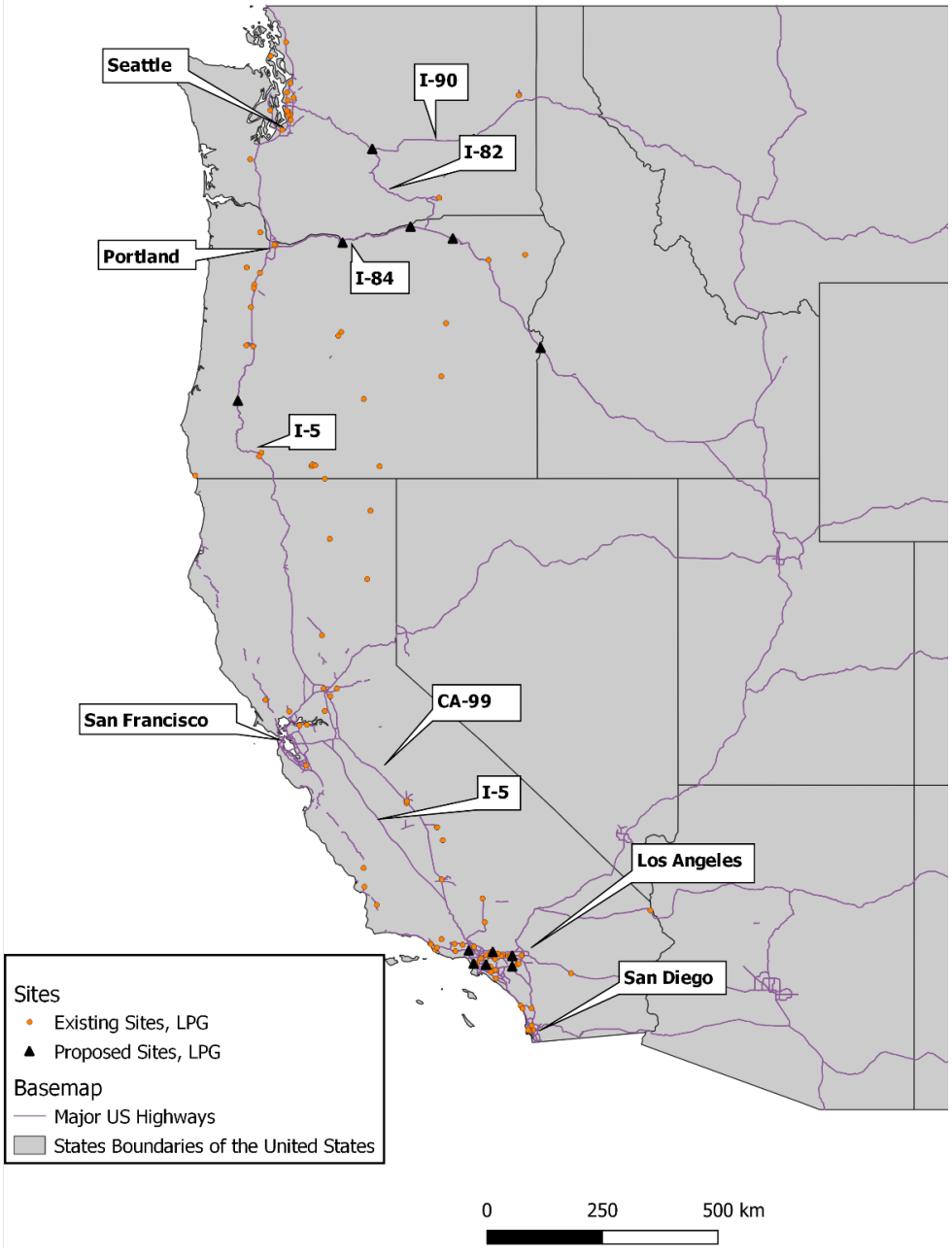
Figure 12: Existing and Proposed H_2 Fueling Stations in California, Oregon, and Washington[LI]



[LI] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

Figure 13 shows existing and proposed LPG stations. Most proposed stations are in the Los Angeles area with one on I-90 in Washington State.

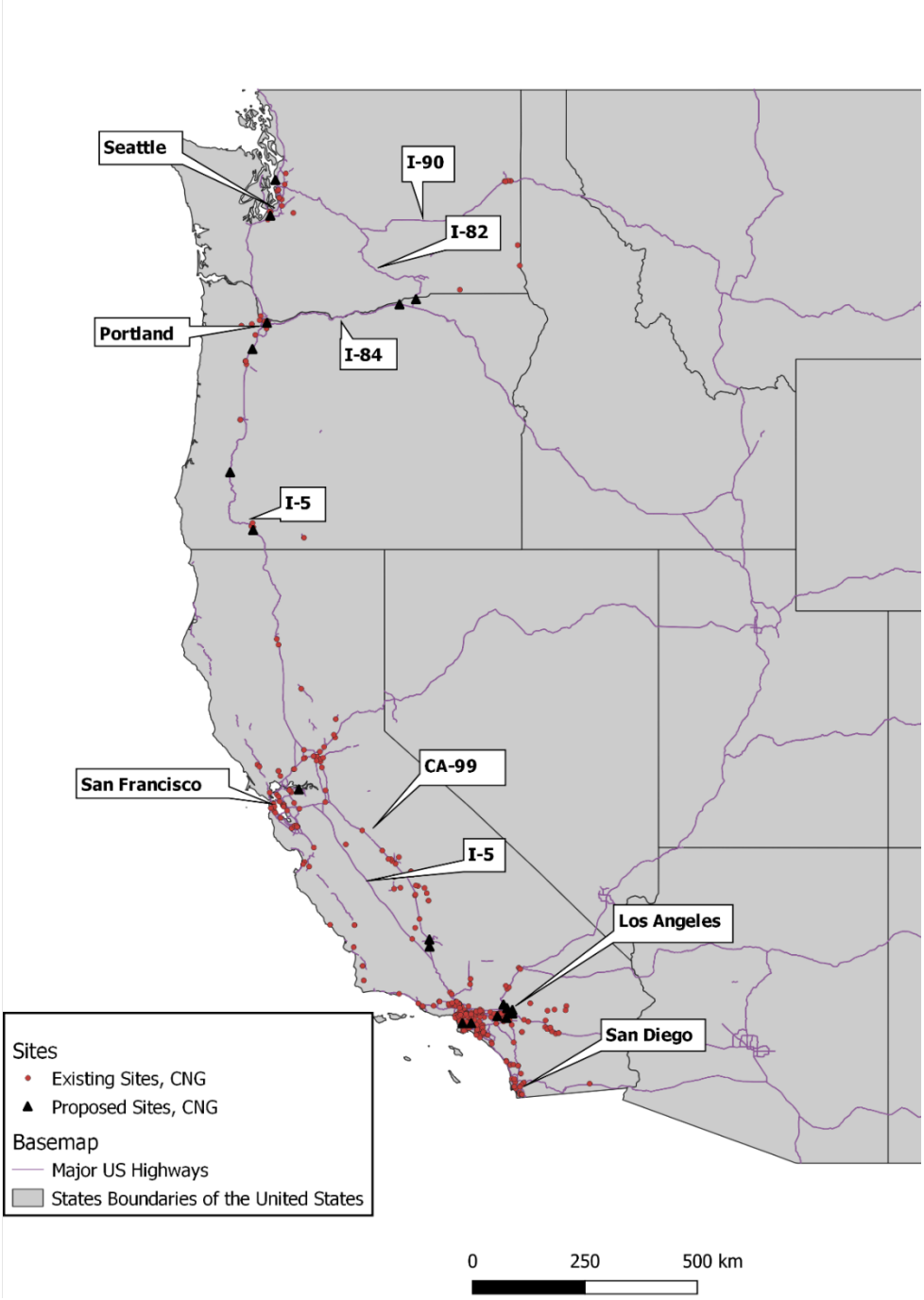
Figure 13: Existing and Proposed LPG Fueling Stations in California, Oregon, and Washington[LII]



[LII] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

Figure 14 shows existing and proposed CNG fueling stations in California, Oregon, and Washington. Proposed sites are distributed throughout all three West Coast states, mostly near major cities.

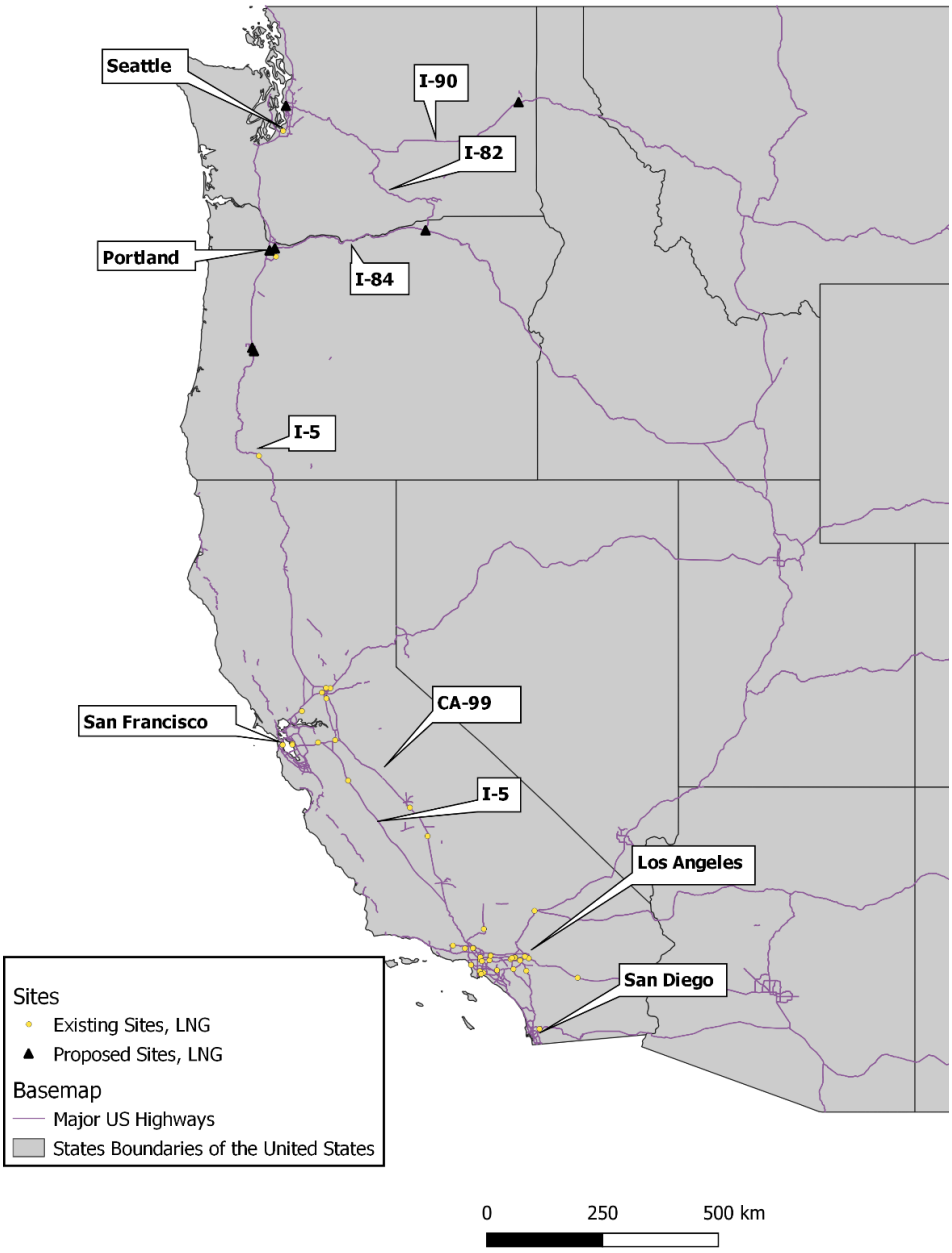
Figure 14: Existing and Proposed CNG Fueling Stations in California, Oregon, and Washington[LIII]



[LIII] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

The following map (Figure 15) shows existing LNG sites along with LNG sites proposed by survey respondents. Like CNG, most proposed sites are near major cities like Los Angeles and Portland, while a few others are suggested to be located on corridors away from those hubs.

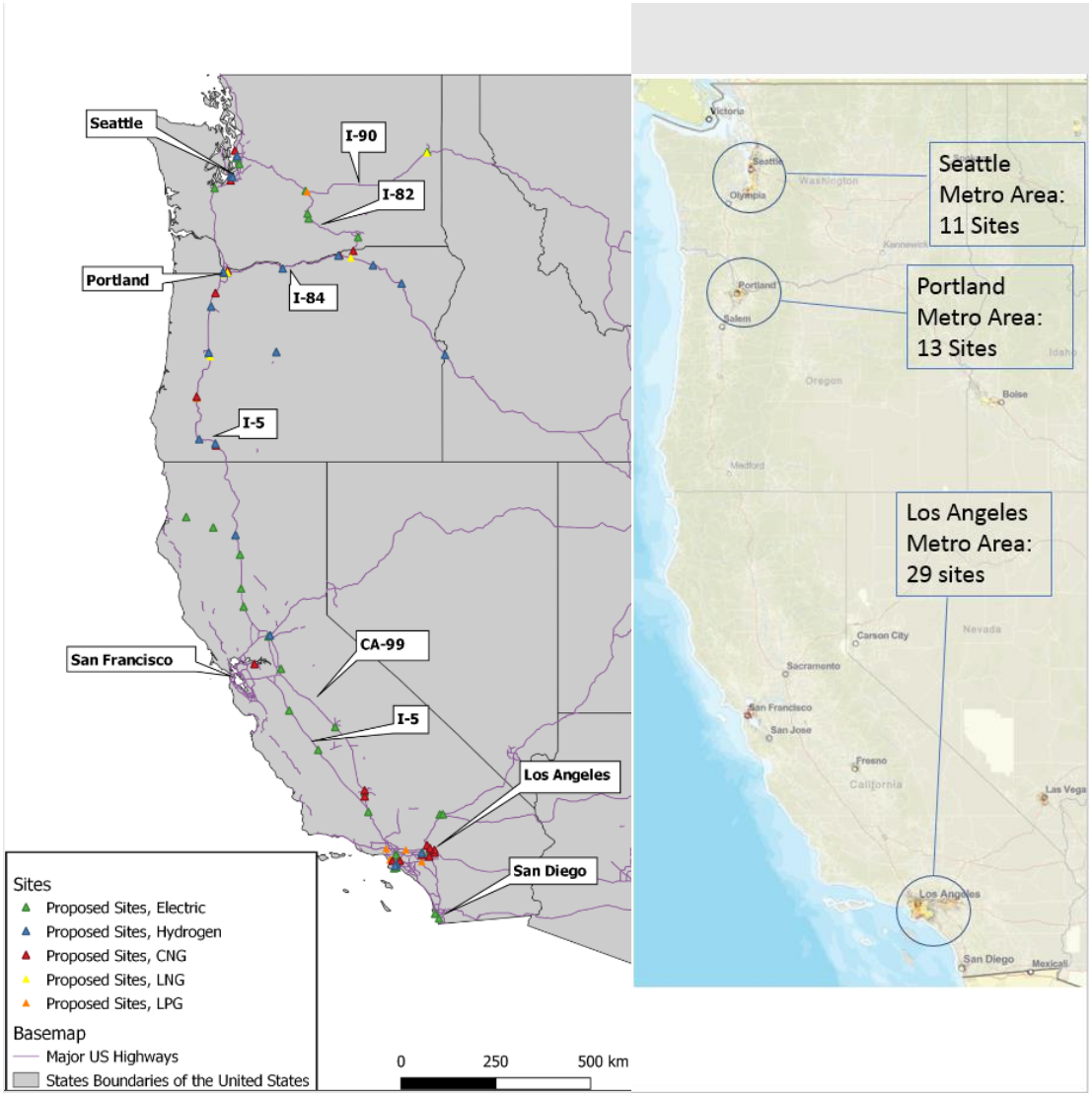
Figure 15: Existing and Proposed LNG Fueling Stations in California, Oregon, and Washington[LIV]



[LIV] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

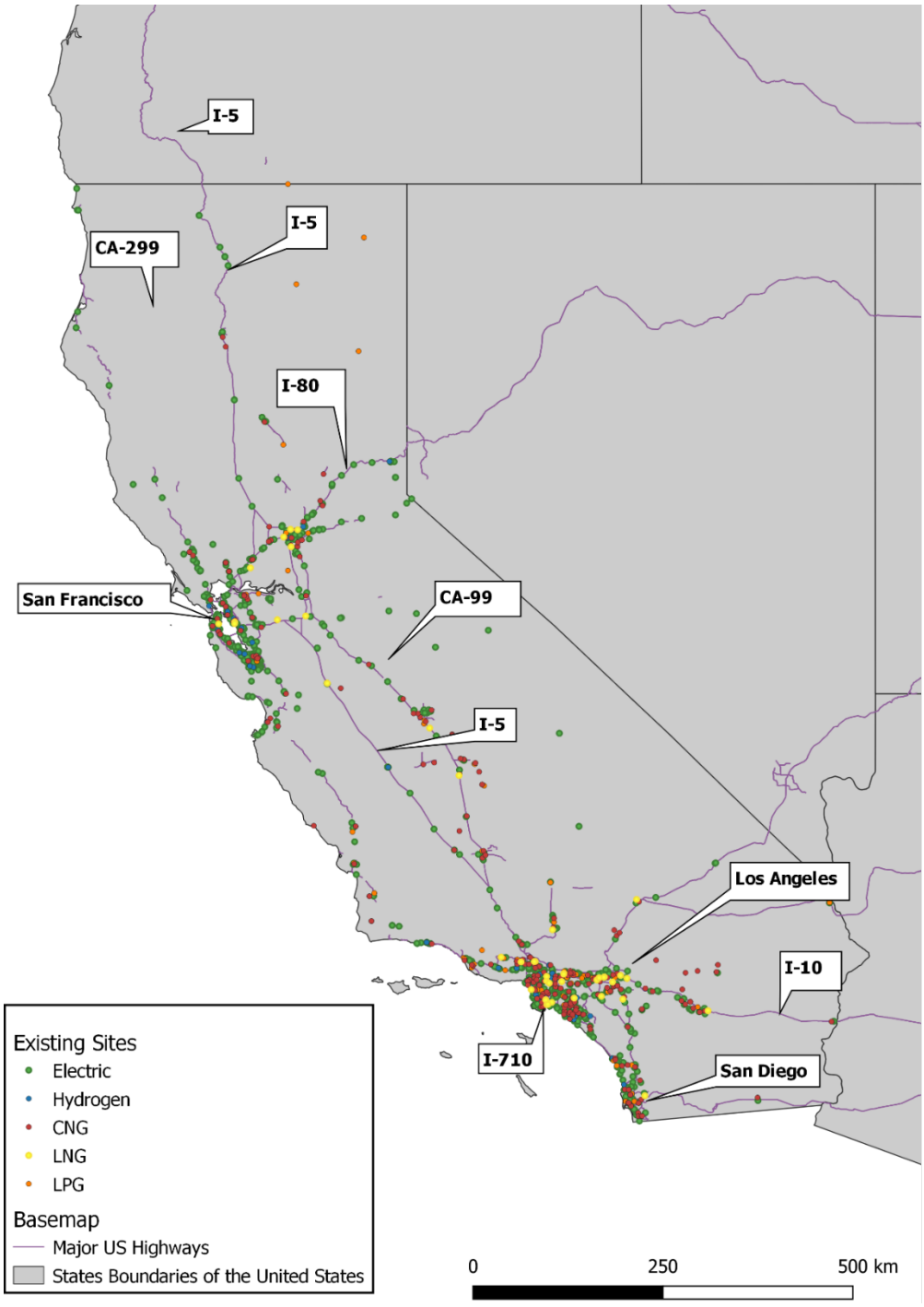
Finally, the following figure shows two maps that demonstrate the overlap of proposed sites and areas that disproportionately suffer from diesel emissions exposure (according to EPA's EJSCREEN tool). The map on the left shows the proposed sites for this report and the map on the right shows a screenshot of the EJSCREEN tool for National Air Toxics Assessment (NATA) Diesel PM (≥5 µg/m^3).

