NORTHWEST CALIFORNIA
ALTERNATIVE FUELS READINESS PLAN

Prepared by
Redwood Coast Energy Authority
Schatz Energy Research Center

In Collaboration with
Mendocino Council of Governments
North Coast Unified Air Quality Management District
Siskiyou County Economic Development Council

AUGUST, 2016

The California Energy Commission provided the funding for this project through its Alternative and Renewable Fuel and Vehicle Technology Program, which issued solicitation PON-13-603 to provide funding opportunities for projects that will help prepare California for the increased use of alternative fuels and vehicles.

PROJECT TEAM

The Redwood Coast Energy Authority was formed in 2003 to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient, and renewable resources available in the region. The Energy Authority is a local government joint powers agency representing all incorporated cities in Humboldt County, the County of Humboldt, and the Humboldt Bay Municipal Water District.

The Mendocino Council of Governments is the regional transportation planning agency for the County of Mendocino and the four incorporated cities. The Mendocino Council of Governments formed as a joint powers agreement in 1972 as mandated by state law to disburse state and federal funds for transportation, to provide regional planning, and to serve as a regional forum. The Mendocino Council of Governments supports transportation-related projects through local assistance and interregional partnerships.

The North Coast Unified Air Quality Management District is a regional environmental regulatory agency with jurisdiction over Humboldt, Del Norte, and Trinity counties. The District's primary responsibility is controlling air pollution from stationary sources, though their efforts also address mobile sources and vehicles. They are committed to achieving and maintaining healthful air quality throughout their tri-county jurisdiction. The District is one of thirty-five local air districts in California and enforces local, state, and federal air quality regulations.

The Schatz Energy Research Center at Humboldt State University was founded in 1989 with a mission to promote the use of clean and renewable energy resources. The Center has been involved in extensive research, planning, design, and analysis activities for the development and implementation of sustainable energy systems.

The Siskiyou County Economic Development Council is a non-profit 501(c)4 corporation designed to promote economic vitality in Northern California. Since its inception in 1985, the SCEDC has been the lead organization in economic development in the area by functioning as a business consulting service and program advisor. The SCEDC develops strategies for constructive and balanced economic growth in Siskiyou County and the greater Northern California region.

ACKNOWLEDGEMENTS

This plan would not have been possible without the significant involvement and feedback from numerous stakeholders and consultants in the project region. The following is a list of contributors in no particular order.

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Mission Statement:

The Northwest California region will take the most efficient approach to meet its regional contribution to reduce greenhouse gas emissions by increasing the adoption of clean low-carbon transportation fuels, and establishing a key set of actions to accomplish this goal.

EXECUTIVE SUMMARY

Funded by the California Energy Commission, the Northwest California Alternative Fuels Readiness Project was launched to develop strategies for the deployment of alternative fuel infrastructure, and identify activities to encourage the adoption of alternative fuel vehicles in rural, northwest California. The anticipated outcome of this project is an established and engaged network of public and private stakeholders throughout the Northwest California region that can foster the successful introduction of alternative fuel vehicles, wise and effective deployment of alternative fuels infrastructure, and the development of a robust market for alternative fuels.

The Northwest California Region consists of the five contiguous counties on California's northwest coast: Del Norte, Siskiyou, Humboldt, Trinity, and Mendocino. As a rural area, Northwest California faces unique alternative fuel adoption issues as compared to more metropolitan areas of the country. As such, infrastructure and markets necessary to achieve federal and state goals must be developed in a manner that recognizes local and regional nuances, as well as the context-dependent strengths and weaknesses of different fuel pathways.

Current Status of Alternative Fuels in the Northwest Region

The State of California has set ambitious goals for reducing greenhouse gas (GHG) emissions through the adoption of a low-carbon fuel standard and the promotion of domestically produced renewable transportation fuels. On the local level, all of the counties in the Northwest Region have individually undertaken some level of planning effort to prepare for the adoption of electric vehicles, and many of the regional partners have Climate Action Plans and General Plans that include "Energy Elements" calling for specific actions to increase the availability and use of alternative fuels. The fuels-related planning goals in the region range from general criteria pollutant emissions reduction goals, to "greening" the public agency fleets and encouraging pedestrian/bicycle trips between County facilities where distances and physical ability permit.

On the community level, the Northwest Region is home to many committed key players integral to the successful implementation of the Readiness Plan. Key stakeholders are broadly categorized into five main groups: government agencies, fuel distributors, vehicle fleets, supporting services and the general public. Supporting services include: firefighters, law enforcement, ambulance services, roadside assistance services, County Offices of Emergency Services, fueling Station owners, fleet operators, dealerships, auto-repair shops, and community colleges.

Commercially available alternative transportation fuels include biodiesel, electricity, ethanol, hydrogen, natural gas, renewable natural gas, propane, and renewable diesel. Renewable diesel is a "second generation" diesel fuel made entirely from plant and waste oils like biodiesel, but without the gelling or engine performance issues of the first

generation biofuels. The fuel types currently offered in the project region include: Level 2 electric vehicle charging stations (28), biodiesel fuel pumps (4), and one hydrogen fueling station (1).