Figure 16: NATA Diesel PM Map for California, Oregon, and Washington



X. APPENDIX A: ADDITIONAL INFRASTRUCTURE SITE MAPS

Figure 17 California Existing Alternative Fuel Infrastructure Sites (All Fuels)[LV]



[LV] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

Figure 18 California Proposed Alternative Fuel Infrastructure Sites (All Fuels, 147 Sites)

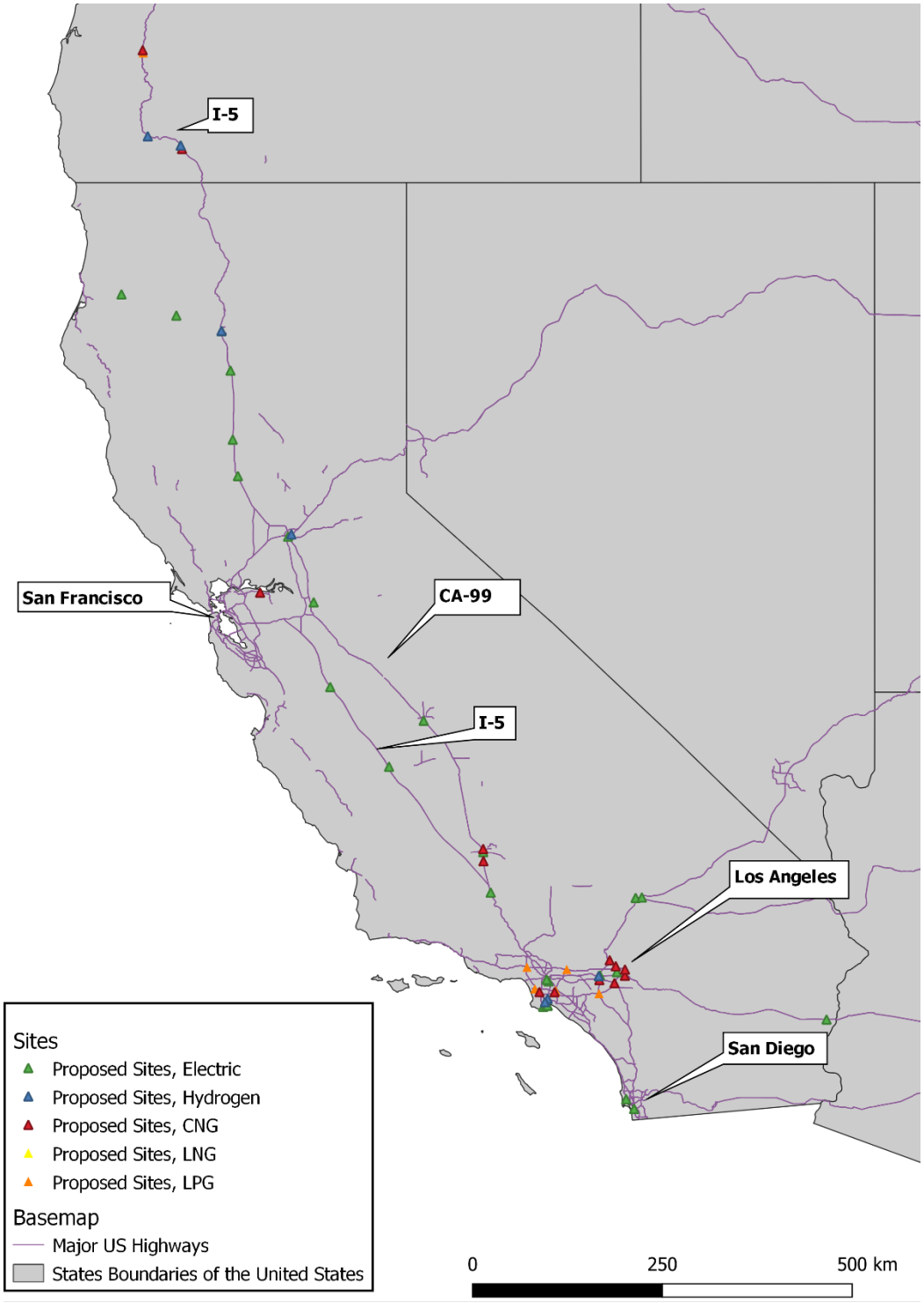
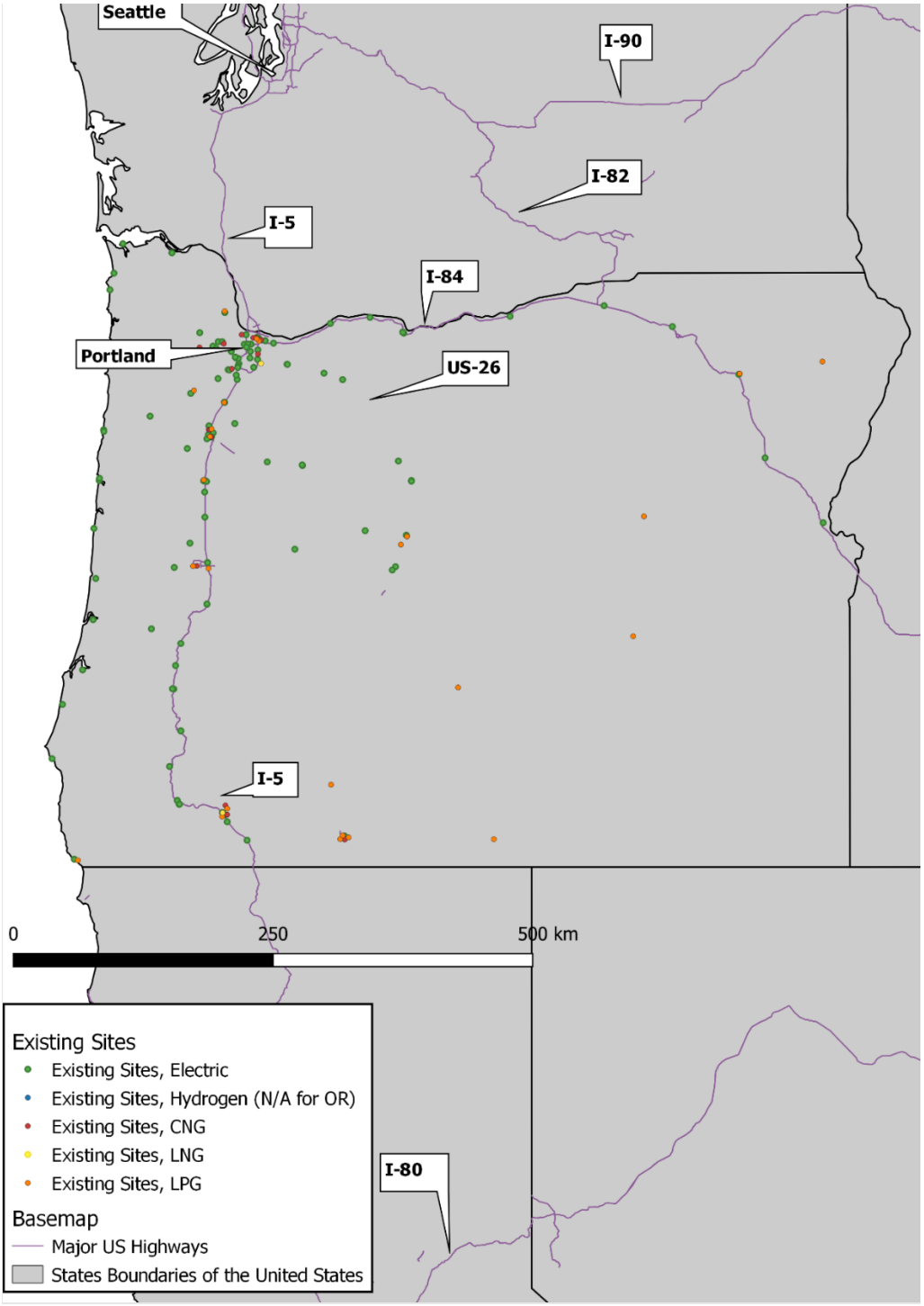


Figure 19 Oregon Existing Alternative Fuel Infrastructure Sites (All Fuels)[LVI]



[LVI] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations..

Figure 20 Oregon Proposed Alternative Fuel Infrastructure Sites (All Fuels, 57 Sites)

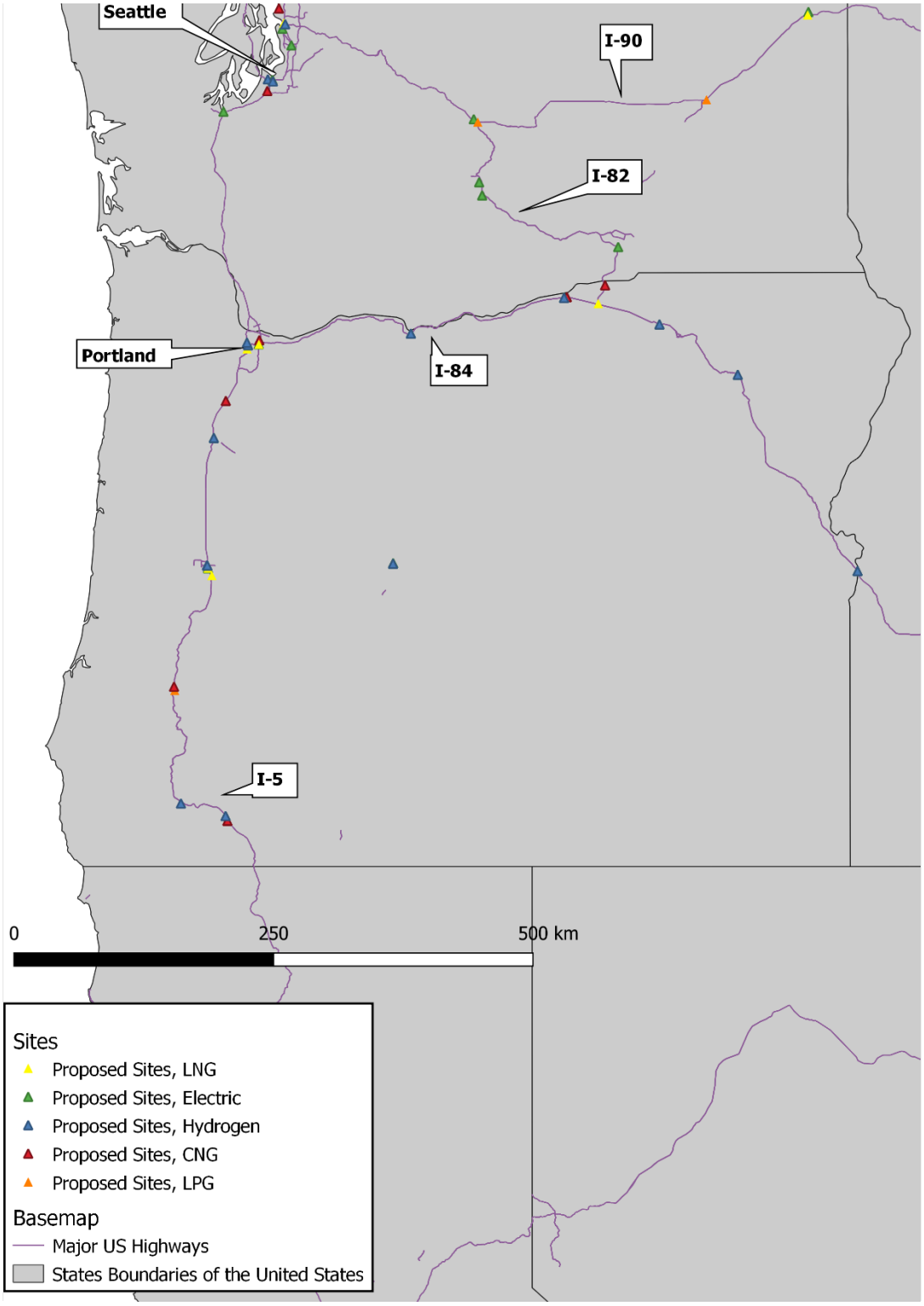
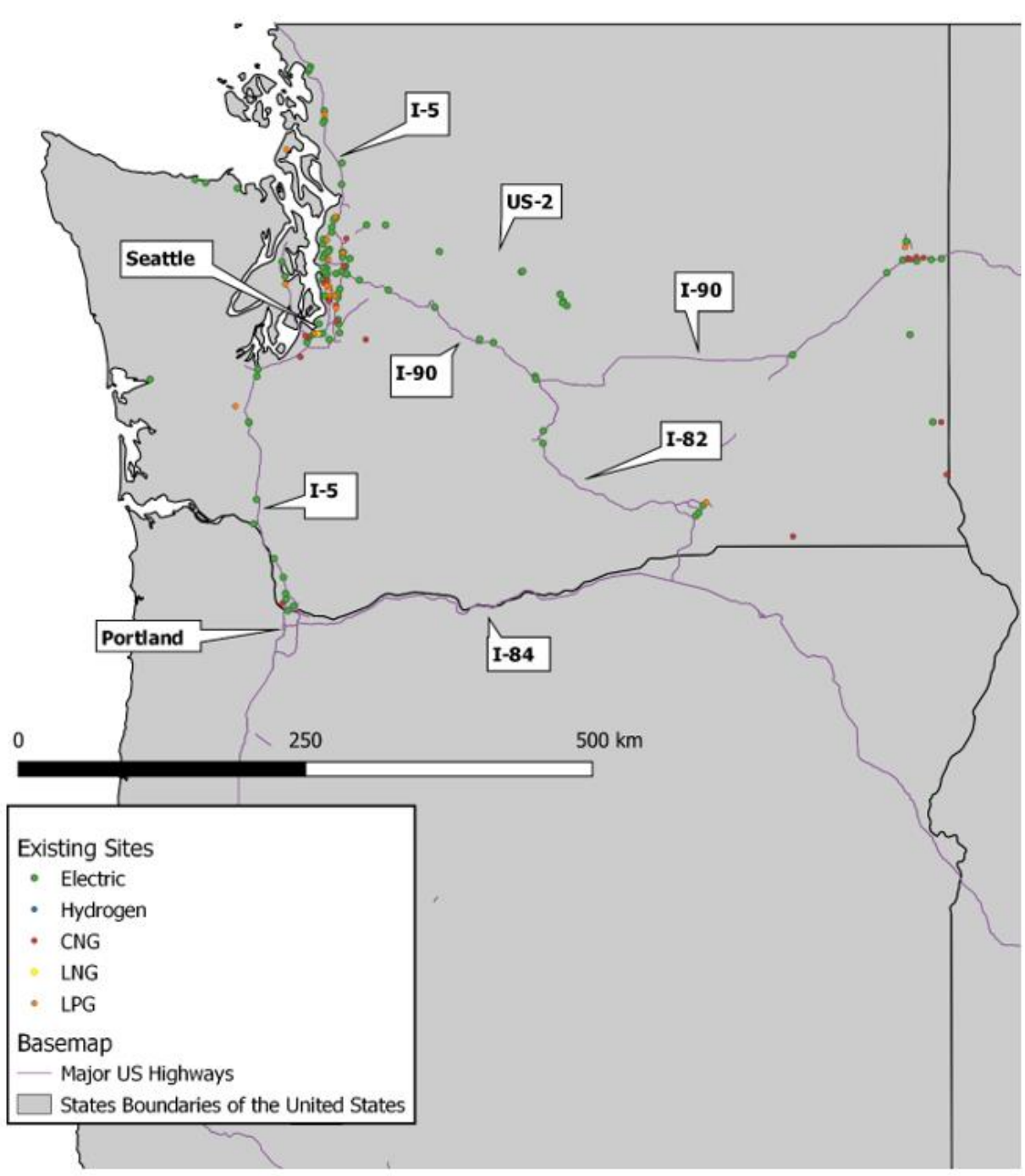
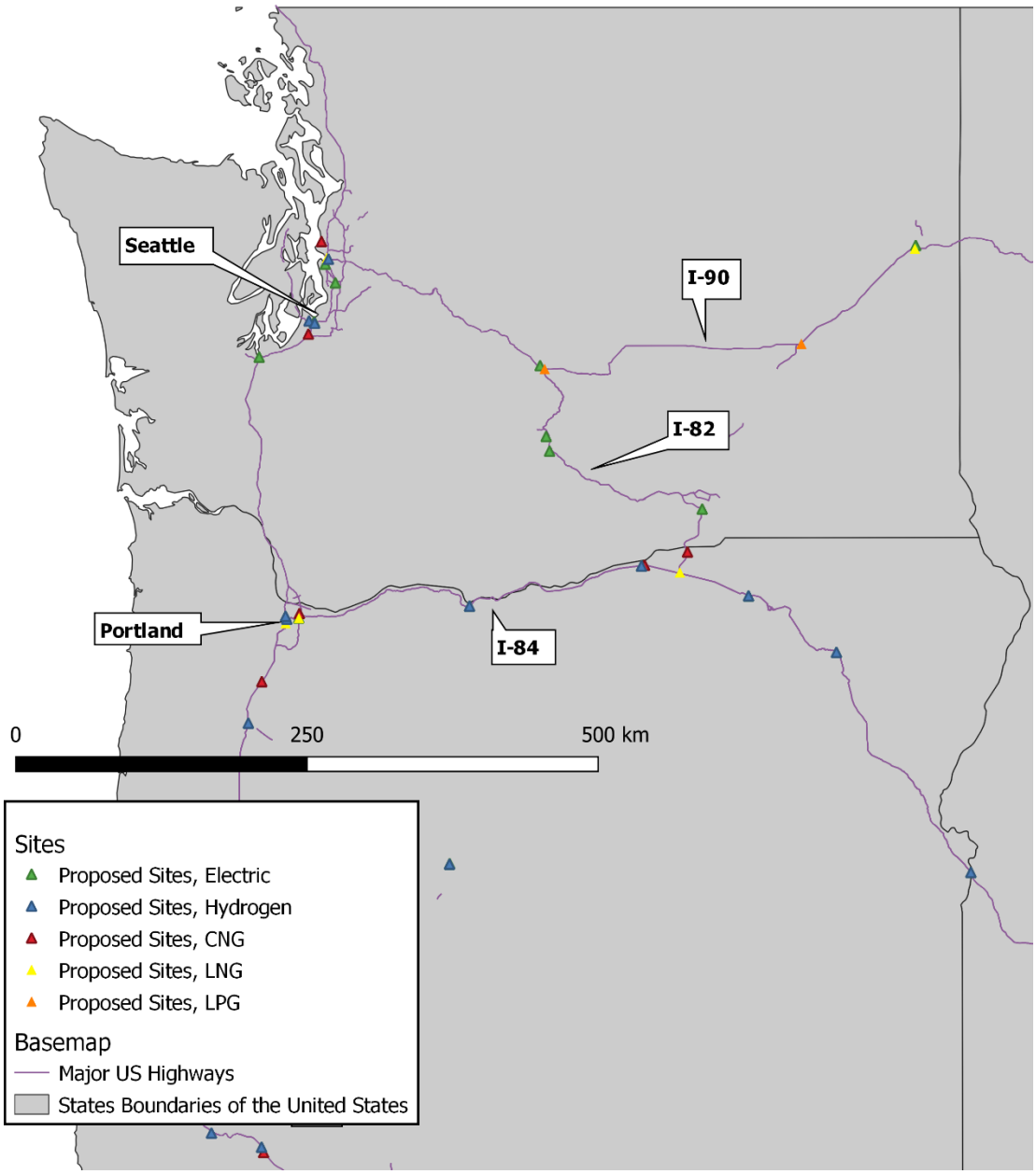


Figure 21 Washington Existing Alternative Fuel Infrastructure Sites (All Fuels)[LVII]



[LVII] Readers should assume that the existing stations on this map include light-duty only stations along with MHD-accessible stations. The source of the existing fueling station data (FHWA Alternative Fuel Corridor Designation) did not offer a method to disaggregate light-duty only stations from MHD-accessible stations.

Figure 22 Washington Proposed Alternative Fuel Infrastructure Sites (All Fuels, 23 Sites)



XI. APPENDIX B: ENVIRONMENTAL JUSTICE CONSIDERATION TABLES

CALSTART evaluated projects proposed in this strategic plan to identify if they may be located within environmental justice (EJ) or disadvantaged communities. The aim of this is to help AFICC partners understand how the proposed projects may serve as important emission reduction solutions for NAAQS non-attainment areas, air quality improvement and public health benefits. For proposed California sites, CALSTART used CalEnviroScreen 3.0 and its combined score on 19 total indicators. For Oregon and Washington, the EPA's EJ mapping and screening tool called EJSCREEN was used. Specifically, CALSTART considered NATA Diesel PM, Ozone, and PM 2.5. 80th percentile and above on these measures was the threshold for a "Yes" designation in the table below. While the definitions of an EJ community vary from state to state, CALSTART sought to approximate the potential EJ community status of each infrastructure site proposed in this plan. Therefore, a "Yes" designation in the table below indicates high likelihood of being located in an EJ community. Please note that due to the state-level differences in defining EJ communities, CALSTART cannot guarantee that each site with a "Yes" designation is, in fact, located within an EJ community, but this represents CALSTART's best judgement on the topic.

Table 44: Environmental Justice Zones for California (Listed Alphabetically by Location)

Fuel Type	State	Location-City	Location-Address (or intersection)	80th Percentile or Above in CalEnviroScreen 3.0
EV	CA	Banta	I-5 / I-205	Yes
EV	CA	Barstow	2825 W. Main St. Barstow, CA 92311	Yes
EV	CA	Barstow	I-15 / I-40	Yes
EV	CA	Blythe	I-10 / HWY-78	No
EV	CA	Coalinga	I-5 & 198	Yes
EV	CA	Fresno	HWY-99 / HWY-41	Yes
EV	CA	Grapevine	I-5 & Edmonston Pumping Plant Road	No
EV	CA	Gustine	I-5 &152	Yes
EV	CA	Hamburg Farms	I-5 / HWY-165	Yes
EV	CA	Inland Empire	I-15	Yes
EV	CA	LA /Hobart	4000 East Sheila St Los Angeles, CA 90023	Yes
EV	CA	Long Beach	Port of LB	Yes
EV	CA	Long Beach	301 Mediterranean Way, Long Beach CA	Yes
EV	CA	Long Beach	Port of Long Beach Terminal	Yes
EV	CA	Long Beach	Port of Long Beach Terminal	Yes
EV	CA	Los Angeles	I-10	Yes
EV	CA	Los Angeles	Port of LA	Yes
EV	CA	National City	I5 & 54	Yes
EV	CA	Red Bluff	I5 & 36	No
EV	CA	Redding	I5 &44	No

Fuel Type	State	Location-City	Location-Address (or intersection)	80th Percentile or Above in CalEnviroScreen 3.0
EV	CA	Sacramento	I-80 / I-50	Yes
EV	CA	San Bernardino (demonstrating BYD)	1535 West 4th St San Bernardino, CA 92411	Yes
EV	CA	San Diego	I5& I8	No
EV	CA	Stockton	6450 South Austin Rd. Stockton, CA 95215	Yes
EV	CA	Weaverville	299 & 3	No
EV	CA	Williams	I-5 / HWY-20	No
EV	CA	Willow Creek	299 & 96	No
EV	CA	Willows	I5 & 162	No
H2	CA	Long Beach	710 & 405	Yes
H2	CA	Long Beach	1926 east pacific coast highway	Yes
H2	CA	Ontario	4325 East Guasti Road	No
H2	CA	Redding	I5&44	No
LPG	CA	Corona	91/15	Yes
LPG	CA	Duarte	605/210	No
LPG	CA	Hawthorne	105/405	Yes
LPG	CA	Norwalk	605/105	Yes
LPG	CA	Ontario	10/15	Yes
LPG	CA	Sherman Oaks	101/405	No
CNG	CA	Bakersfield	I-5 & 119	No
CNG	CA	Barstow	I-15 & Lenwood Road	No
CNG	CA	Bellflower	15330 Woodruff Ave, Bellflower, CA 90706	Yes
CNG	CA	Coachella	I-10 and Dillon Road	No
CNG	CA	Gardena	14800 South Spring St Gardena CA 90248	Yes
CNG	CA	Kettleman City	I-5 &41	No
CNG	CA	Lost Hills	I-5 & 46	Yes
CNG	CA	Lost Hills	I-5 & 46	Yes
CNG	CA	Tehachapi	58 &58B	No

Table 45: Environmental Justice Zones for Oregon

Fuel Type	State	Location-City	Location-Address (or intersection)	80th Percentile or above in NATA Diesel PM	80th Percentile or above in Ozone	80th Percentile or above in 2.5PM
CNG	OR	Bend	97 & 20	No	Yes	No
EV	OR	Bend	97 & 20	No	Yes	No
EV	OR	Bend	HWY-20 / HWY-97	No	Yes	No
H2	OR	Bend	97 & 20	No	Yes	No
CNG	OR	Boardman	I-84 & South Main Street	No	Yes	Yes
H2	OR	Boardman	I-84 & South Main Street	No	Yes	Yes
LPG	OR	Boardman	I-84 & South Main Street	No	Yes	Yes
EV	OR	Boardman	I-84 & South Main Street	No	Yes	Yes
CNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	No	No	No
LNG	OR	Eugene	3500 E 17th Ave Eugene OR 97403	No	No	No
EV	OR	Eugene	3500 E 17th Ave Eugene OR 97403	No	No	No
H2	OR	Eugene	I-5 & 126	No	No	No
EV	OR	Eugene	I-5 & 126	No	No	No
H2	OR	Eugene	I5 &105	No	No	No
LNG	OR	Eugene	I-5 &H58	No	No	No
H2	OR	Grants Pass	I5&99	No	No	No
LNG	OR	Hermiston	182 & 184	No	Yes	No
CNG	OR	La Grande	I-84 & 82	No	Yes	No
H2	OR	La Grande	I-84 & 82	No	Yes	No
EV	OR	La Grande	I-84 & 82	No	Yes	No
EV	OR	Medford	I-5 & 62	No	No	No
H2	OR	Medford	I-5 & 62	No	No	No
CNG	OR	Ontario	I-84 & 30	No	Yes	Yes
H2	OR	Ontario	I-84 & 30	No	Yes	Yes
LPG	OR	Ontario	I-84 & 30	No	Yes	Yes
EV	OR	Ontario	I-84 & 30	No	Yes	Yes
CNG	OR	Pendleton	I-84 & 395	No	Yes	No
H2	OR	Pendleton	I-84 & 395	No	Yes	No
LPG	OR	Pendleton	I-84 & 395	No	Yes	No
EV	OR	Pendleton	I-84 & 395	No	No	No

Fuel Type	State	Location-City	Location-Address (or intersection)	80th Percentile or above in NATA Diesel PM	80th Percentile or above in Ozone	80th Percentile or above in 2.5PM
CNG	OR	Portland	205 and Sandy Boulevard	No	No	No
CNG	OR	Portland	I-5 & 405	No	No	No
H2	OR	Portland	I-5 & 405	Yes	No	Yes
EV	OR	Portland	I-5 & 405	Yes	No	Yes
H2	OR	Portland	I5 &84	Yes	No	No
EV	OR	Portland	I-84 & 205	Yes	No	No
LNG	OR	Portland	I205 & 184	Yes	No	No
LPG	OR	Roseburg	I-5 & SE Oak Avenue	No	No	No
CNG	OR	Salem	I-5 & 22	No	Yes	No
H2	OR	Salem	I-5 & 22	No	No	No
EV	OR	Salem	I-5 & 22	No	No	No
CNG	OR	The Dalles	I-84 & 197	No	Yes	No
H2	OR	The Dalles	I-84 & 197	No	Yes	No
LPG	OR	The Dalles	I-84 & 197	No	Yes	No
EV	OR	The Dalles	I-84 & 197	No	Yes	No
CNG	OR	Umatilla	I82 & 730	No	Yes	Yes
CNG	OR	Woodburn	214 and I-5	No	Yes	Yes

Table 46 Environmental Justice Zones for Washington

Fuel Type	State	Location-City	Location-Address (or intersection)	80th Percentile or above in NATA Diesel PM	80th Percentile or above in Ozone	80th Percentile or above in 2.5PM
EV	WA	Bellevue	405 & I5	Yes	No	No
LPG	WA	Ellensburg	I-90 & 82	No	Yes	No
EV	WA	Ellensburg	Main and Washington	No	Yes	No
EV	WA	Kennewick	I-82 / HWY-395	No	Yes	Yes
EV	WA	Olympia	Capital & Jefferson	No	No	No
EV	WA	Port of Seattle	Port of Seattle	Yes	No	No
LPG	WA	Ritzville	I-90 &261	No	Yes	Yes
H_2	WA	Seattle	I5 & 90	Yes	No	No
EV	WA	Spokane	Division & Mission	No	Yes	Yes
H_2	WA	Tacoma	I5 &7	Yes	No	No
EV	WA	Tacoma	Market & Pacific Avenue	Yes	No	No
H_2	WA	Tacoma	Tacoma	Yes	No	No
EV	WA	Tacoma	Tacoma	Yes	No	No
EV	WA	Yakima	Nob Hill & 1st	No	Yes	No
EV	WA	Yakima	Yakima & 4th	No	Yes	No

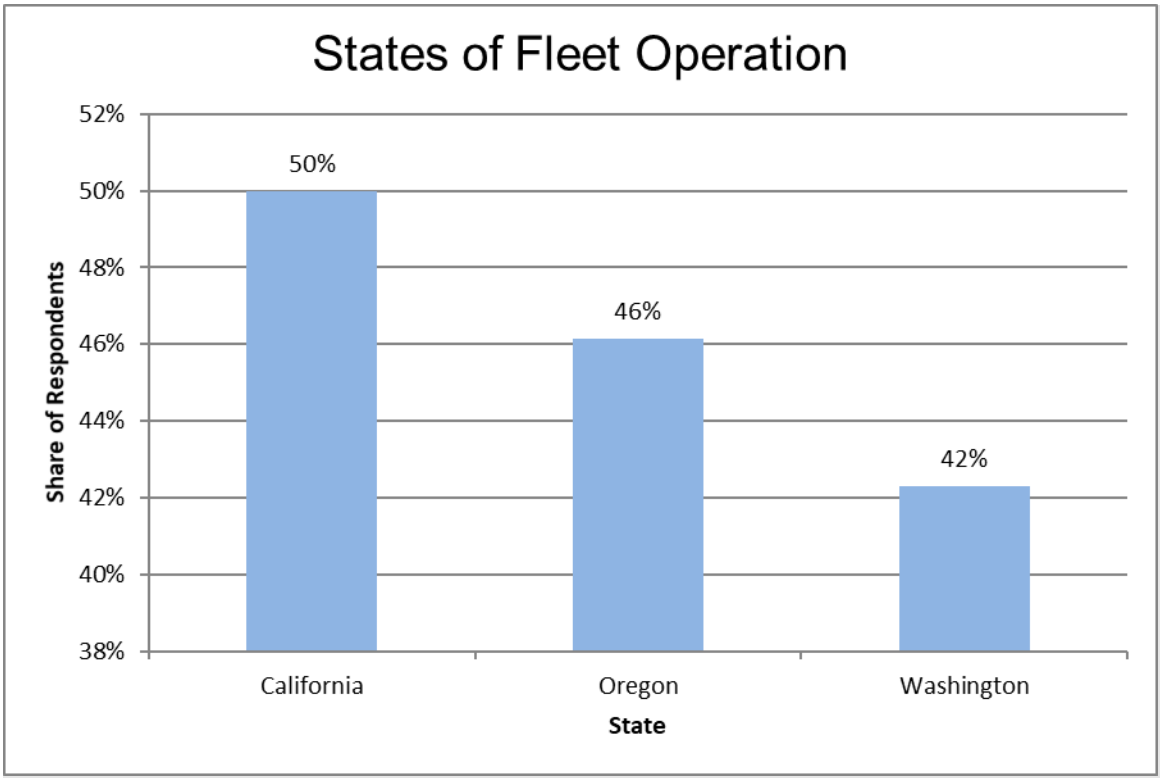
XII. APPENDIX C: FLEET AND FUEL PROVIDER SURVEY RESULTS

This section includes detailed fleet and fuel provider survey results. These surveys represent only one form of soliciting project proposals and information for this strategic plan. In addition to these two surveys, CALSTART yielded information through additional outreach via email and phone calls. As this section does not include information from organizations that submitted project proposals through outreach conducted outside of the surveys, it does not convey the full and final results or key findings for this effort. For complete results, refer to the project listings in Section IX as well as the Conclusions and Recommendations listed in Section VIII, both of which included key findings from the surveys and other forms outreach combined.

Fleet Survey Results[LVIII]

In total, 26 organizations responded to the fleet survey, representing respondents from all three states within the plan's purview. While respondents operated in all three states, California had the highest share of respondents which operated within it.

Figure 23: States of Fleet Operation

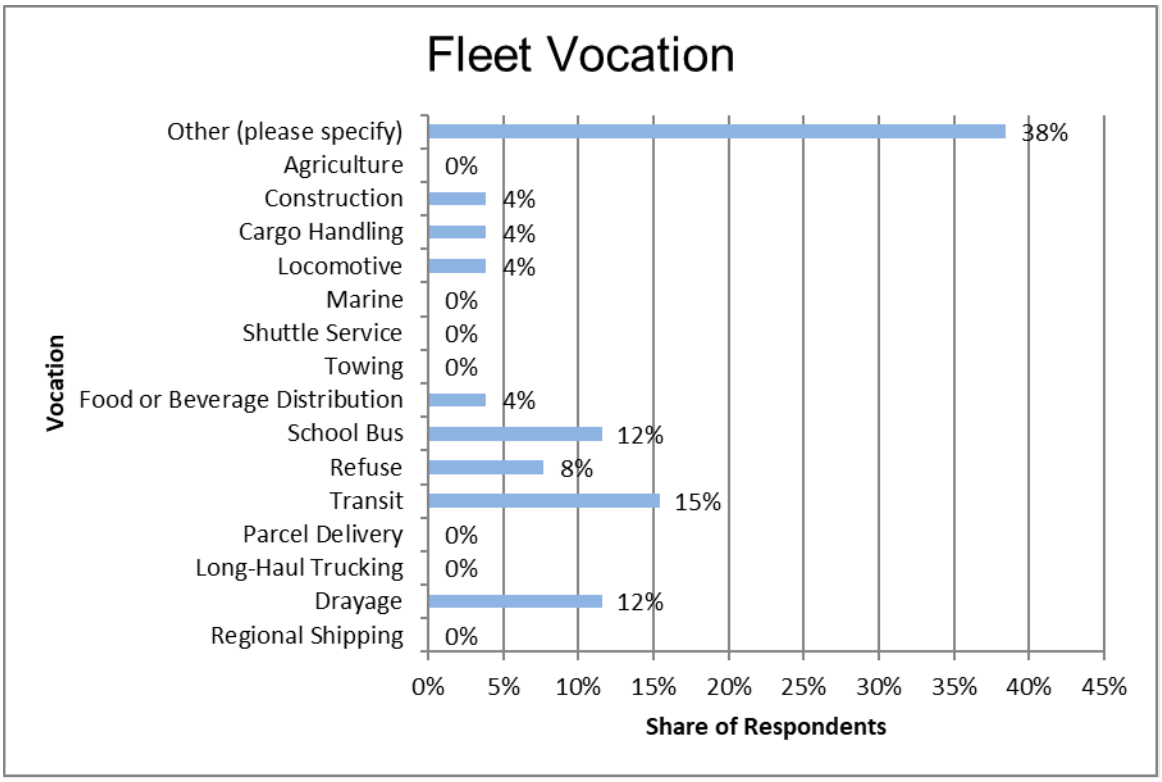


Fleet Vocation: Respondents also operated within a wide range of MHD vocations, including drayage trucking, transit buses, refuse haulers, school buses, food and beverage distribution, locomotive services, cargo handling, construction, regional government, air quality inspection and monitoring, road

[LVIII] As stated above, this survey was administered before additional outreach was conducted which yielded additional information, and therefore the survey results in and of themselves are not a complete representation of the full results of this effort. Please refer to Sections VIII and IX for full and final results.

maintenance, airport shuttle services, marine cargo handling, utility service fleets, and municipal street sweeping.

Figure 24: Fleet Vocation



Vehicles/Equipment Currently Operating and Planning to Procure: Fleets were asked to describe how many vehicles or off-road equipment that currently operate for each of the following fuel types: gasoline, diesel, compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas (LPG), hydrogen (H_2), and electric vehicle charging (EV). Table 47 shows summary statistics for the aggregate number of vehicles operated by all fleets per fuel type.

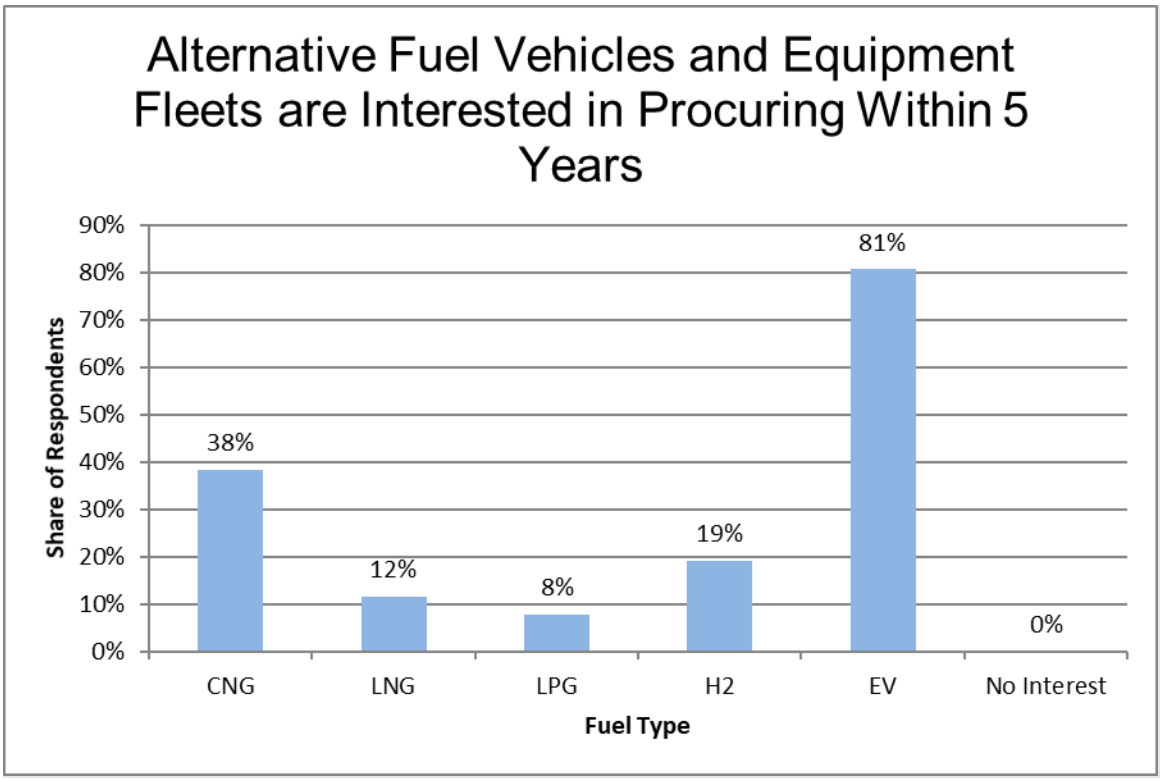
Table 47: Summary Statistics - Number of Vehicles Operated by Fleet per Fuel Type

	Gasoline	Diesel	CNG	LNG	LPG	H_2	EV
Average	608	541	38	9	4	0.27	20
Maximum	5000	8000	225	230	35	7	195
Minimum	0	0	0	0	0	0	0
Sum Across All 26 Respondents for This Question	15,816	14,055	988	239	111	7	532

Some fleets included vehicles and off-road equipment that did not fit into any of the fuel types listed above. For instance, one survey respondent had 312 E85 vehicles, and one more had 315 Flex Fuel E85 vehicles.