There are already a significant number of commercially available alternative fuel vehicles on the market, these include: The number of available models of alternative fuel vehicles on the market is expected to continue to rise. Currently, the strongest growth in the alternative fuel vehicle market is: flex-fuel (E85), diesel (biofuels), and electric / hybrid electric vehicles.

Looking Forward

In addressing the mission of taking the most efficient approach to reducing greenhouse gas emissions from the transportation sector, this plan focuses on developing a least-cost path to foster a local vehicle and fuel market that meets the Low Carbon Fuel Standard (LCFS) goal of reducing the carbon intensity of the total fuel mix by 10% by 2020. The least-cost path is only one of many possible benchmarks the region can use to accomplish the mission proposed here, and should be used as a tool to help provide regional stakeholders a sense of the potential impact of changes to the transportation sector.

A modeling effort was undertaken to identify the lowest "incremental societal cost" mix of fuels and vehicles needed to meet the regional target of a 10% reduction in transportation carbon emissions, or 240 kilo tons of carbon dioxide equivalent (CO2eq). The model used vehicle cost, fuel infrastructure cost, and fuel cost (including distribution) to compare the total lifecycle cost to society for each fuel and technology above that of the fossil fuel that it would displace.

The model also estimated the quantity of existing and new vehicles that would be needed to meet the least-cost fuel mix portfolio by 2020. Model results indicate that electric light duty vehicles are overwhelmingly the largest quantity of low-carbon fuel vehicles anticipated (19,400). Although the upfront capital cost is currently relatively high for electric vehicles (EVs), the low cost of fuel and fueling infrastructure results in EVs demanding the lowest total incremental societal investment. Results are shown in Table 1.

Table 1: Estimated number of vehicles running an alternative fuel in 2020.

	Light Duty						Heavy Duty	
	BEV	**PHEV**	**E15**	**E85**	**B20 / RD**	**H_2**	**E15**	**B20 / RD**
Total	19,400	600	1,500	350	100	200	2,800	1,650
% of All On-Road Vehicles in 2020	17% of LDVs						2.7% of HDVs	

The total gallons of fossil fuel to be offset annually in order to meet the LCFS target by 2020 are estimated to be 17 million gallons per year of gasoline, and 4 million gallons

per year of diesel fuel. There are numerous combinations of low-carbon fuels and vehicles that can meet the LCFS target, some having a higher incremental cost than others. Under the least-cost scenario, the quantity of low-carbon fuels that would be required to meet the offset fossil fuel demand is shown in Table 2.

Table 2: Estimated quantity of alternative fuels to be sold in 2020.

	Electricity[a] End-use MWh/year	Liquid Fuels Unblended Gallons / year			H_2[e] kg / year
		E15[b]	E85[c]	B20 / RD[d]	
Total	131,100	425,100	249,700	806,100	73,100
% Impact	~6% increase in regional electricity consumption	~10% reduction in regional consumption of gasoline and diesel			

The quantity of fueling stations needed in the region was estimated based on the projected quantity of low-carbon fuels demanded in 2020. The results of the analysis show that the vast majority of fueling infrastructure needed under the least-cost scenario are home EV charging stations (20,000), and public EV charging stations (339). Additionally, the region would also need thirteen (13) renewable diesel stations, six (6) ethanol fuel pumps, and five (5) hydrogen fuel dispensers. The combined total of 22 liquid and gaseous fueling stations represents about ten percent (10%) of the total number existing gasoline and diesel stations in the region.

From a full portfolio perspective, total estimated incremental cost above business-as-usual is $43 million (in 2015 dollars) between 2015 and 2020. On a per-vehicle basis, this cost is roughly $1,600 per alternative fuel vehicle, across all fuel and vehicle types modeled. The model results indicate that Ethanol, biodiesel, and renewable diesel have the lowest amortized incremental costs as these fuels can utilize existing fueling station infrastructure and do not require a new vehicle purchase. Electric vehicles have a high amortized incremental vehicle cost; however, EVs also have a low total incremental cost as the fuel cost is markedly less costly due to the efficiency of the EV engine. Plug-in hybrid-electric vehicles, flex-fuel vehicles, and hydrogen vehicles have the highest overall amortized incremental cost over three times the incremental cost of the drop-in fuel and electric vehicle counterparts.

The average marginal greenhouse gas abatement cost ($/T CO_2eq.) of the different alternative fuel pathways was also modeled. Battery electric vehicles, used cooking oil biodiesel, and tallow-based renewable diesel all had the lowest abatement cost of ~$70 - $180/T CO_2eq. Hydrogen, flex-fuel vehicles running off of sorghum ethanol, and soy based renewable diesels have the highest abatement cost of over $600/t CO_2eq.

While alternative fuel vehicles and fuel supply are the primary components needed to forge a low-carbon transportation market, it is just as important to enable the numerous industries that support the auto industry. These include: government planning and inspection agencies, first responders, dealerships, maintenance and repair businesses, towing and salvage businesses, fleet operators, and fuel distributors. Information about low-carbon fuels permitting challenges and AF training needs was gathered through

interviews and Working Groups to identify practical strategies to reduce permitting barriers.

Barriers to Establishing a Thriving Alternative Fuels Market

With input from numerous stakeholders across the region 22 specific barriers were identified as being key challenges to the development of an alternative fuel market. Barriers to increasing the diversity of low-carbon fuels are mainly related to the relative newness of alternative fuels, and are not tied to the efficacy of the fuels and technologies themselves. Many of these barriers can be surmounted through outreach, education, thoughtful policy, and coordinated regional efforts to establish a low-carbon fuels network.

The identified barriers are organized into the following categories: Vehicles, Infrastructure, Fuels, and Support Services. They collectively represent technical, social, and economic challenges.

Key barriers associated with the uptake of low-carbon fuel vehicles include:

- **Higher capital cost** – Most alternative fuel vehicles command a higher up-front cost than a comparable conventional ICE vehicle.
- **Limited range** – Limited driving range can be a real or perceived barrier for potential BEV drivers, as most BEVs cannot be driven long distances without recharging.
- **Limited product offerings** – The variety of alternative fuel vehicles available on the market today is relatively limited, covering only a small subset of the wide range of end-use activities that vehicles serve.
- **Long charging times** – The time required to charge electric vehicle batteries is long in comparison to the time required to refuel vehicles that utilize liquid fuels.
- **Risk aversion, market inertia, and lack of awareness** – Potential customers being unfamiliar with the technology and uncertain about its costs and benefits.

Key barriers associated with AF infrastructure development include:

- **Lack of public fueling infrastructure** – The lack of public infrastructure is in part due to the classic “chicken-or-the-egg” conundrum. Fuel providers will not deploy fueling infrastructure if there are not enough vehicles to utilize it, and consumers will not buy alternative fuel vehicles if they can’t refuel them.
- **Lack of fuel production and distribution infrastructure** – In addition to a lack of alternative fuel retail providers in the Northwest California region, there is also a lack of local alternative fuel producers. This can affect the availability and cost of alternative fuels in the region.
- **Lack of standardization in public charging infrastructure** – A lack of standardization of PEV charging infrastructure can present difficulties for PEV drivers.

Key challenges associated with low-carbon fuels include:

- **The "Blend Wall" –** The "blend wall" is a maximum percentage of ethanol that can be blended into gasoline per EPA regulation.
- **Fuel economy reduction –** The lower energy content per gallon in liquid biofuels will result in reduced vehicle range and increased fuel consumption.
- **Public perception –** While it was originally thought that there would be significant environmental gains by using these fuels made from domestic biomaterials, careful analysis has shown that some first generation biofuels may not offer much in the way of environmental benefits.

Commitment to Action

Conventional vehicles can be difficult to unseat; consumers know their attributes and are accustomed to buying, driving, and fueling these vehicles. Additionally, petroleum-based fuels have a long history of externalized societal costs, which sustains an artificially low price point for this incumbent fuel. Alternative fuel vehicles, on the other hand, have many different operational characteristics, but also have new benefits with which drivers and other stakeholders must become familiar. It is expected that technology and costs will change significantly over the next five years, opening doors for some fuels and closing them for others. Regardless of the ultimate fuels mix, the switch to low-carbon fuels presents an opportunity to create a universal costing system for transportation fuels that includes all lifecycle costs and levels the playing field for clean fuels to take hold in our local energy economy.

With input from numerous stakeholders in the region 69 specific actions were developed to address the barriers that stand between business-as-usual and the opportunities that alternative fuels offer. These actions are generally assigned to one or more of the following agency and party groups: (S)tate of California departments and agencies, (L)ocal government, such as planning and permitting departments, City Councils and Boards of Supervisors, and a (C)oalition of local agencies and stakeholders supporting the efficient development of alternative fuels in the region. Actions are grouped into the following categories:

- Market development actions, funding mechanisms, and incentive programs
- Land Use, Zoning, and Permitting Changes
- Safety, First Responder, and Auto Support Industry Training
- Outreach and Promotion

Following the list of actions, a proposed next step is to establish a regional Clean Cities Coalition to coordinate regional efforts and formalize steps towards addressing the barriers and actions proposed in this plan. This is viewed as a critical step if the ambitious targets proposed in this plan are to be realized.

Reducing emissions from the transportation sector is integral to achieving ambitious GHG emissions reductions targets and reduced health impacts from air pollution. With the magnitude of this opportunity in mind, the actions proposed here ask that state and local government agencies, and all key regional stakeholders make concrete commitments in the immediate near term to pave the way for alternative fuels to flourish in Northwest California.

1. INTRODUCTION

The State of California has set ambitious goals for reducing greenhouse gas (GHG) emissions through the adoption of a low carbon fuel standard and the promotion of renewable and alternative fuels for transportation. The California Energy Commission (CEC) has been tasked to develop and fund strategies for advancing these goals. This catalyzed the creation of the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP).