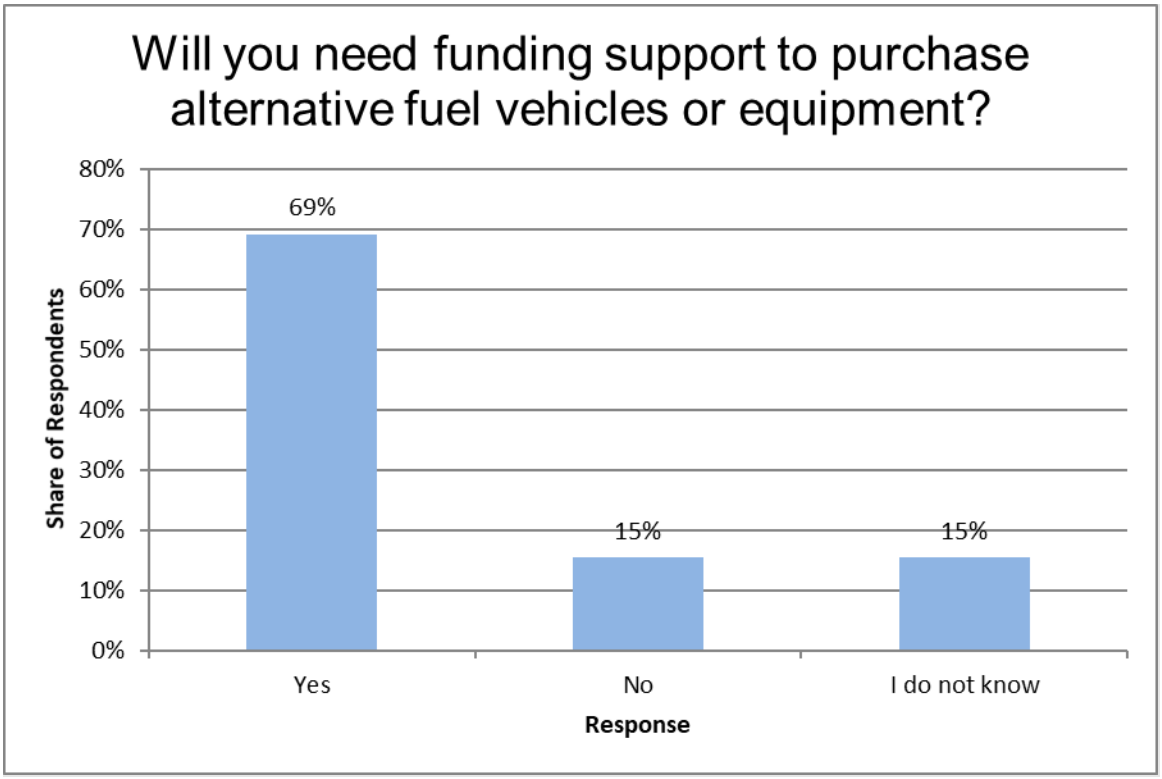
When asked what alternative fuel vehicles and off-road equipment the respondents were interested in adding to their fleets within the next three to five years, the most popular fuel type was EV, followed by CNG, H_2, LNG, and LPG. There were no fleets that stated that they were not interested in adding alternative fuel vehicles to their fleet.

Figure 25: Alternative Fuel Procurement Interests



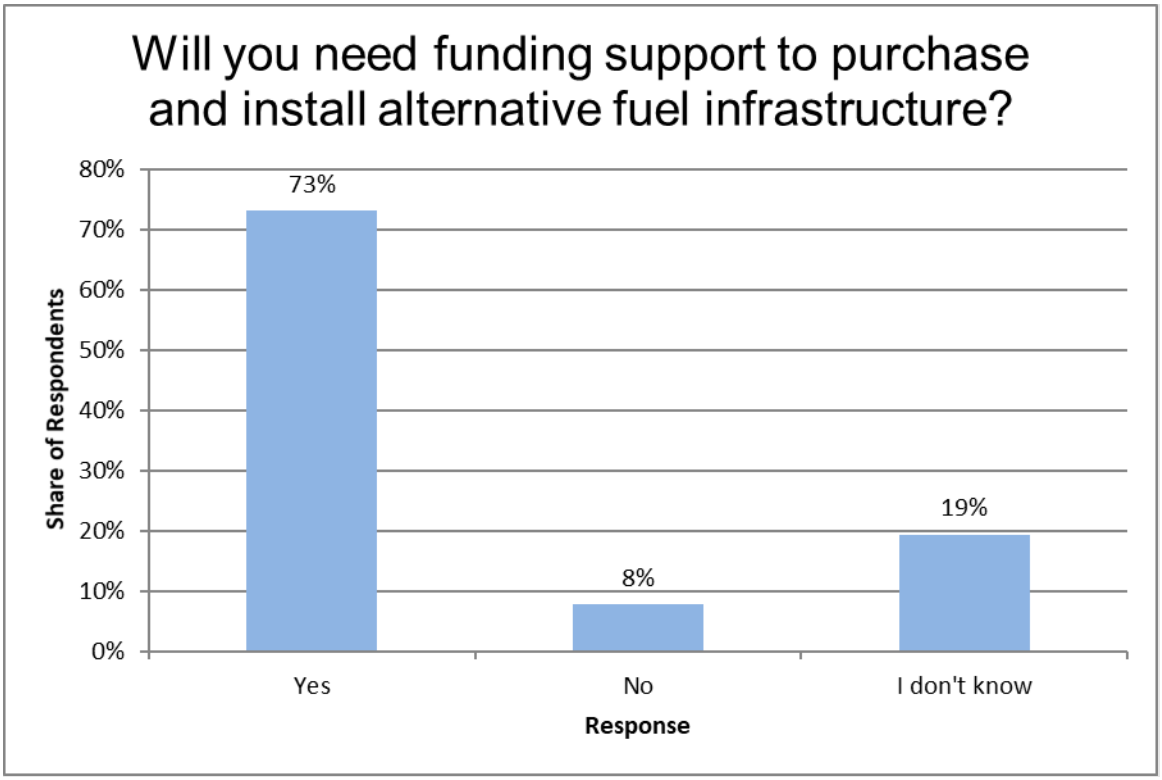
Funding Needs for Vehicles: When asked if they will need funding support to purchase alternative fuel vehicles and off-road equipment, 69.2% respondents said "Yes", while 15.4% of respondents said "No" and 15.4% of respondents said, "I don't know".

Figure 26: Fleet Funding Needs for Alternative Fuel Vehicles



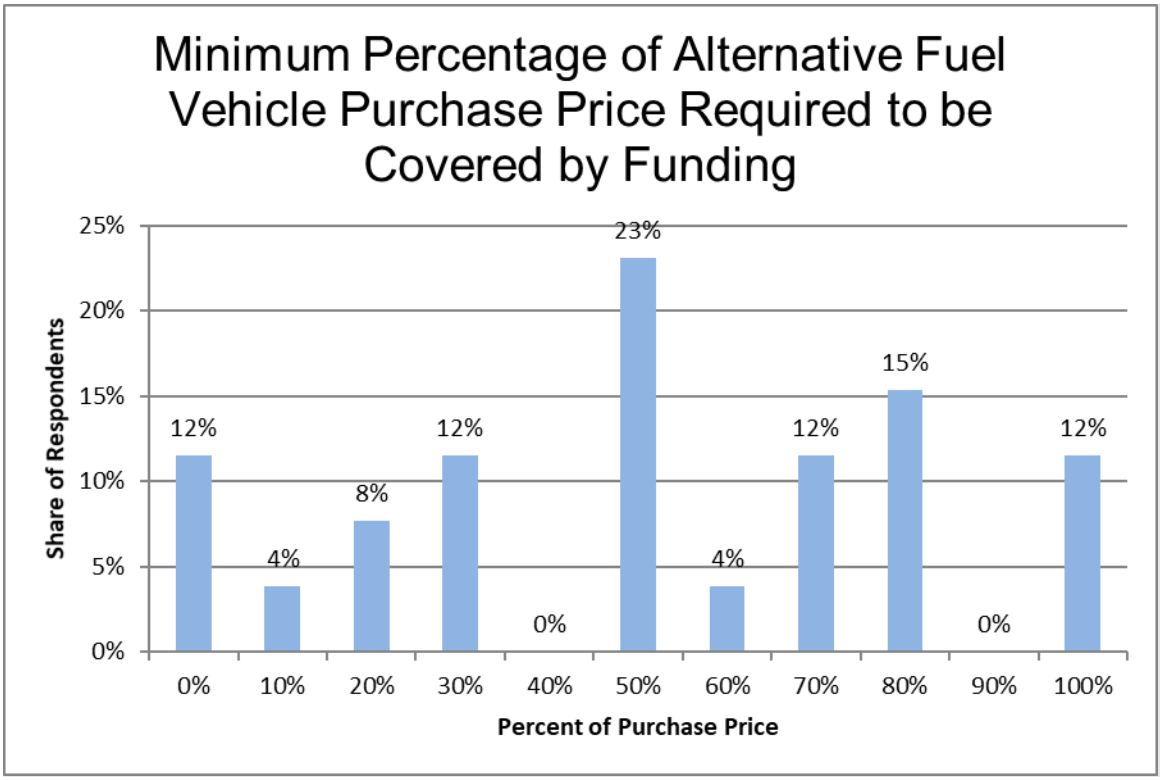
Anticipated Funding Needs for Infrastructure: In the same vein, when asked if they will need funding support to purchase and install alternative fuel infrastructure, 73% of respondents said “Yes” while 8% of respondents said “No” and 19% of respondents said, “I don’t know”.

Figure 27: Fleet Funding Needs for Alternative Fuel Infrastructure



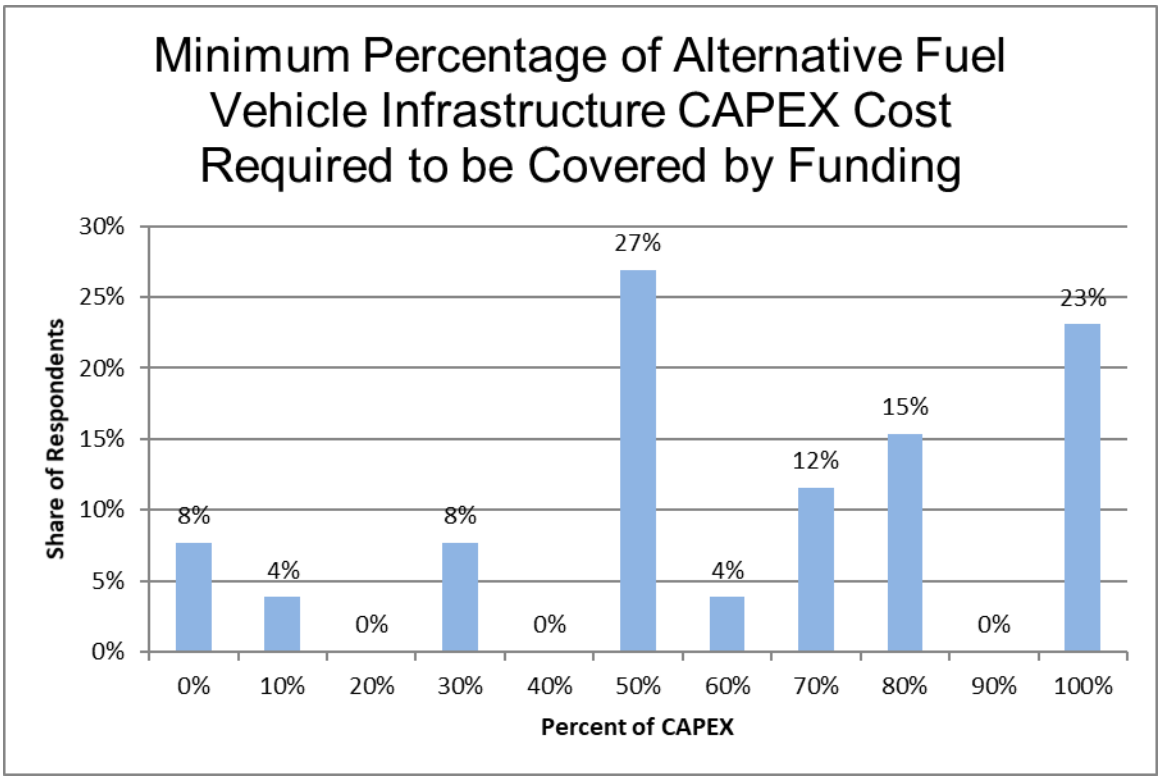
Cost Share Potential: CALSTART was interested to know what sort of cost share requirement would be best suited for an alternative fuel infrastructure funding program. As such, CALSTART asked respondents if funding were available to help them purchase an alternative fuel vehicle or off-road equipment unit, what would be the minimum percentage of the total vehicle purchase price which funding must cover to justify purchase of that vehicle. The answer with the most responses was 50%, while a sizeable number of respondents also said 0%, 30%, 70%, 80%, and 100%.

Figure 28: Minimum Fleet Funding Needed for Alternative Fuel Vehicles



Additionally, CALSTART asked respondents if funding were available to help them cover the capital expenses for installing alternative fuel infrastructure, what would be the minimum percentage of the total CAPEX which funding must cover to justify development. The two answer choices with the most responses were 50% and 100%, with 27% and 23% of respondents, respectively.

Figure 29: Minimum Fleet Funding Needed for Alternative Fuel Infrastructure CAPEX



Proposed Infrastructure Locations & Privacy Preferences: In addition to funding needs, CALSTART was interested in knowing where fleets think the best locations would be for alternative fuel infrastructure. As such, CALSTART asked fleets where in California they will require fueling or charging stations within the next three to five years, for each fuel type. Responses varied in how precise they were. While some respondents went so far as to give latitude and longitude coordinates, many others simply named cities or highways where they believe stations should be located. The following list describes the fleets' answers.

Table 48: Fleet Proposed Alternative Fuel Infrastructure Locations - California

CNG	LNG	LPG	H_2	EV
Bakersfield	Gardena	I-5 Sacramento to Mt. Shasta	Los Angeles County Disadvantaged Communities	Barstow
Gardena		HWY 299 Eureka to Susanville	60 FWY in Riverside County	San Bernardino
105 FWY		HWY 44 Eureka to Susanville	15 FWY in Riverside County	Commerce
605 FWY			10 FWY in San Bernardino County	Stockton
91 FWY			210 FWY in San Bernardino County	Cottonwood
Bellflower			215 FWY in San Bernardino County	HWY 44 Eureka to Susanville
			15 FWY in San Bernardino County	HWY 299 Eureka Susanville
			Long Beach	I-5 Sacramento to Mt. Shasta
				Long Beach
				215 FWY in San Bernardino County
				210 FWY in San Bernardino County
				10 FWY in San Bernardino County
				15 FWY in Riverside County
				60 FWY in Riverside County
				Los Angeles County Disadvantaged Communities
				Bakersfield

Respondents also suggested numerous station locations in Oregon. The following list shows their responses.

Table 49: Fleet Proposed Alternative Fuel Infrastructure Locations - Oregon

CNG	LNG	LPG	H_2	EV
I-205 / NE Sandy Boulevard	I-5 North Portland	I-5 / Roseburg	5 FWY	5 FWY
I-5 / Woodburn Exit	I-205 / I-84 East Portland	I-84 / The Dalles	I-5 / Medford	Long Beach
I-5 North Portland	I-82 / I-84 Hermiston	I-84 / Boardman or Port of Morrow	I-5 / Eugene	Airports
I-205 / I-84 East Portland	I-5 / H-58 Eugene	I-84 / Pendleton	I-5 / Salem	Portland
I-82 / I-84 Hermiston	US-26	I-84 / Ontario	I-5 / Portland	Eugene
I-5 / H-58 Eugene	Hillsboro	Eugene	I-84 / The Dalles	
I-84 Boardman	Hubbard		I-84 / Boardman or Port of Morrow	
Umatilla			US-97 / Bend	
I-5 Medford			I-84 / Pendleton	
Roseburg			I-84 / La Grande	
I-5 / Salem			I-84 / Ontario	
I-5 / Portland			Portland	
US-97 / Bend				
I-84 / US-97 / The Dalles				
I-84 / Boardman or Port of Morrow				
I-84 / Pendleton				
I-84 / La Grande				
I-84 / Ontario				
I-5 Eugene to Portland				
Eugene				
Portland				

Finally, the following list shows where respondents suggested station locations in Washington.

Table 50: Fleet Proposed Alternative Fuel Infrastructure Locations - Washington

CNG	LNG	H_2	EV
Coordinates: 47.171882, -122.486240	I-5 / H-2 Everett	5 FWY	I-5 / Exit 193 Northbound Everett
I-5 / H-2 Everett	I-5 / H-599 Tukwila		Puget Sound
I-5 / H-599 Tukwila	I-90 Cle Elum		5 FWY
I-90 Cle Elum	I-90 Spokane		Spokane
I-90 Spokane	I-5 Canadian Border to Olympia		Tri-Cities
Puget Sound			Seattle
Spokane			Bellevue
Kennewick			Yakima
I-5 Clark County			Tacoma
			Olympia
			47.171432, -122.484975
			I-5 / Exit 193 Northbound Everett

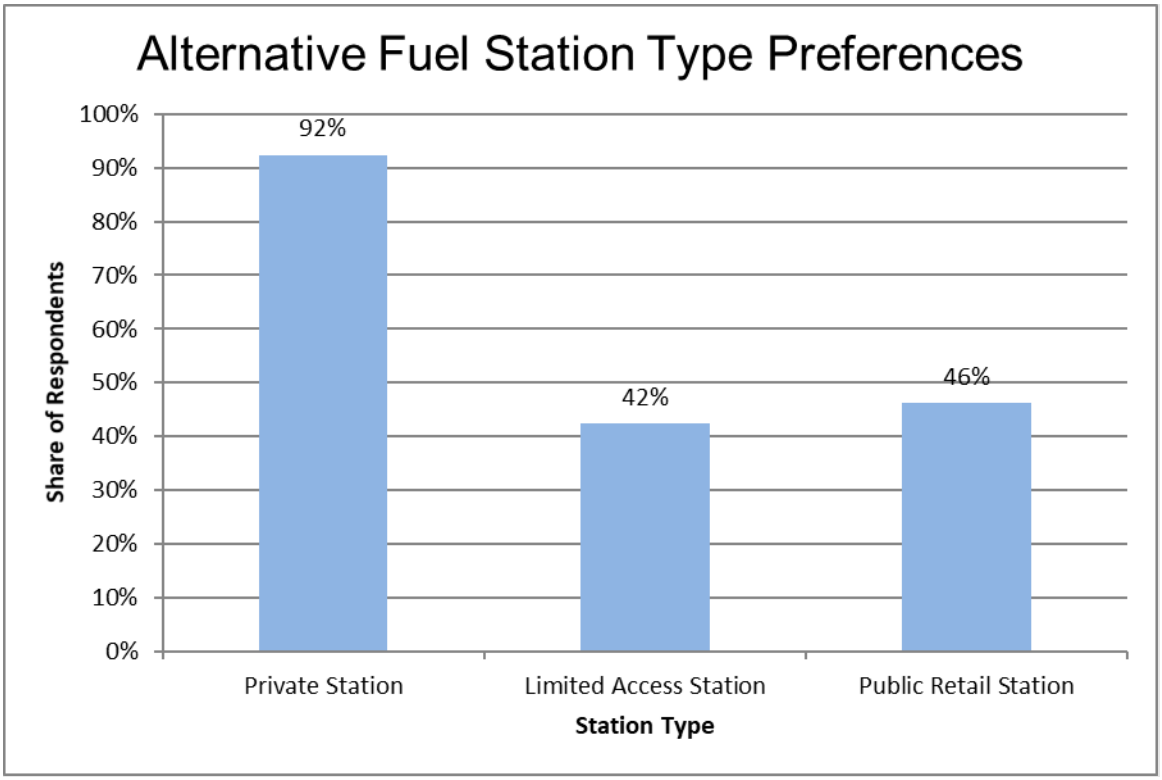
In addition to assessing where fleets need locations for alternative fuel infrastructure, CALSTART also sought to understand the average daily distance traveled for their vehicles. Understanding this information is important for knowing what locations are best suited for fueling stations. Table 51 shows summary statistics for daily distance traveled by each fleet.

Table 51: Summary Statistics – Daily Distance Traveled by Fleets

	Average	Maximum	Minimum
Distance (Miles)	102	250	0
Hours of Operation	11	24	0

CALSTART also sought to understand the fueling station privacy preferences by each fleet. Figure 30 shows which alternative fueling station type each fleet would use. 92% of fleets would use a private station, while 46% of fleets would use a public retail station and 42% of fleets would use a limited access station.

Figure 30: Station Type Preferences by Fleets



Anticipated Fueling Needs: To better understand the fuel demands of alternative fueling stations, CALSTART asked fleets to explain how much fuel they expect their MHDVs and off-road equipment require per year for each fuel type. Table 52 shows summary statistics of fleets' responses.

Table 52: Expected Annual Fuel Demand by Fleets

	CNG (DGE)	LNG (DGE)	LPG (Gal)	H2 (Kg)	EV (Megawatt Charging Capacity)
Average	416,874.67	54,541.82	1,555.56	0	2.14
Maximum	4,400,00	440,000	10,000	0	10
Minimum	0	0	0	0	0

To see the distribution of responses to this question by fuel type, see Figure 31 through Figure 34.

Figure 31 Annual Compressed Natural Gas Demanded by Fleet Respondents

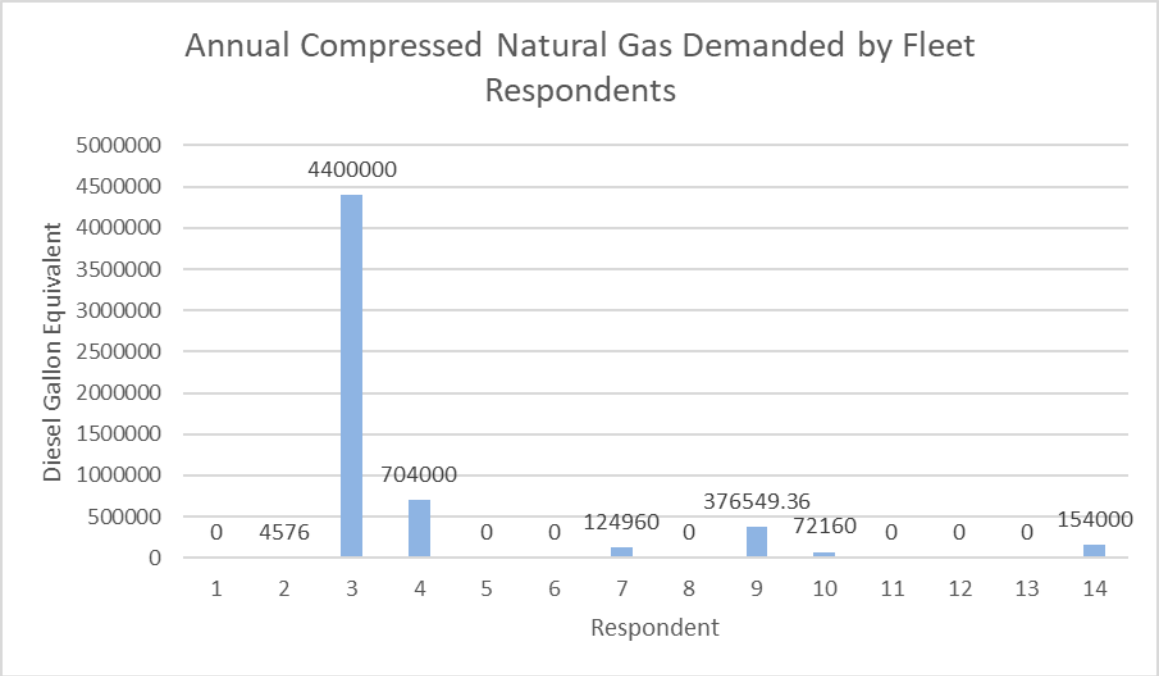


Figure 32 Annual Liquefied Natural Gas Demanded by Fleet Respondents

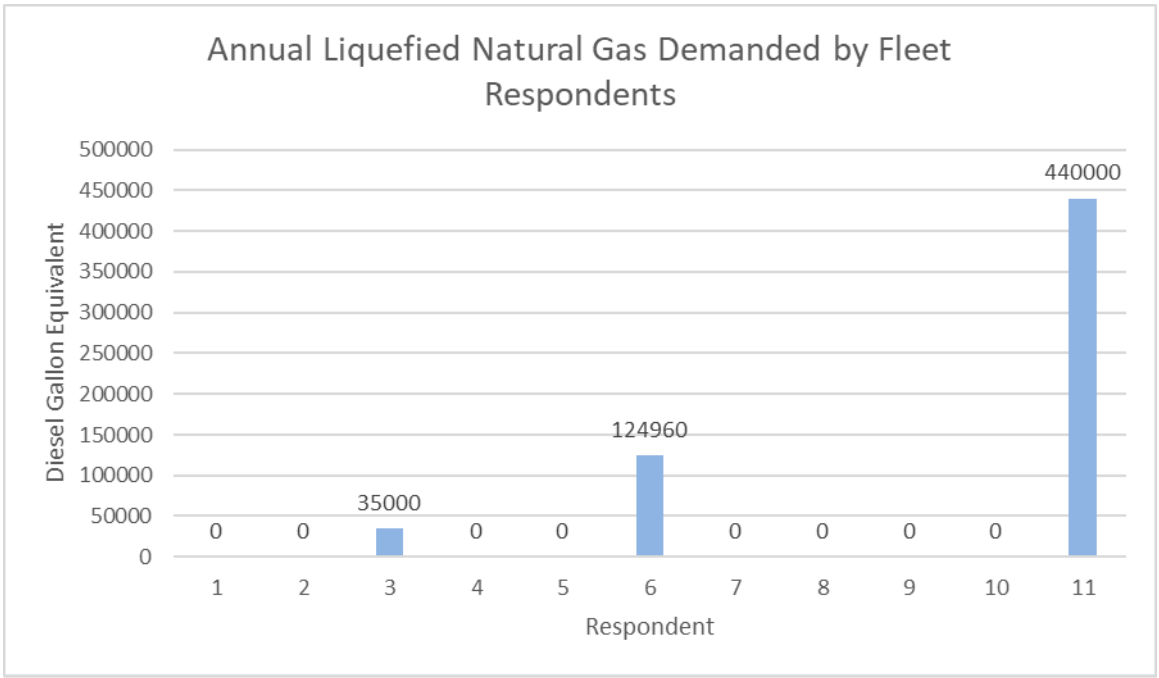


Figure 33 Annual Liquefied Petroleum Gas Demanded by Fleet Respondents

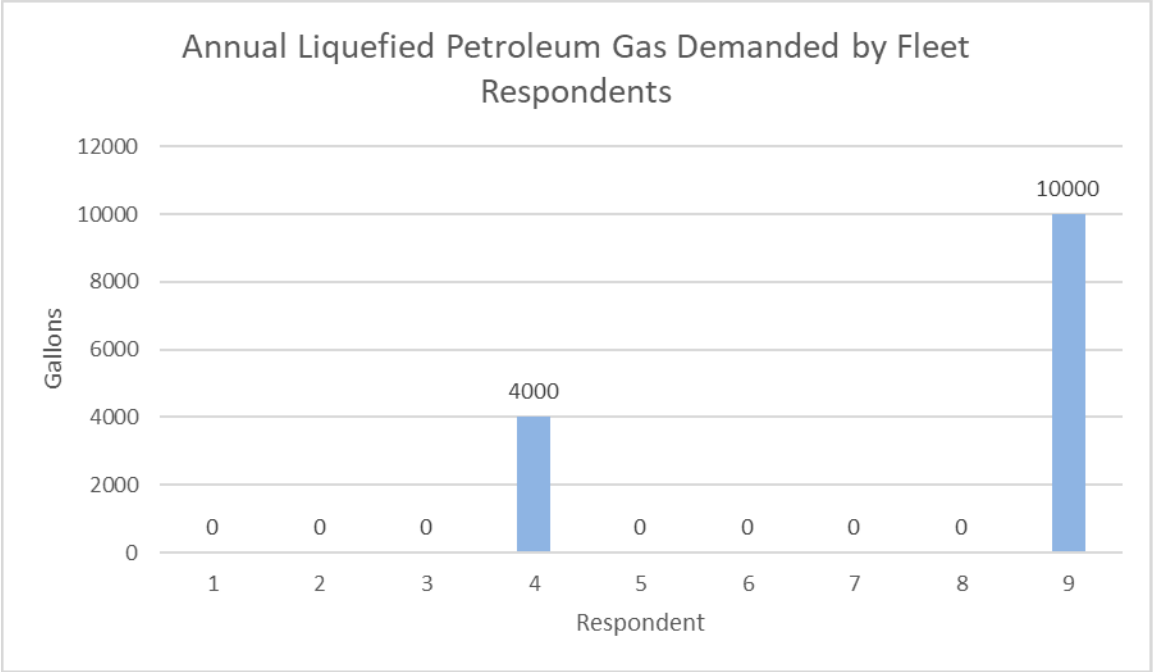
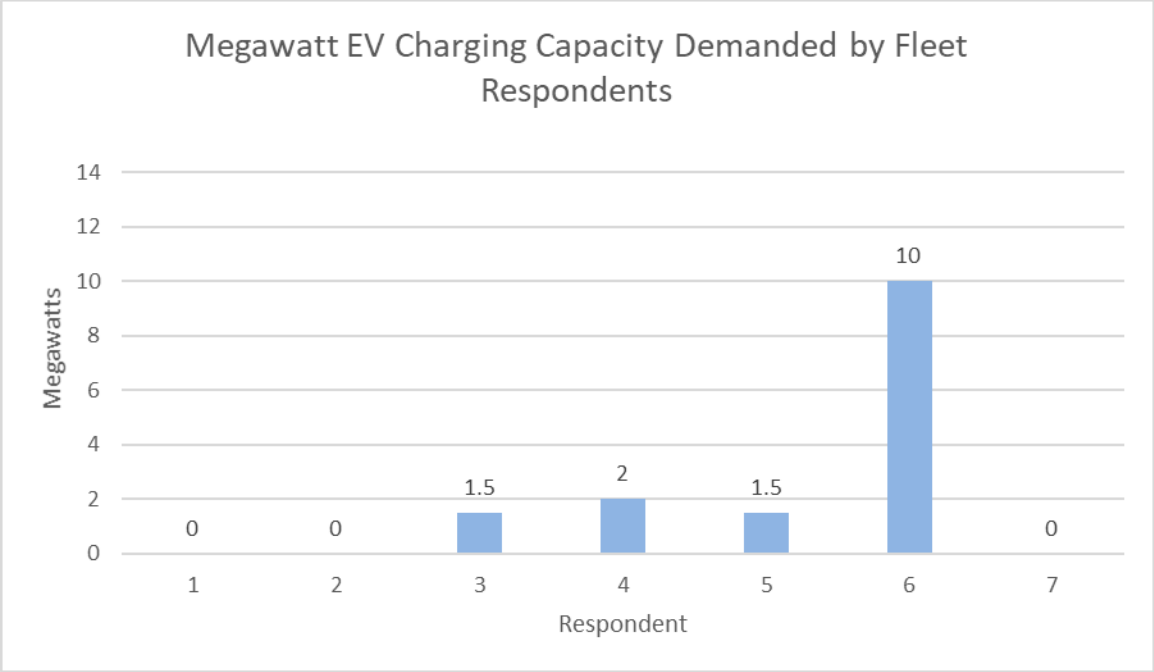


Figure 34 Megawatt EV Charging Capacity Demanded by Fleet Respondents

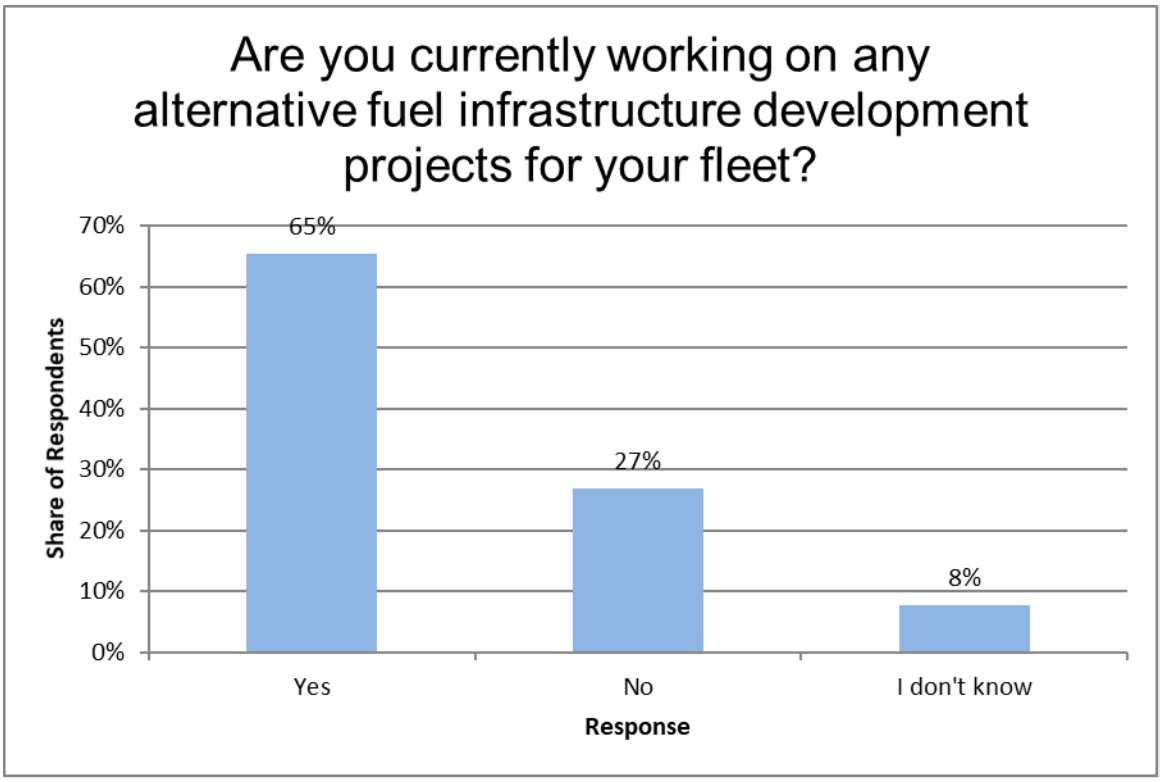


Suggested Project Partners for Infrastructure Development: Having the right partners involved is also important to any alternative fuel infrastructure development project. As such, when asked what project partners are required for each fleet to have in order to install a fueling station, they provided a number of answers. Here is a list of common partners that fleets listed as important partners to a project:

Mobile Source Air Pollution Reduction Review Committee (MSRC), Air Quality Management District (AQMD), Construction, Planning, Ports, State, Procurement/Sourcing, Landlord, Electrical Design, Engineering, Real Estate, Engineering Construction Procurement, General Contractor, Consultants, Original Equipment Manufacturers, City, and utilities.

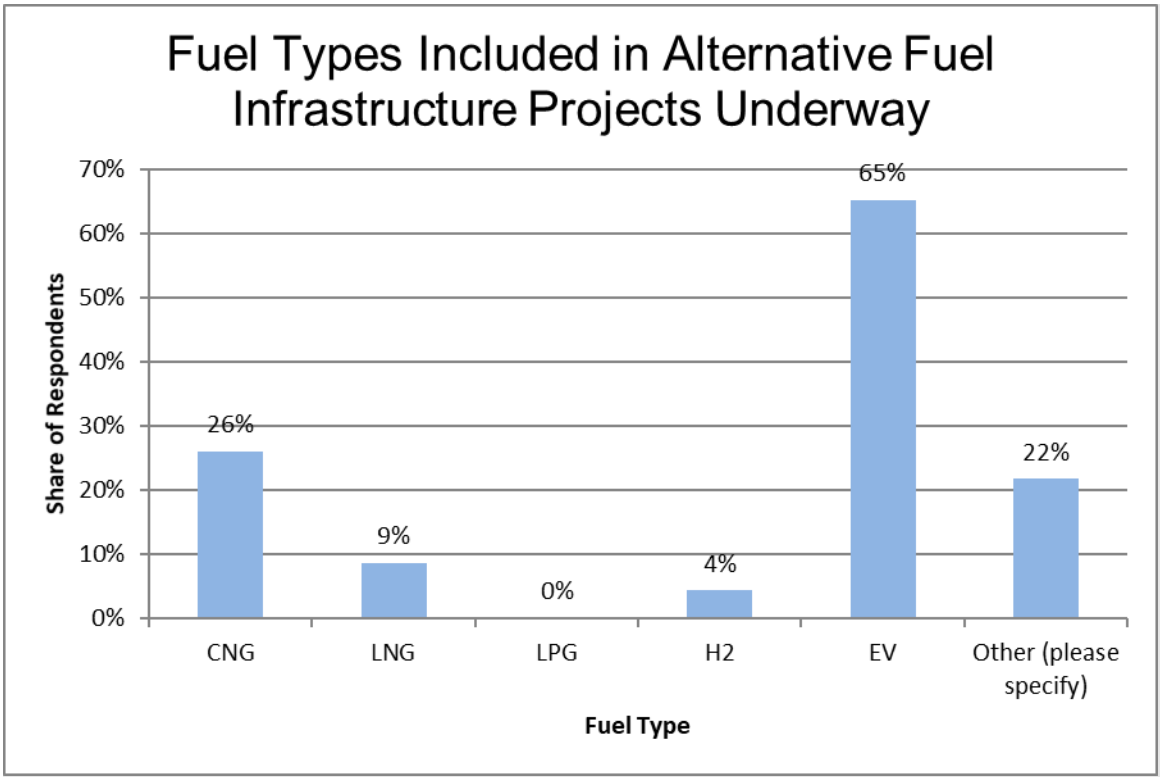
Current Infrastructure Projects: In addition to future projects, several fleets already had alternative fuel infrastructure development projects underway at the time of survey distribution. According to survey results, 65% of fleet respondents were working on a project.

Figure 35: Current Alternative Fuel Infrastructure Projects by Fleets



Of those that had an alternative fuel infrastructure project underway, the majority of them were electric charging station projects, followed by CNG, LNG, and H_2. Other responses included renewable natural gas and renewable diesel projects.