In 2013 the Redwood Coast Energy Authority, in partnership with the Schatz Energy Research Center, the Mendocino Council of Governments, the North Coast Unified Air Quality Management District, and the Siskiyou County Economic Development Council, applied to and won CEC solicitation PON-13-603. Funded through the ARFVTP project under grant award CEC-ARV-13-012, the Northwest California Alternative Fuels Readiness Project was launched in 2014 to:

1. Assess the opportunity for low carbon fuel commercialization and adoption in the local context of the Northwest Region,
2. Develop strategies for the deployment of alternative fuel infrastructure,
3. Identify key actions to encourage the adoption of alternative fuel vehicles in rural northwest California, and
4. Integrate these local nuances into a strategic planning and outreach effort that increases alternative fuel use in the region.

To accomplish the goals of this project, the project team led a coordinated effort within the project region to support the successful introduction of alternative fuel vehicles, wise and effective deployment of alternative fuel infrastructure, and the development of a robust market for alternative fuels. This was accomplished by conducting a strategic assessment of the barriers to and opportunities for regional adoption of alternative fuels, and by developing a targeted outreach program in the region designed to promote alternative fuels.

The key drivers for the Northwest California Alternative Fuels Readiness Project include:

- **Pubic Health**: Reduced air pollutants in the region.
- **Local Economy**: Additional jobs, improved fuel economy, and reduced vehicle operation and maintenance costs.
- **Energy Security**: Reduced price volatility and less dependency on foreign oil sources.
- **Environmental Community**: Increased environmental consciousness in our region that will attract tourism, businesses, and residents.
- **Alignment with State and National Goals**: Assist in meeting greenhouse gas emissions reduction goals and municipal fleet goals.

One of the more common drivers towards the use of alternative fuels is to reduce greenhouse gas emissions. Fuels that offer lower lifecycle greenhouse gas emissions compared with gasoline or diesel are also referred to as low-carbon fuels. However, reduction in greenhouse gas emissions is not the sole reason to consider alternative fuels. Additional reasons include:

- Potential reduction in maintenance costs,
- Reduced susceptibility of fuel prices to market volatility,

- Increased energy security due to domestic production of fuel,
- Potential increased investment in local economies,
- Reduced emissions of criteria air pollutants,
- Avoided social justice impacts relating to the exploration and extraction of fossil fuels in some regions, and
- Mitigated environmental concerns such as water quality and land use impacts from fossil fuel supply chains.

1.1. Northwest California

For the purposes of this Readiness Plan, the Northwest California Region consists of the following five contiguous counties in Northwest California: Del Norte, Siskiyou, Humboldt, Trinity, and Mendocino. Totaling 18,715 square miles, the region encompasses over 11% of California. However, the largest city in the region, Eureka, has a population of only 27,000. As a rural area, the Northwest faces unique alternative fuel adoption issues as compared to more metropolitan areas. All of the counties in the Northwest Region have individually undertaken some level of planning effort to prepare for the adoption of electric vehicles, and continue to do so today. This Readiness Plan adds to this work by presenting results of region-wide coordination in the broader arena of alternative fuels.

1.2. Document Scope

The scope of this document looks specifically at on-road vehicles, and focuses on vehicle miles traveled under the power of non-petroleum fuels. It considers all on-road vehicle classes from motorcycles to buses and class 8 trucks. Only fuels and vehicles that are commercially available as of July, 2015 are considered.

Off-road vehicles are not considered in the regional targets identified; however, much of the fuel and vehicle information, and many of the identified barriers and actions, do apply to off-road vehicles as well. In addition, alternative modes of transportation are not considered, such as bicycling or walking, although these are equally important options for reducing the regional consumption of petroleum fuels. Finally, additional opportunities for fuel reduction such as driver training, engine control module modification, and idle reduction technologies, are not assessed, but should be part of any discussion regarding opportunities for petroleum fuel use reduction.

1.3. Understanding Sources of Emissions from Transportation Fuels

A major driver for alternative transportation fuel policy is the reduction of criteria and greenhouse gas emissions. Therefore, it is worth addressing different emissions sources and types in order to better understand the drivers behind many current and future policies.

There are two main categories of emissions associated with the transportation sector:

- Criteria emissions are airborne pollutants that have been regulated federally since 1963, which was first instigated by the famous smog events in Los Angeles in the 50's. These are pollutants that significantly impact public health, some of which can also have significant environmental impacts such as ozone layer depletion and acid rain.

- Greenhouse gas emissions are airborne emissions that are associated with the greenhouse effect which impacts the global average atmospheric temperature.

There are two primary periods in time within the lifecycle of transportation fuels where both criteria and greenhouse gas emissions sources are considered. Both can occur during the following:

- Well-to-pump is the period within a fuel lifecycle where raw source materials are extracted or produced, refined, and transported to a distribution point such as a gas station.
- Pump-to-wheels (or tailpipe) is the actual use of the fuel by the vehicle.

When considering the cumulative criteria and/or greenhouse gas emissions across the full lifecycle of a fuel, the term most often used is "Well-to-Wheels" which aggregates greenhouse gas emissions across both life cycle periods.