Figure 36: Current Alternative Fuel Infrastructure Projects by Fleets per Fuel Type



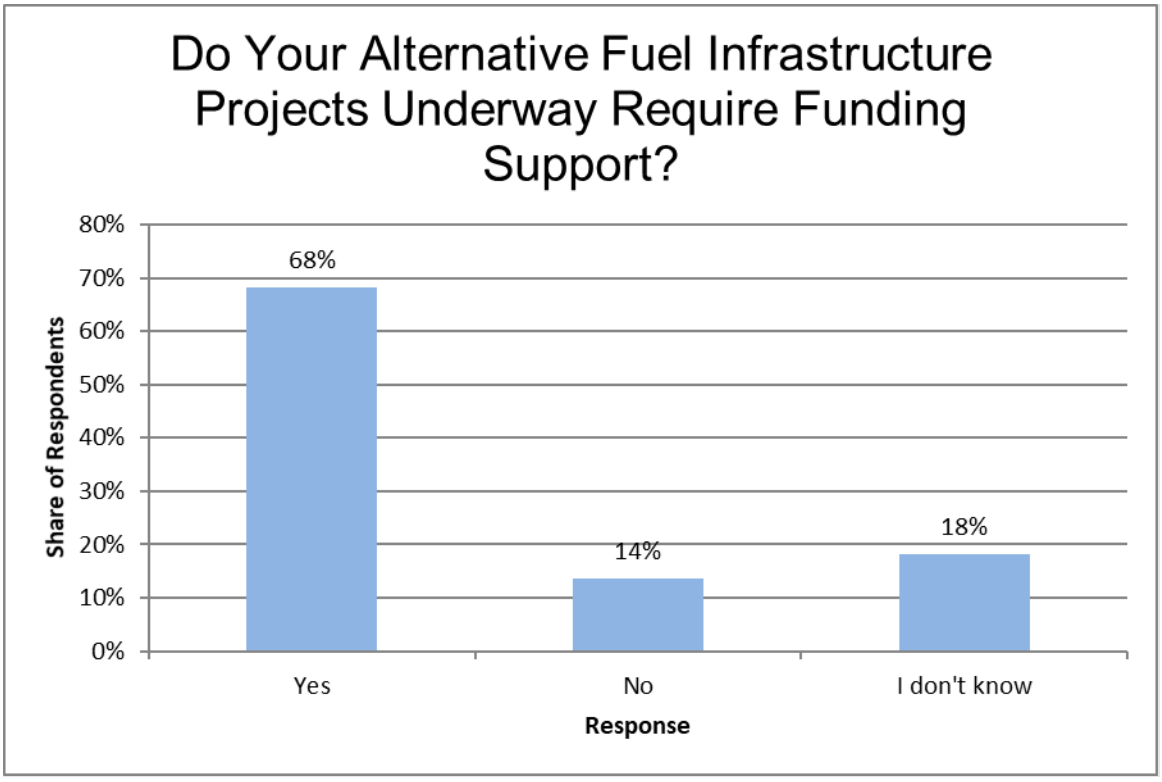
Respondents which had alternative fuel infrastructure projects underway at the time of survey distribution were asked to describe the details of their projects. Table 53 shows the range of projects that are currently underway by fleets who responded to the survey.

Table 53: List of Current Alternative Fuel Infrastructure Projects Underway by Fleets

	Fuel Type	Annual Fueling Capacity	Number of Vehicles/Equipment Units it is Built to Support	Number of Dispensers	Public or Private Station?	Located in a DAC?	Estimated Completion Year
Fleet Project 1	EV	6,000 MWh	45	45	Private	Yes	2028
Fleet Project 2	EV	N/A	30	30	Limited Access	No	2019
Fleet Project 3	EV	N/A	3-5	2	Private	No	Ongoing
Fleet Project 4	EV	N/A	10 buses	10	Private	Yes	N/A
Fleet Project 5	EV	N/A	40	40	Private	N/A	2021
Fleet Project 6	EV	N/A	8	8	Public	No	2019
Fleet Project 7	EV	N/A	6	8	Private	Yes	2019
Fleet Project 8	EV	N/A	4	N/A	Private	Yes	2021
Fleet Project 9	EV	N/A	N/A	N/A	Private	Yes and No	2022
Fleet Project 10	EV	Varies by site	Varies by site	Varies by site	Private	Yes	Varies by site
Fleet Project 11	CNG	1,056,000 DGE	300 per day	3	Public	Yes	Operational today, expansion by 2019
Fleet Project 12	CNG	26,400 DGE	200	4	Private	Yes	2020
Fleet Project 13	EV	N/A	10	10	Private	N/A	N/A
Fleet Project 14	CNG	N/A	N/A	N/A	N/A	N/A	2021

Current Project Funding Needs: Many respondents who stated that they are currently working on alternative fuel infrastructure projects said that those projects could use funding support. As seen in Figure 37 below, 68% of respondents said that their projects could use funding.

Figure 37: Fleet Funding Needs for Alternative Fuel Infrastructure Projects Currently Underway



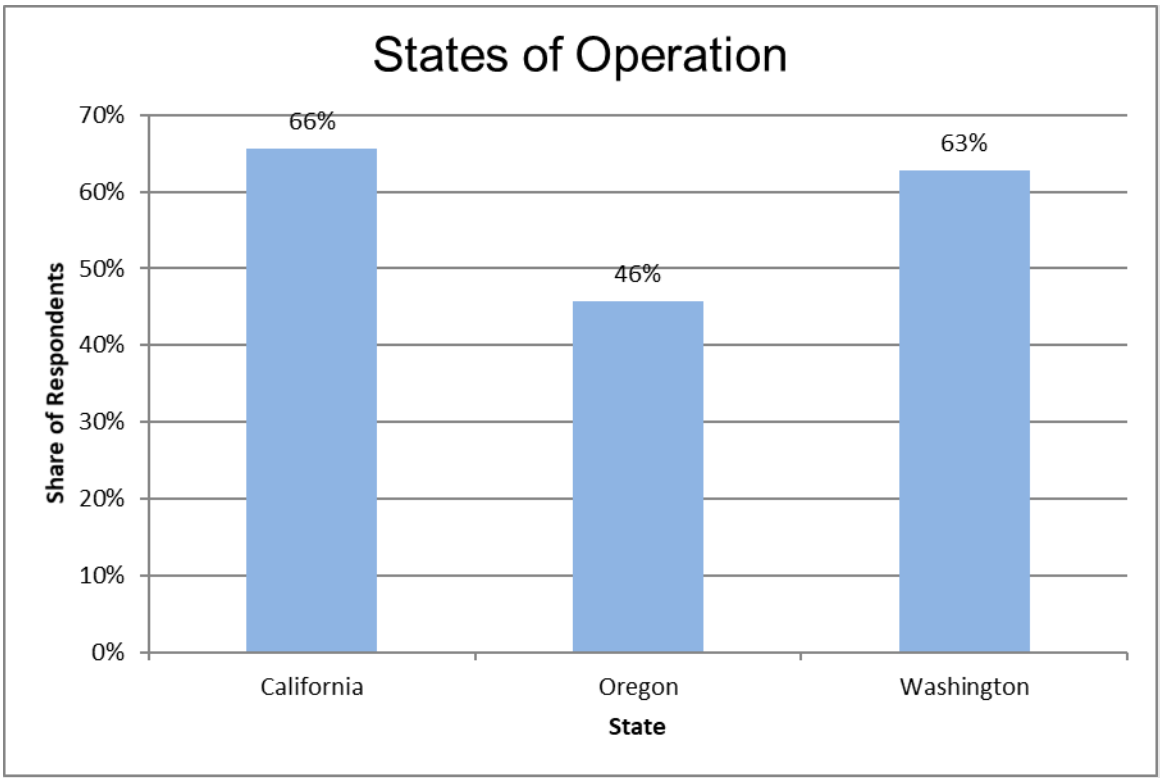
Respondents stated various uses for this funding, including the following: adding time-fill stations, adding gas compression capacity, installing power lines, paying for electric work, trenching, expanding a station to retail, construction, design, and purchasing infrastructure, vehicles, equipment, or signage. Of these uses, purchasing infrastructure and equipment had the most responses.

Fuel Provider Survey Results[LIX]

In total, 31 organizations responded to the fuel provider survey, and like the fleet survey this group represents all three West Coast states.

Of all three states, California had the largest share of representation, followed by Washington then Oregon.

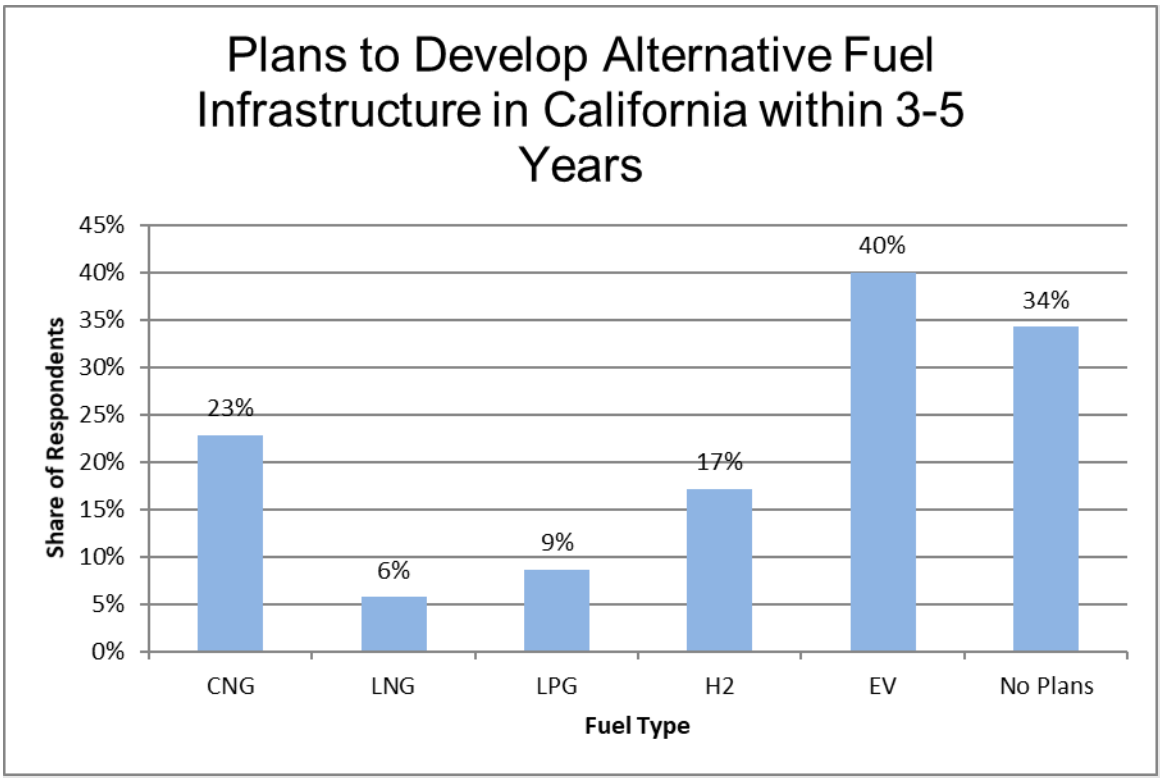
Figure 38: Fuel Provider States of Operation



[LIX] As stated above, this survey was administered before additional outreach was conducted which yielded additional information, and therefore the survey results in and of themselves are not a complete representation of the full results of this effort. Please refer to Sections VIII and IX for full and final results.

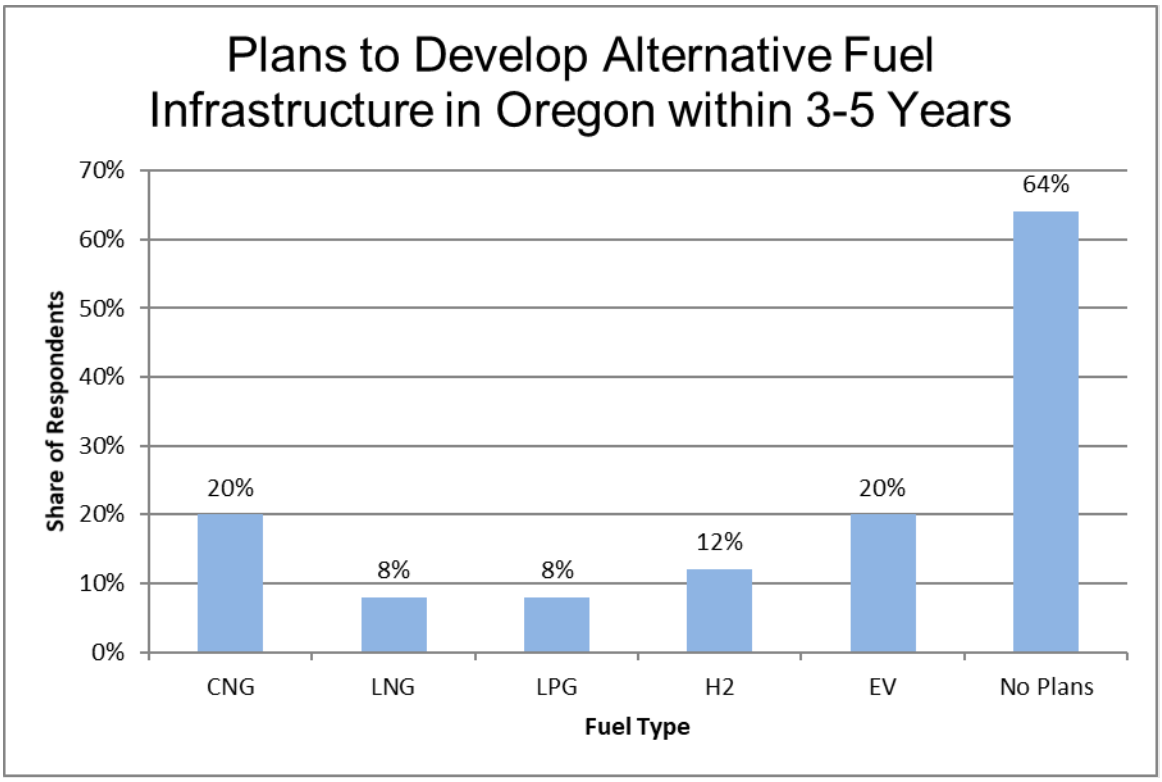
Alternative Fuel Station Development Plans: The survey started by asking fuel providers what fuel types they plan to develop in California within the next three to five years. While all alternative fuel types were represented, electric vehicle charging had the highest share of responses, followed by respondents with no plans to develop in that time frame, CNG, H_2, LPG, and then LNG.

Figure 39: Fuel Provider Plans to Develop Alternative Fuel Infrastructure in California Within Three-to-Five Years



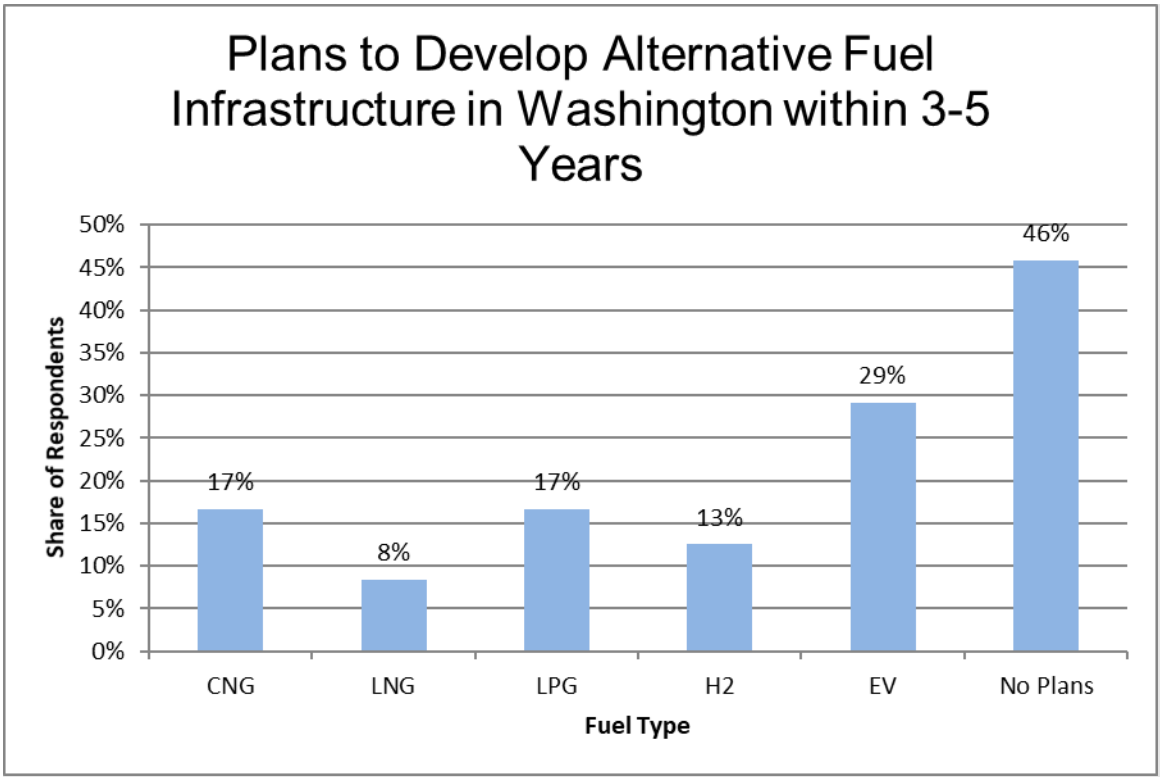
Respondents largely have no plans to develop alternative fuel stations in Oregon. However, those that do plan on developing mostly EV charging and CNG stations, followed by H_2, and then LNG and LPG.

Figure 40: Fuel Provider Plans to Develop Alternative Fuel Infrastructure in Oregon Within Three-to-Five Years



Like Oregon, most respondents do not have plans to develop alternative fuel stations in Washington. For those that do, a majority plan to develop EV charging stations, followed by CNG, LPG, H_2, and LNG stations.

Figure 41: Fuel Provider Plans to Develop Alternative Fuel Infrastructure in Washington Within Three-to-Five Years



Proposed Infrastructure Locations: CALSTART also asked fuel providers where they see a need for developing MHDVs vehicle alternative fueling stations in all three states. As with the fleet survey responses, the preciseness of each suggestion varies, with some respondents giving highway interchanges and some simply naming cities and towns. The following list describes fuel provider responses for California.

Table 54: Fuel Provider Proposed Alternative Fuel Infrastructure Locations - California

CNG	LPG	H_2	EV
San Joaquin Valley	605 / 210 FWY	Fleet Depots	I-80
Bakersfield	605 / 105 FWY		I-10
	10 / 15 FWY		I-15
	91 / 15 FWY		US-101
	101 / 405 FWY		I-5
	105 / 405 FWY		Warehouse Districts around the Inland Empire
	405 / 22 FWY		Warehouse Districts around Los Angeles
			Port of Long Beach
			Port of Los Angeles

Fuel providers also provided similar suggestions in the state of Oregon, although they provided significantly fewer locations in this state.

Table 55: Fuel Provider Proposed Alternative Fuel Infrastructure Locations - Oregon

CNG	H_2	EV
I-5	Fleet Depots	I-5
		Metropolitan Areas

The following list describes the same suggestions for Washington.

Table 56: Fuel Provider Proposed Alternative Fuel Infrastructure Locations - Washington

CNG	LPG	H_2	EV
Tacoma	I-90	Tacoma	I-5
Seattle		Seattle	Metropolitan Areas
Ports		Ports	Tacoma
I-5		Fleet Depots	Seattle
			Ports

Projected Annual Fuel Demand, CAPEX, and Development Time Estimates: In addition to the optimal locations for alternative fuel infrastructure, CALSTART also sought to understand what annual level of demand is required to justify the development of a Class 8-accessible station for fuel providers. Table 57 summarizes statistics on this topic by fuel type.

Table 57: Annual Demand for Fuel Required to Justify Station Development per Fuel Type

	CNG (DGE)	LNG (DGE)	LPG (Gal)	H_2 (Kg)	EV (MW Capacity)
Average	249,333	No Answers	67,500	30,000	2
Maximum	352,000	No Answers	75,000	30,000	2
Minimum	88,000	No Answers	60,000	30,000	2

To see the distribution of responses by fuel type, see Figure 42 through Figure 45. As you will see in these figures, only a handful of the total survey respondents shared responses to this question, and it varied by fuel type.

Figure 42 Suggested Minimum Annual Level of CNG Demand Needed to Justify Station Development

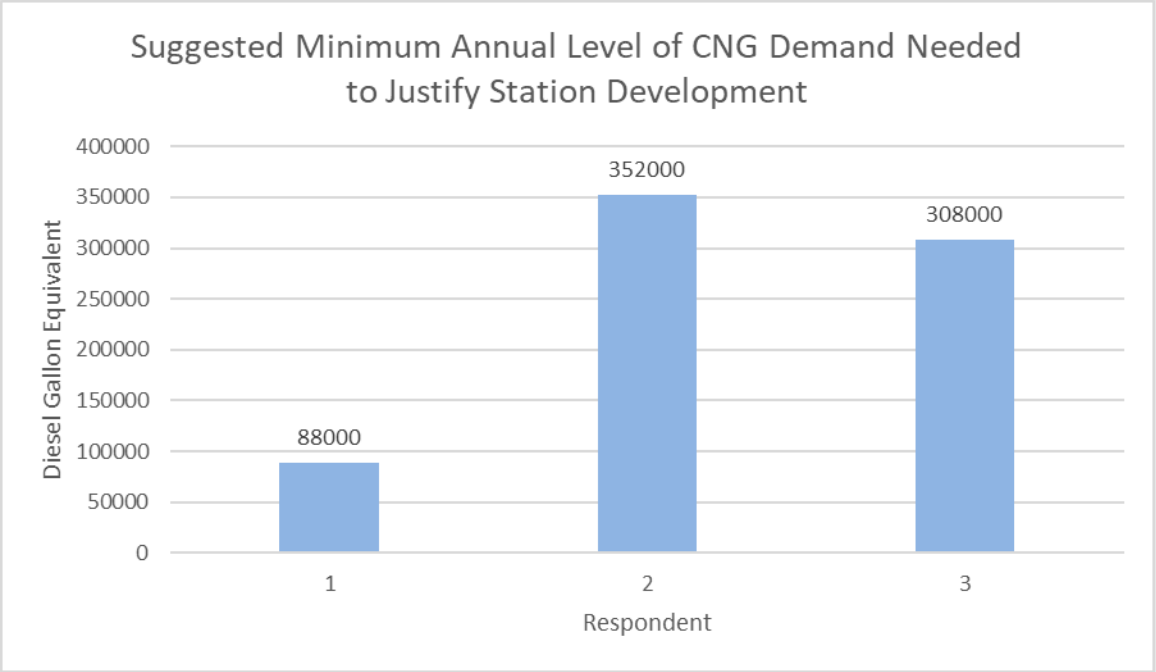


Figure 43 Suggested Minimum Annual Level of LPG Demand Needed to Justify Station Development

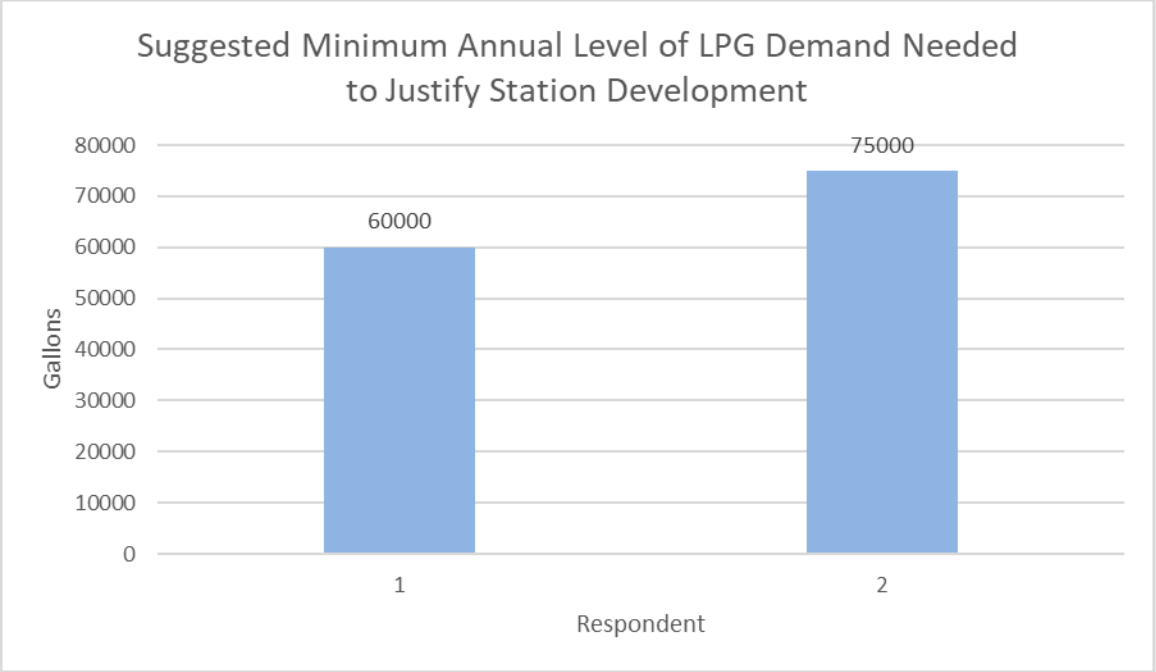


Figure 44 Suggested Minimum Annual Level of Hydrogen Demand Needed to Justify Station Development

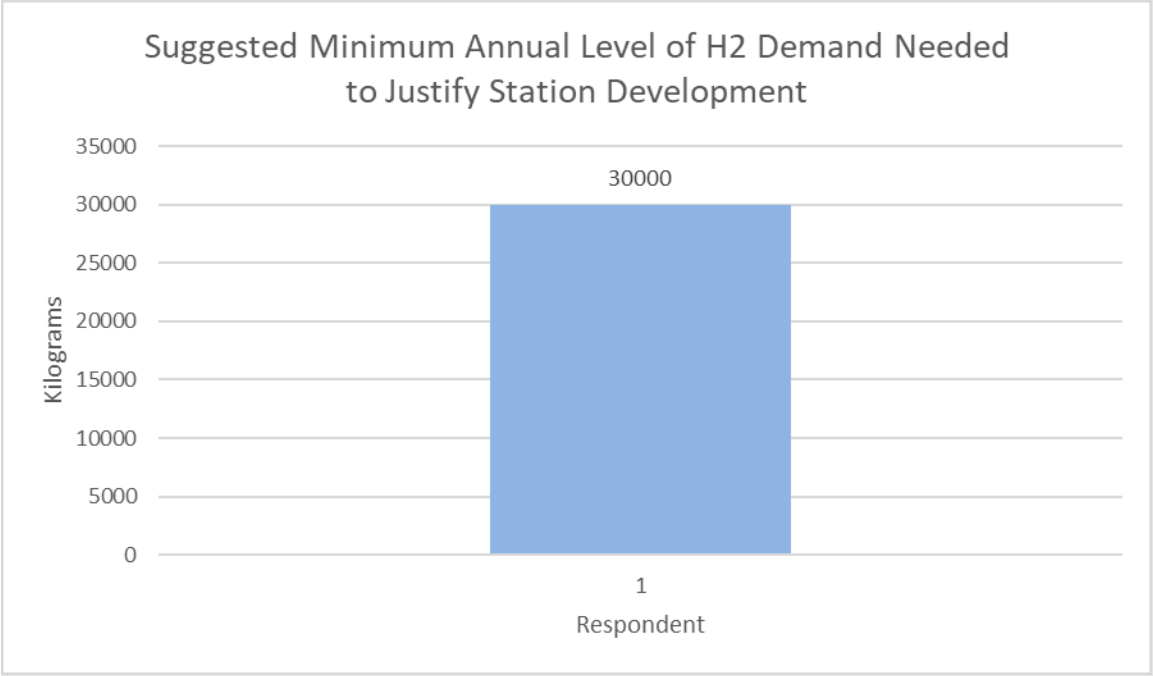
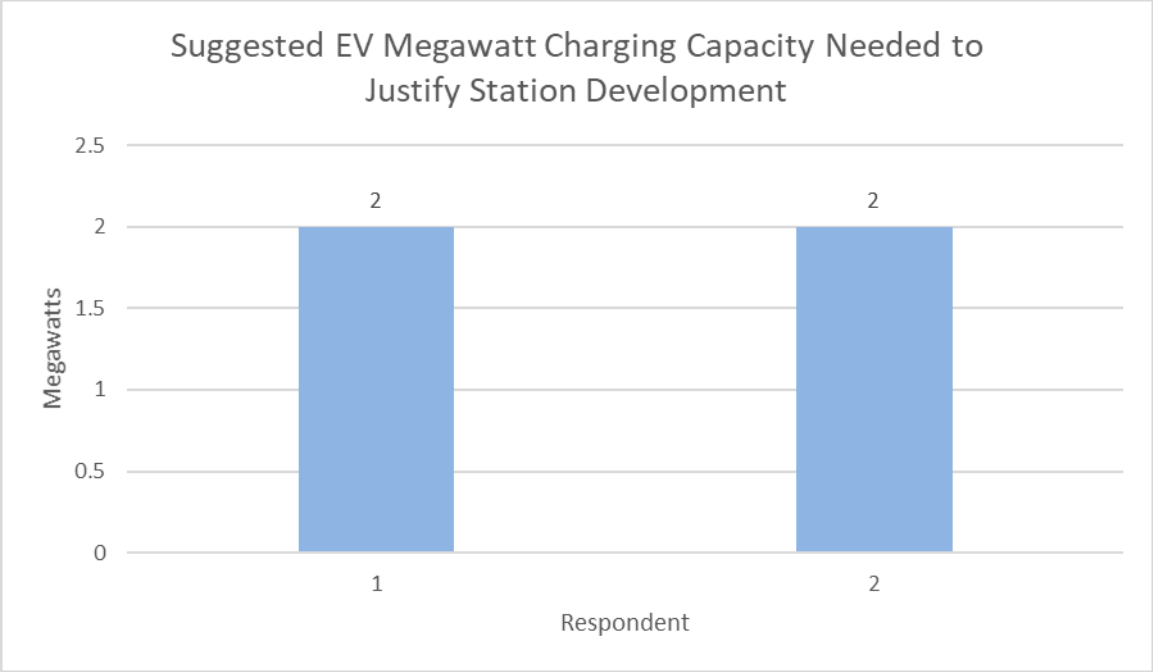


Figure 45 Suggested EV Megawatt Charging Capacity Needed to Justify Station Development



Similarly, CALSTART asked fuel providers to describe their estimated CAPEX range for developing one fueling station at the minimum level of annual demand they described in the table above. These results represent estimates for stations that meet the minimum capacity requirements that fuel providers suggested are needed to justify the business case for station development. The CAPEX of any fueling or charging station will vary by size and scope. This is reflected in Section IX as the CAPEX estimates for specific project proposals vary and differ from the average responses provided through surveys as shown in Table 58.

Table 58: Estimated CAPEX per Station per Fuel Type via Survey Responses

	CNG	LNG	LPG	H_2	EV
Average	$1,125,000	$500,000	$285,000	$625,000	$50,000
Maximum	$2,000,000	$500,000	$500,000	$750,000	$50,000
Minimum	$500,000	$500,000	$70,000	$500,000	$50,000

When asked the projected timeline to develop one fueling station for each of the following fuel types, the respondents gave numerous responses. Table 59 shows summary statistics across all responses per fuel type.

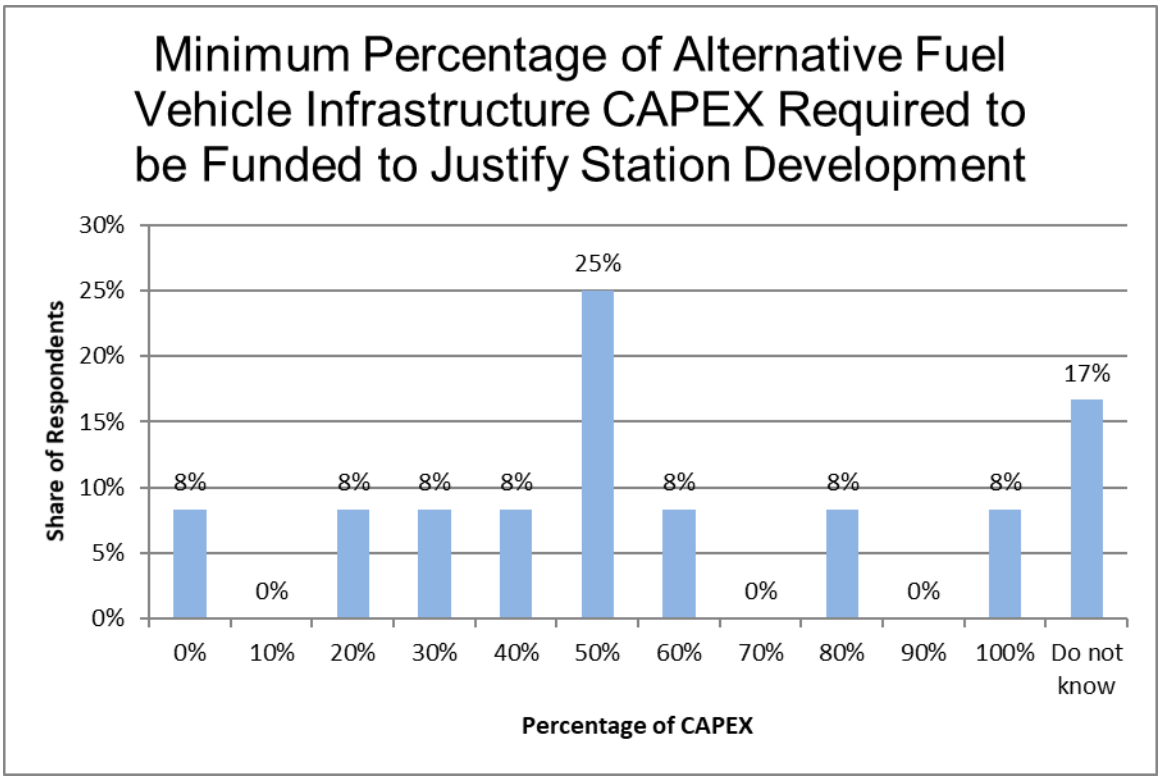
Table 59: Estimated Development Timeline per Station per Fuel Type

	CNG	LNG	LPG	H_2	EV
Average	13.8 months	12 months	5.67 months	20 months	8.5 months
Maximum	24 months	12 months	12 months	24 months	12 months
Minimum	9 months	12 months	2 months	12 months	5 months

As with fleets, CALSTART asked fuel providers what partners are important to an infrastructure development project. The three partners which were mentioned most, in order, were utilities, engineering procurement and construction providers, and city permitting offices. Fuel providers also mentioned the following partners less frequently: original equipment manufacturer, the state, operations and maintenance contractors, project management organizations, modular fuel storage and dispensing vehicle companies, companies providing rail access, software vendors, and hardware vendors.

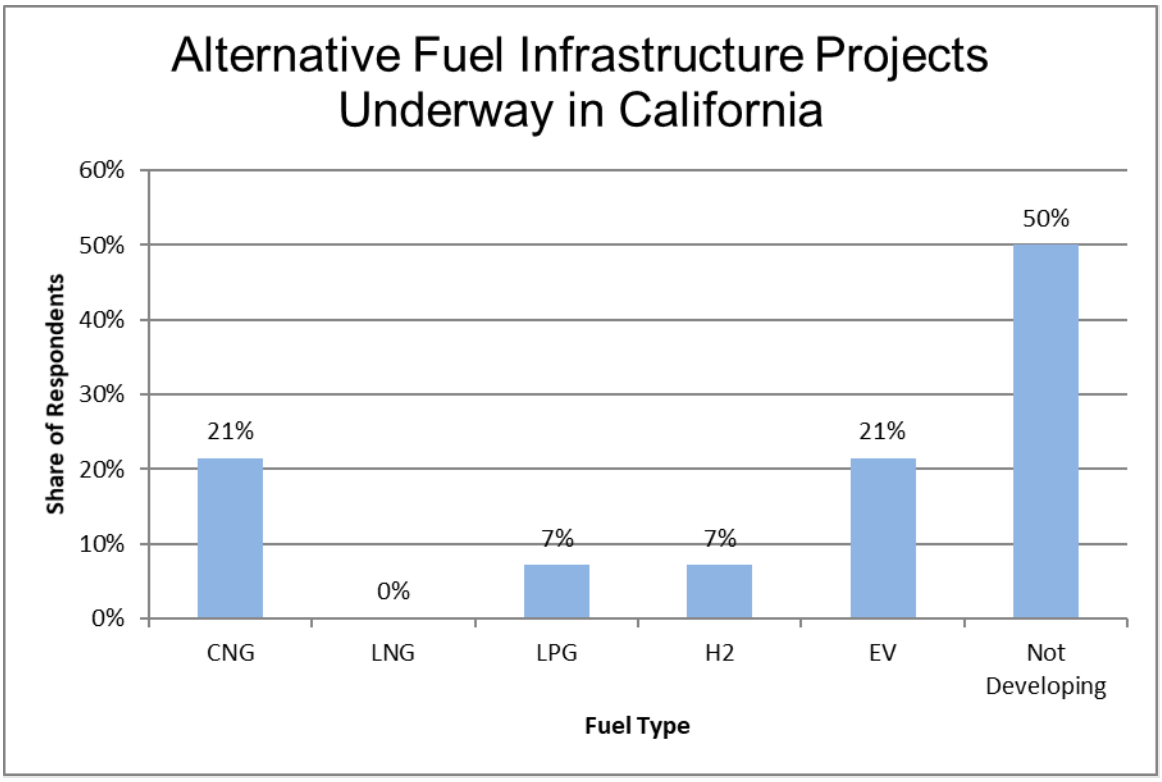
Infrastructure Funding Needs: Fuel providers were asked, if funding were available to help them cover the capital expenses for developing alternative fueling infrastructure, what is the minimum percentage of the total capex that funding must cover for them to consider the development. 73% respondents stated that ≥80% should be covered by funding assistance.

Figure 46: Minimum Fuel Provider Funding Needed for Alternative Fuel Infrastructure CAPEX



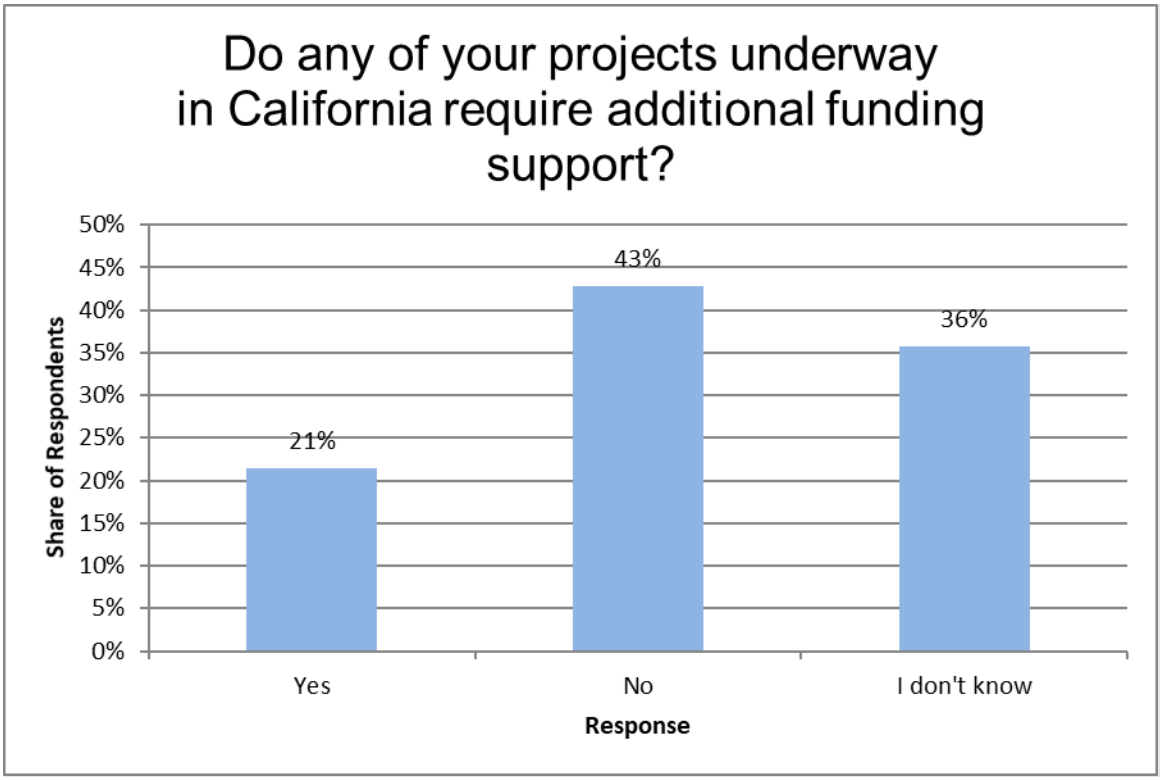
Infrastructure Projects Currently in Development and Funding Needs: When asked about current alternative fuel infrastructure development projects in California, most respondents said there were none in development, but those that did state projects were focused primarily on EV and CNG stations, followed by LPG and H2 station development.