It is important to consider both of these lifecycle periods when assessing the emissions associated with different transportation fuels. Both fuels and vehicle technologies can have varying impacts on one or both of these lifecycle periods. For example, electric and hydrogen fuel cell vehicles are the only commercially available technologies and fuels that have zero tailpipe emissions. However, electricity and hydrogen can have well-to-pump criteria and greenhouse gas emissions. Table 3 summarizes these emissions sources.

Table 3: Sources of criteria and greenhouse gas emissions.

Criteria Pollutants Carbon Monoxide Lead Particulates Ozone NOx SOx	Pump-To-Wheels (Tailpipe)	All vehicles except electric and fuel cell electric
	Well-to-Pump	All fuels[a]
Greenhouse Gases Carbon Dioxide Methane Nitrous Oxide Refrigerants CFCs Many others	Pump-To-Wheels (Tailpipe)	All vehicles except electric and fuel cell electric[b]
	Well-to-Pump	All fuels[a]

a: Well-to-Pump emissions vary widely based on fuel source.
b: Fuel cell electric vehicles emit water vapor which is a greenhouse gas. However, the impact of water vapor emissions associated with a high adoption of fuel cell vehicles is expected to be negligible, in the vicinity of 2% - 3% above water vapor emissions from the current on-road vehicle fleet.[1]

1 Colella, W. G., M. Z. Jacobson, and D. M. Golden. 2005. "Switching to a U.S. Hydrogen Fuel Cell Vehicle Fleet: The Resultant Change in Emissions, Energy Use, and Greenhouse Gases." Journal of Power Sources 150 (October): 150–81. doi:10.1016/j.jpowsour.2005.05.092.

2. CURRENT STATUS

The following sections present a snapshot of the current status of alternative fuels in the Northwest Region. This snapshot includes an overview of state and federal legislation, a review of state and regional planning documents, an assessment of currently available alternative fuels and vehicles, and identification of key stakeholders.

2.1. Business As Usual

A business-as-usual scenario predicts how alternative fuels adoption would be expected to proceed in the region under the current conditions and without additional policies or incentives beyond those currently in place. Table 4 and Table 5 show the expected population of vehicles and quantity of fuel consumed under a business-as-usual scenario in the near term through the year 2020. Business-as-usual is defined as the vehicle mix and population for the Northwest Region in the year 2020 that is forecasted by the EMFAC2011 vehicle emissions model developed and maintained by the California Air Resources Board (CARB). The values shown in Table 4 and Table 5 were taken directly from the EMFAC2011 model using the default settings.

Existing vehicles, referred to in Table 4 and Table 5, are those vehicles that are model years 2015 or older. New vehicles are model years 2016 through 2020. Note also that "passenger vehicles" refers to the light-duty auto (LDA) vehicle class in the EMFAC2011 model. These are sedans and hatchbacks, and other similar smaller vehicles.

Table 4: Passenger Vehicles - business-as-usual vehicle miles traveled, quantity of gasoline and diesel consumed, and vehicle population for the year 2020.

Region	Total VMT (miles/day)		Gallons Fuel Consumed (gallons/day)		Vehicle Population (Vehicles)			
	Diesel	Gas	Diesel	Gas	Diesel – New	Diesel – Existing	Gas – New	Gas – Existing
Del Norte	1,921	297,572	1,284	24,860	16	39	2,802	5,157
Humboldt	21,216	1,710,272	1,392	133,500	173	433	16,032	29,498
Mendocino	17,353	1,190,458	1,125	93,240	141	351	11,128	20,476
Siskiyou	4,417	500,701	2,945	45,730	39	99	5,133	9,444
Trinity	1,396	1,444,444	901	14,420	11	28	1,355	2,494

Table 5: All Vehicles Other Than Passenger Vehicles - business-as-usual vehicle miles traveled, quantity of gasoline and diesel consumed, and vehicle population for the year 2020.

Region	Total VMT (miles/day)		Gallons Fuel Consumed (gallons/day)		Vehicle Population (Vehicles)			
	Diesel	Gas	Diesel	Gas	Diesel – New	Diesel – Existing	Gas – New	Gas – Existing
Del Norte	115,242	687,831	8,743	46,225	724	2,205	6,336	14,906
Humboldt	884,475	3,643,434	92,477	228,624	4,424	13,472	33,501	78,814
Mendocino	903,035	2,838,535	113,706	180,329	3,736	11,378	26,085	61,368
Siskiyou	999,056	1,567,419	147,532	113,835	2,917	8,884	14,942	35,152
Trinity	223,516	489,880	31,527	37,732	781	2,379	4,565	10,741

2.2. Federal and State Legislation Related to Alternative Fuels

There are several Federal and State mandates and regulations requiring various stakeholders to take an active role in building the alternative transportation fuel and vehicle marketplace. The State of California has set ambitious goals for reducing greenhouse gas emissions through the adoption of a low carbon fuel standard and the promotion of renewable and alternative fuels for transportation. The following detail pertinent currently applicable mandates and regulations. Detailed up-to-date information can be found at afdc.energy.gov.

The Energy Policy Act (EPAct) of 1992 (Public Law 102-486) was passed by Congress to address the country's increasing dependence on petroleum. The act mandated that an increasing percentage of new vehicles purchased by government fleets be alternative fuel vehicles, and developed a renewable fuel standard.

The EPAct requires 75% of new light-duty vehicle acquisitions by covered federal fleets be alternative fuel vehicles. Executive Order 13693 requires federal agencies with 20 vehicles or more to ensure that by 2025, 50% of their light-duty vehicle acquisitions are zero-emission vehicles or plug-in hybrid electric vehicles (https://federalfleets.energy.gov/). Certain state governments are subject to similar EPAct requirements. In California, the purchase or lease of alternative fuel vehicles is encouraged for state offices, agencies, and departments. Any vehicle that the state owns or leases that can run on alternative fuel must operate on that fuel if it's available. The state has also set goals to reduce or displace fleet petroleum use. Additionally, the agencies responsible must work with other agencies to incentivize state employee use of alternative fuels. This may be by providing electric vehicle charging, reduced-cost parking, or other programs. The State Agency Low Carbon Fuel Use Requirement will be in effect starting January of 2017 at which time at least 3% of bulk transportation fuel purchased by the state must be very low carbon fuels, defined as having no greater than 40% of the carbon intensity of the closest comparable petroleum fuel.

- **Executive Order 13693** guides planning for federal sustainability in the next decade, and specifically addresses fleet and vehicle efficiency. By the end of 2020, PEVs and ZEVs shall make up 20 percent of all new agency passenger vehicle acquisitions, and 50 percent by 2026. Agencies will also plan for appropriate charging or refueling infrastructure, and ancillary services, to accommodate the fleet composition.

- **Corporate Average Fuel Economy (CAFE) standards** were enacted by Congress in 1975 with the purpose of reducing energy consumption by increasing vehicle fuel economy. Standards are set by the National Highway Traffic Safety Administration (NHTSA) for five year periods; final standards have been set for light-duty vehicles, model years 2017 to 2021 and non-final standards for years 2022 to 2025. Standards for medium and heavy-duty vehicles, model years 2018 to 2027 have been proposed.

- **California Assembly Bill 32**, the California Global Warming Solutions Act of 2006, requires reducing greenhouse gas emissions to 1990 levels by the year 2020, and 80% below 1990 levels by 2050. AB 32 requires a Scoping Plan, to be updated every 5 years, that lays out strategies to reduce GHG emissions based on the latest science and technologies. The California Air Resources Board (CARB), which is a department within the California Environmental Protection Agency that oversees air quality, was charged with developing the Scoping Plan and subsequent updates. They have implemented several initiatives over the years to reduce GHGs across multiple sectors, including the Low Carbon Fuel Standard Program, Zero Emission Vehicle (ZEV) Program, and an Emissions Trading Program (Cap-and-Trade).

- **California Senate Bill 375**, the Sustainable Communities and Climate Protection Act of 2008, requires metropolitan planning organizations (MPO) to prepare a sustainable communities strategy as part of regional transportation planning that would include measures to meet regional GHG reduction targets. Regional targets are set by the Air Resources Board and periodically updated as needed.

- **California Senate Bill 350** mainly commits the state to more renewable energy and increased energy efficiency. However, it also addresses alternative transportation by tasking electric utilities with investing in electric vehicle charging infrastructure.

2.3. Local Planning Documents Related to Alternative Fuels

Local governments have begun planning efforts to address federal and state legislation, as well as identify and codify their own relevant goals. Infrastructure and markets necessary to achieve federal and state goals must be developed in a manner that recognizes local and regional nuances, as well as the context-dependent strengths and weaknesses of different fuel pathways.

Many of the local planning and regulatory documents that guide future development within the Northwest Region contain content relevant to alternative fuels readiness planning. These documents provide an overview of the range of goals in the region, help identify potential stakeholders, and lay a foundation for determining which individual strategies may work best to meet petroleum reduction goals. Below are selected elements of local regulatory documents that contain language relevant to alternative transportation fuels.

2.3.1. Regional and Statewide

There are numerous state and regional planning documents that are relevant to alternative fuels planning. In addition, there are a few collaborations the state has entered in to with other states and nations. These include:

- **Upstate Plug-In Electric Vehicle Readiness Plan**: Siskiyou, Shasta, and Tehama counties (2014)
    - This project developed a readiness plan for the accelerated adoption of electric vehicles by the community. The plan can be found on the website of the Siskiyou County Economic Development Council.
- **North Coast Plug-In Electric Vehicle Readiness Plan**: Del Norte, Humboldt, and Trinity counties (2014)
    - This project developed a readiness plan for the accelerated adoption of electric vehicles by the community. The plan can be found on the website of the Redwood Coast Energy Authority.
- **California ZEV Action Plan**: State of California (2013)
    - This plan develops a roadmap for the state to achieve 1.5 million zero emission vehicles on California roads by 2025. The plan can found on the website of the Governor's Office of Planning and Research.
- **Multi-State ZEV Action Plan**: States of California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont (2013)
    - This plan outlines specific collaborative actions that the eight states can do to collectively achieve 3.3 million zero emissions vehicles on the road by 2025. The plan can found on the website of the Multi-State ZEV Task Force.
- **International ZEV Alliance**: British Columbia, California, Connecticut, Germany, Maryland, Massachusetts, The Netherlands, New York, Norway, Oregon, Québec, Rhode Island, The United Kingdom,

and Vermont (2015)
    - "The International Zero-Emission Vehicle Alliance (ZEV Alliance) is a collaboration of national and subnational governments working together to accelerate adoption of ZEVs. The participants set ambitious, achievable targets for ZEV deployment, take actions to achieve those targets as appropriate in each jurisdiction, act together to achieve individual and collective targets, and encourage and support other jurisdictions in setting and achieving ambitious ZEV targets."