Figure 47: Current Fuel Provider Alternative Fuel Infrastructure Projects Underway – California



Further, 43% of fuel providers who are currently developing projects in California do not need funding support. 36% of fuel providers with projects under way stated that they did not know if they would need funding support for those projects, and 21% said that they did need funding.

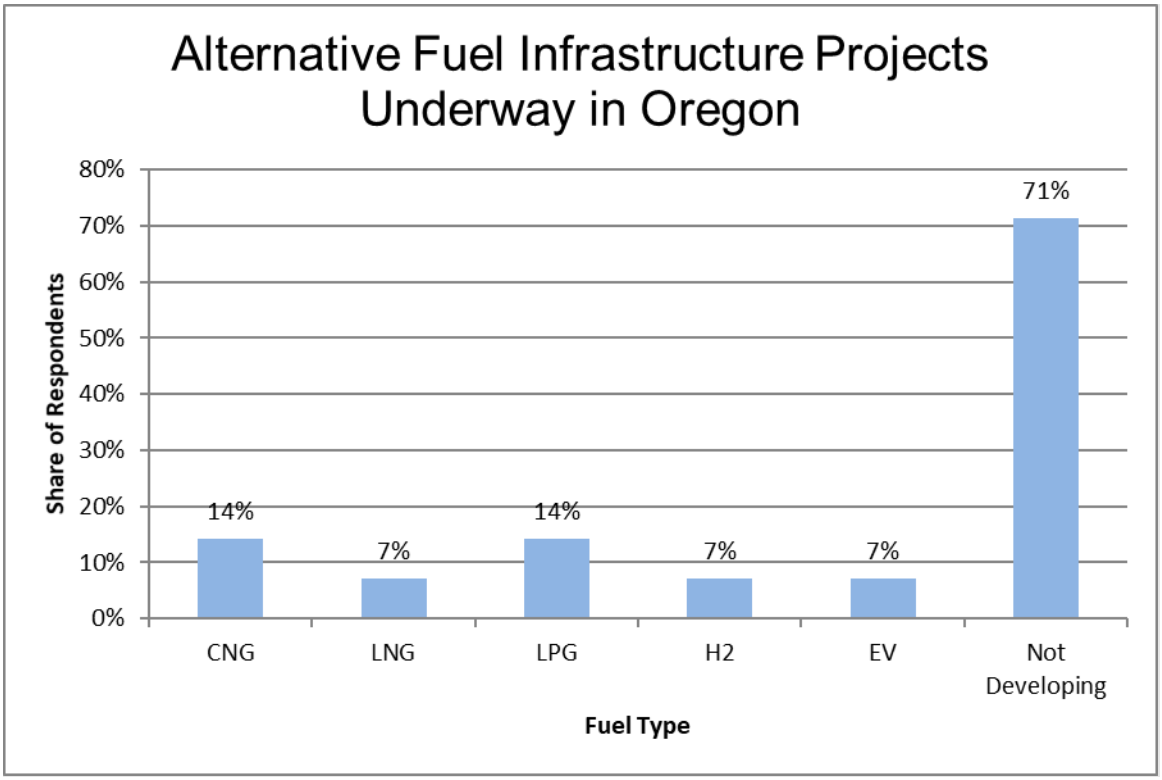
Figure 48: Fuel Provider Funding Needs for Current Projects Underway – California



Those that did say that funding could be used on their current projects listed a number of uses for that funding. Uses included purchasing materials, expanding project scope, marketing, purchasing equipment, site expansion, upgrading utility service.

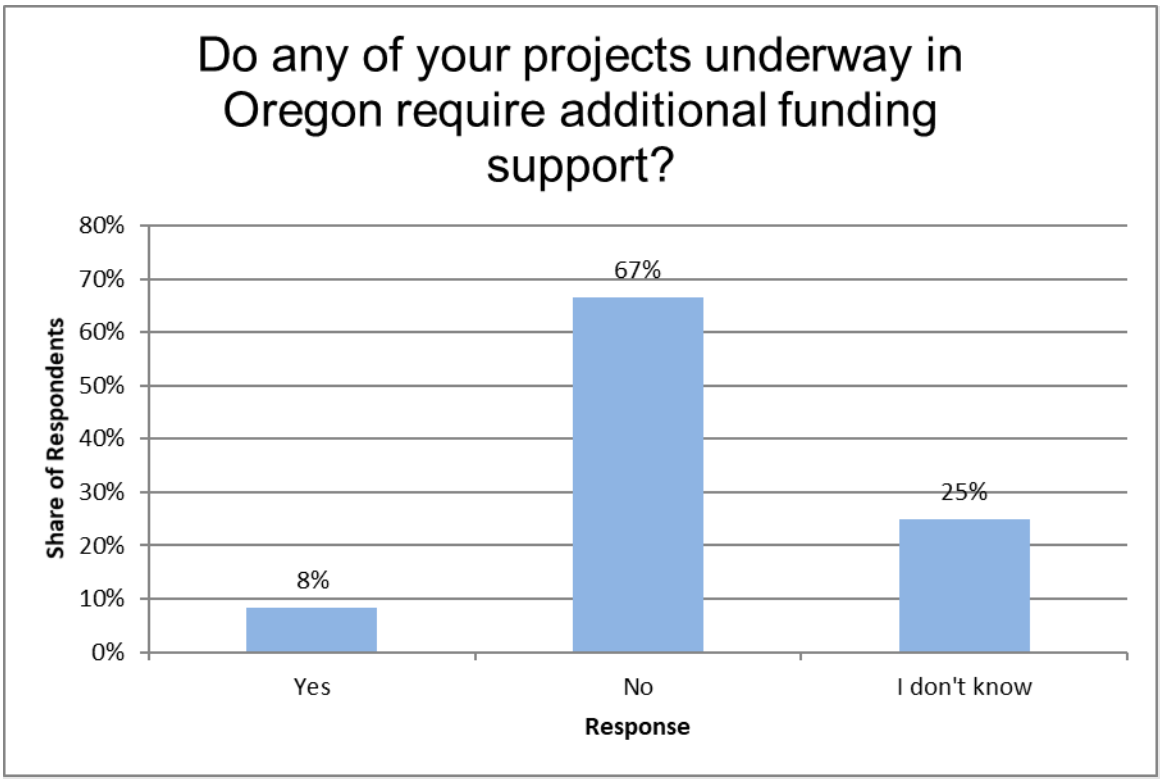
Similarly, most respondents said that they are not developing projects in Oregon. Of those that do have projects underway in Oregon, 14% are working on either CNG or LPG projects, and 7% are working on either LNG, H_2, or EV projects.

Figure 49: Current Fuel Provider Alternative Fuel Infrastructure Projects Underway – Oregon



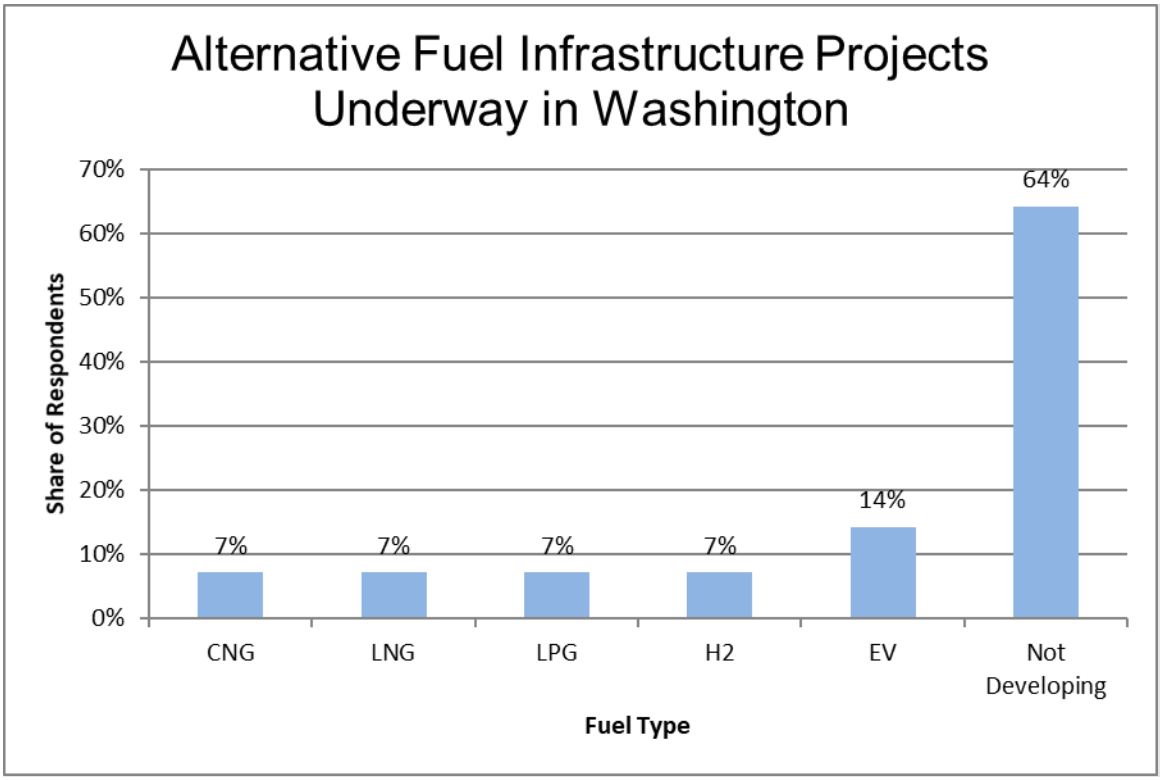
Most respondents that had projects underway in Oregon stated that they do not need additional funding, 25% stated that they do not know if funding is needed, and 8% stated that they could use additional funding. Those that need funding would use it for the following purposes: fund expansion of project scope, purchase construction materials, secure fuel storage and supply, purchase dispenser trucks, fund software development and support.

Figure 50: Fuel Provider Funding Needs for Current Projects Underway – Oregon



Again, in Washington, the majority of respondents stated that they are not currently developing alternative fuel stations. Those that are focus mostly on EV charging, followed by a tie between CNG, LNG, LPG, and H_2.

Figure 51: Current Fuel Provider Alternative Fuel Infrastructure Projects Underway – Washington



While the majority of respondents who are developing projects in Washington stated that they do not require additional funding, those that do listed a few uses for funding. Those uses are as follows: leasing land, purchasing equipment, design, permitting, scope expansion, and purchasing materials.

Figure 52: Fuel Provider Funding Needs for Current Projects Underway – Washington

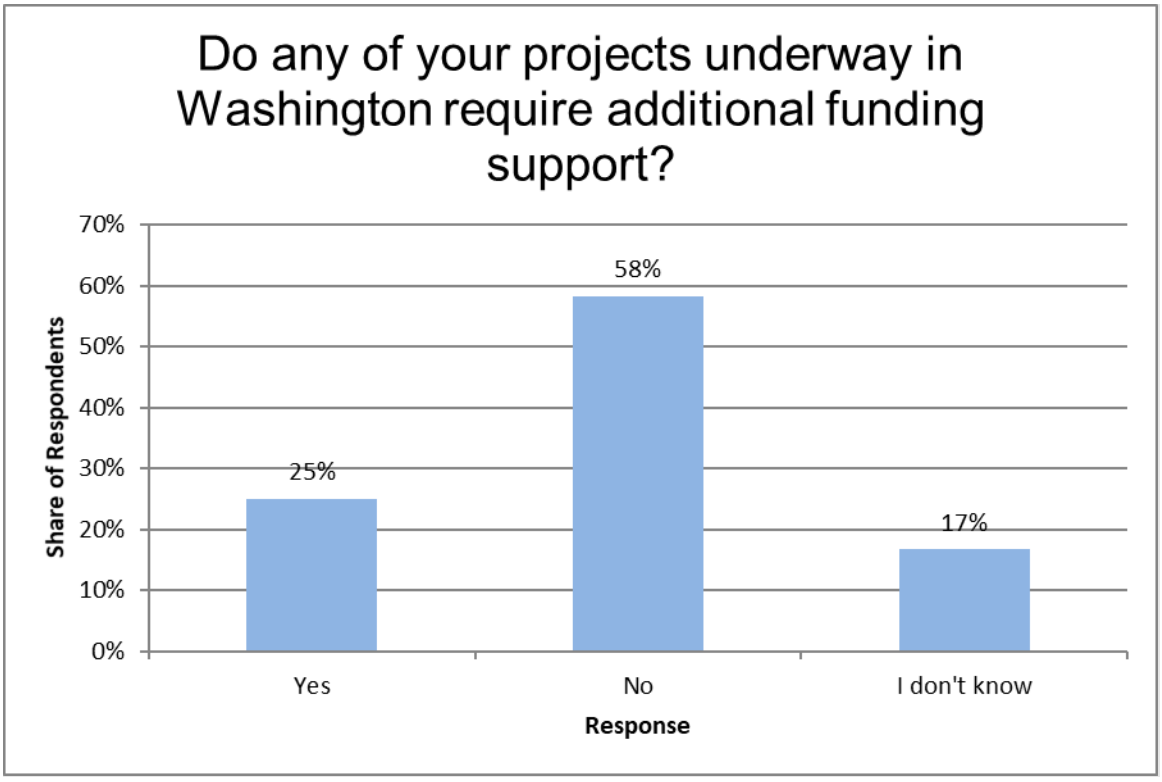


Table 60 shows the range of projects that are planned or currently underway in California by fuel providers who responded to the survey.

Table 60: Current and Planned Alternative Fuel Infrastructure Projects by Fuel Providers - California

	Fuel Type	Project Timeline	Public or Private Station?	Station Location	Annual Fueling Capacity	Number of Dispensers	Located in a DAC?
Fuel Provider Project 1	EV	Nine months (Complete 2020)	Private	Multiple locations	12.5 MW (across all sites)	1000	Some
Fuel Provider Project 2	RNG	N/A	Public	Multiple locations	N/A	N/A	Some
Fuel Provider Project 3	CNG, RNG	N/A	Public	Los Angeles	176,000 DGE	4	Yes
Fuel Provider Project 4	CNG	18 months	Public	N/A	264,000 DGE	2	Don't Know
Fuel Provider Project 5	H_2	60 months	Private	N/A	1,760,000 DGE	N/A	Don't Know
Fuel Provider Project 6	EV	36 months	Public	Freight Corridors	"Several Thousand Trucks"	N/A	Don't Know
Fuel Provider Project 7	EV	N/A	Private	Port of San Diego	N/A	30	Yes
Fuel Provider Project 8	EV	24 months	Private	35 W. Saint Josephs St., Arcadia, CA	N/A	2	No
Fuel Provider Project 9	LPG	Complete 2021	Public	Los Angeles County	200,000 Gallons	1	Don't Know
Fuel Provider Project 10	CNG	12 months	Public	N/A	264,000 DGE minimum	2	Don't Know
Fuel Provider Project 11	LPG	Complete 2021	Public	Orange County	200,000 gallons	1	Don't Know
Fuel Provider Project 12	LPG	Complete 2021	Public	Riverside County	200,000 gallons	1	Don't Know
Fuel Provider Project 13	LPG	Complete 2021	Public	San Bernardino County	200,000 gallons	1	Don't Know

	Fuel Type	Project Timeline	Public or Private Station?	Station Location	Annual Fueling Capacity	Number of Dispensers	Located in a DAC?
Fuel Provider Project 14	RNG	N/A	Public	N/A	N/A	N/A	N/A
Fuel Provider Project 15	LPG	Complete 2021	Public	405 / 10 FWY	200,000 gallons	1	Don't Know
Fuel Provider Project 16	CNG	36 months	Private	Several Locations: Industrial and Agricultural Areas	11,300,000 DGE	7-15	Don't Know

Table 61 shows the same results for projects planned or currently underway in Oregon.

Table 61: Current and Planned Alternative Fuel Infrastructure Projects by Fuel Providers - Oregon

	Fuel Type	Project Timeline	Public or Private Station?	Station Location	Annual Fueling Capacity	Number of Dispensers	Located in a DAC?
Fuel Provider Project 1	CNG, EV	24 months	Public	N/A	264,000 DGE minimum	3	Don't Know
Fuel Provider Project 2	EV	36 months	Public	Freight Corridor	"Several thousand trucks per day"	N/A	Don't Know
Fuel Provider Project 3	EV	Operational 03/2019	Private	Transit Depot	450 kW	1	Don't Know
Fuel Provider Project 4	EV	Operational 03/2019	Private	Transit Depot	100 kW	6	Don't Know
Fuel Provider Project 5	EV	Complete 2022	Private	Transit Agencies	Varies by site	100 (across all sites)	Don't Know
Fuel Provider Project 6	CNG	36 months	Private	Several Locations: Industrial and Agricultural Areas	11,300,000 DGE	7-15	Don't Know
Fuel Provider Project 7	CNG	12/2020	Private	SE Portland	26,400 DGE	2	Yes
Fuel Provider Project 8	Biofuel	6 months	Private	Redmond	3-5 million gallons	5-7	Don't Know

Table 62 shows projects planned or currently underway in Washington.

Table 62: Current and Planned Alternative Fuel Infrastructure Projects by Fuel Providers - Washington

	Fuel Type	Project Timeline	Public or Private Station?	Station Location	Annual Fueling Capacity	Number of Dispensers	Located in a DAC?
Fuel Provider Project 1	H_2	36 months (Complete 2023)	Public	Tacoma	N/A	N/A	Yes
Fuel Provider Project 2	CNG, EV	24 months	Public	N/A	264,000 DGE minimum	3	Don't Know
Fuel Provider Project 3	EV	36 months	Public	Freight Corridor	"Several thousand trucks per day"	N/A	Don't Know
Fuel Provider Project 4	LPG	Open Now	Both	Multiple locations	360,000 gallons	2	No
Fuel Provider Project 5	EV	36 months (Complete 2023)	Public	Tacoma	N/A	N/A	Yes
Fuel Provider Project 6	H_2	36 months (Complete 2023)	Public	Tacoma	35,000 kg	N/A	Yes
Fuel Provider Project 7	LPG	3 months	Both	N/A	60,000 gallons	2	No
Fuel Provider 8	EV	Complete 2021	Public	Tacoma	150 MWh/year	N/A	Yes
Fuel Provider Project 9	CNG	36 months	Private	Several Locations: Industrial and Agricultural Areas	11,300,000 DGE	7-15	Don't Know
Fuel Provider 10	CNG	2020	Private	Vancouver	26,400 DGE	2	No

XIII. APPENDIX D: Endnotes

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