2.3.2. Del Norte County

- **County General Plan** (2003)
    - Goal 8.D: "To maximize the efficient use of transportation facilities so as to … 3) reduce the quantity of emissions of pollutants from automobiles."
- **County Regional Transportation Plan Update** (2016)
    - Policy 3.9.3.2.2: "Promote projects that can be demonstrated to reduce air pollution, such as active transportation projects and alternative fuel programs."

2.3.3. Humboldt County

- **County General Plan Update** (not yet adopted as of July 2016)
    - E-P4: "...Support the development and implementation of Electric Vehicle (EV) charging stations and other alternative fueling infrastructure."
    - E-P5: "Recognize the Redwood Coast Energy Authority (RCEA) as the regional energy authority, which will foster, coordinate, and facilitate countywide strategic energy planning, implementation and education through a Comprehensive Action Plan for Energy."
    - E-P7: "The County government shall reduce building and transportation energy consumption by implementing energy conservation measures and purchasing renewable energy and energy efficient equipment and vehicles whenever cost-effective. Conservation and renewable energy investments should be planned and implemented in accordance with and performance-based action plan and County Greenhouse Gas Emission Reduction goals."
    - E-P10: "Major commercial, business, industrial, or mixed-use facility developments shall be required to submit a transportation management plan that addresses energy conservation measures such as … alternative fueling stations; …"
    - AQ-P10: "To lead by example, the County of Humboldt shall reduce its 2003 greenhouse gas emissions from governmental operations consistent with the state Global Warming Solutions Act and subsequent implementing legislation and regulations."
    - AQ-P14: "Encourage and provide incentives for commercial and residential design that supports the charging of electric vehicles."
    - AQ-IM4: "The County shall prepare a Climate Action Plan for its governmental operations consistent with the Countywide Climate Action Plan that seeks emission reductions in the following areas:
        - E. Renewable Energy and Low-Carbon Fuels
        - F. Efficient Transportation"

- **Comprehensive Action Plan for Energy** (2012)
    - "Vehicle Fleets: Encourage local government and private fleets to maximize the use of high-efficiency vehicles and alternative fuels."
    - "Alternative Fuels: Encourage when appropriate the use of alternative fuels that will reduce greenhouse gas emissions, which may include hydrogen, biodiesel, ethanol and natural gas."
    - "Biofuels Development: Promote the use of waste oils and other biomass sources for biofuels production. Focus on waste oils and other biomass that are not already being used for other purposes, and explore potential opportunities and issues of new technologies for biofuels production from local resources."
- **County Regional Transportation Plan** (2014)
    - PT-11: "Support the transition to alternative fuels for transit fleet."
- **RePower Humboldt Readiness Plan** (2013)
    - Assesses the potential for offsetting a portion of transportation fuel energy via electric vehicles using electricity generated from local resources.
- **City of Arcata – Community Greenhouse Gas Reduction Plan** (2006)
    - Goal C-1: "Incorporate energy and climate policy into the city's transportation plan and encourage policies at all levels for efficient and non-polluting transportation."
    - Goal C-4: "Improve Mass Transit Infrastructure: … Purchase more energy efficient transit buses that run on less fuel…"
    - Goal C-5: "For both health and environmental reasons, the City should promote … alternatively fueled vehicles. …"
    - Goal C-7: "Green the City Fleet. Use fuels or energy sources which emit fewer greenhouse gases, such as electricity or natural gas. Create a purchasing policy for acquiring new City vehicles that are more fuel efficient such as hybrids. The City should purchase a variety of vehicles, such as bicycles, electric bicycles, small electric vehicles, and energy efficient automobiles, and should institute policies that require that the most energy-efficient vehicle be used for each City purpose."
- **City of Arcata – General Plan** (2008)
    - RC-8a: "…The City shall convert City vehicle fleets to a mix of fuels that best meets the objectives of this policy."
    - RC-8c: "Promotion of Energy Efficiency in Transportation …"
- **City of Blue Lake – Climate Action Plan** (Not yet adopted as of July 2016)
    - LG.3: "Purchase alternative fuel and/or hybrid vehicles to replace current fleet vehicles."
    - AT1.a: "Public education and promotion of low-carbon transportation options, including alternative fuels."
    - AT3.a: "Support the installation of EV charging stations."
- **City of Fortuna – General Plan** (2010)
    - HS-3.6: "Increase clean‐fuel use, ..."
    - LU-1/10: "The City shall monitor technological advances — such as, electric vehicle use increases, … in order to plan for changes that may affect land use."

2.3.4. Mendocino County

- **Mendocino County General Plan** (2009)
  - RM-45: "Encourage the use of alternative fuels, energy sources and advanced technologies that result in fewer airborne pollutants."
  - DE-161: "The County will demonstrate leadership in the implementation of programs encouraging the use of alternative modes of transportation by its employees, as well as the use of alternative fuels. Example programs may include:
    - A purchasing program that favors hybrid, electric, or other energy-efficient vehicles;
    - Assisting in the development of demonstration projects for alternative fuel technologies such as ethanol, hydrogen, and electricity; and
    - Transit incentives."
- **Mendocino County Regional Transportation Plan** (2011)
  - "Evaluate transportation projects based on their ability to reduce Mendocino County's transportation-related greenhouse gas emissions."
  - "Monitor new technologies and opportunities to implement energy efficient and nonpolluting transportation infrastructure."
- **Mendocino County Zero Emissions Vehicle (ZEV) Regional Readiness Plan** (2013)
  - "The purpose of this effort is to provide regional transportation planning to build on previous work and participate in ongoing statewide and nationwide transitions to new vehicle technologies and renewable energy infrastructure in response to health and environmental impacts, energy issues, and climate change."
- **Mendocino County Zero Emission Vehicle (ZEV) Regional Readiness Plan Phase 2 – Feasibility Report** (2015)
  - "This plan begins where the Mendocino County ZEV Regional Readiness Plan Phase 1 leaves off. It focuses on the following two implementation steps:
    - Engaging the community and soliciting public input on the location of the PEV Charging Stations as well as alternative sites, and to hear community preferences.
    - Determining the feasibility and planning-level costs of each preferred station location, including maps of each site."
- **City of Ukiah General Plan** (1995)
  - Goal EG-2: "Improve the efficiency of energy use within the private transportation system."
  - Policy EG-2.1: "Encourage the use of alternatively powered vehicles."
  - Goal EG-3: "Improve the efficiency of energy use within the City's and County's vehicle fleet."
  - Policy EG-3.1: "The City and County shall serve as models for programs to operate fleet vehicles at maximum fuel efficiency."
  - Goal OC-37: "Support programs that reduce PM10 emissions."
- **City of Ukiah Climate Action Plan** (2013)
  - Action TL - 3.1a: "Participate in City - wide marketing efforts for Clean Air Days, Bike - to - Work Days, Sunday Streets/Car - Free Sundays, etc."

- Action TL – 3.1b: “Consider setting aside funding and/or pursuing grant funding to replace the City fleet vehicles with additional electric, hybrid – electric, and alternative fuel vehicles.”

- **City of Fort Bragg Draft Climate Action Plan** (2012)
  - Goal 3: Expand transportation alternatives by encouraging an alternative fueling station, coordinating with the Regional Blueprint Planning effort to improve transportation choices and reduce GHGs.

2.3.5. Siskiyou County

- **Siskiyou County General Plan** (1993)
  - Energy Element: "Shifting to cost effective alternative fuels."
  - Energy Element: "Commercialization of alternative fueled/powered vehicles."
  - Energy Element: "Transportation fuels can be diversified through the introduction of alternative fuels such as methanol and electric-powered vehicles. There is also a need for a local contingency plan in the event outside supplies are disrupted, e.g. gasoline shortage as a result of an international oil crisis."
  - Energy Element: “Improving the efficiency of the transportation sector …” (intended meaning is reducing the number of Single Occupancy trips, but could also be extrapolated to mean increased vehicle efficiency).
  - Energy Element: "The County Planning Department shall maintain and distribute basic reference information and referrals for persons interested in energy efficient land-use and transportation techniques."
  - Energy Element - Implementation Measure N: "In recognition of new federal legislation requiring federal government purchase of clean-fuel vehicles, and inasmuch as the Forest Service operates the largest public vehicle fleet in the County, the County shall seek a joint clean-fuel demonstration project with the Forest Service to create the basis for wider availability of clean fuels in the County."
- **Siskiyou County Strategic Plan** (2008)
  - F-6 Strategy: “Help develop County policy with regard to climate change and greenhouse gases. Assist in the development of database to help inform County action relative to AB 32…”

2.3.6. Trinity County

- **Trinity County General Plan** (2002)
  - Circulation Element – Goal 3: “Maintain and upgrade the existing transportation system to prevent costly deterioration, to ensure that efficiency of the system does not decline, to maintain air quality and conserve energy, and to increase mobility and reduce travel time within Trinity County and adjacent regions.”
- **Weaverville Community Plan** (1990)
  - Goal 7 of the Transportation Section: “To maintain the high air quality in the Weaverville basin while expanding the transportation network.”

2.4. Commercially Available Fuels and Vehicles

The following provides an introductory description of the commercially available alternative transportation fuels and vehicle technologies. An overview of different fuels is given along with key benefits and drawbacks to each fuel.

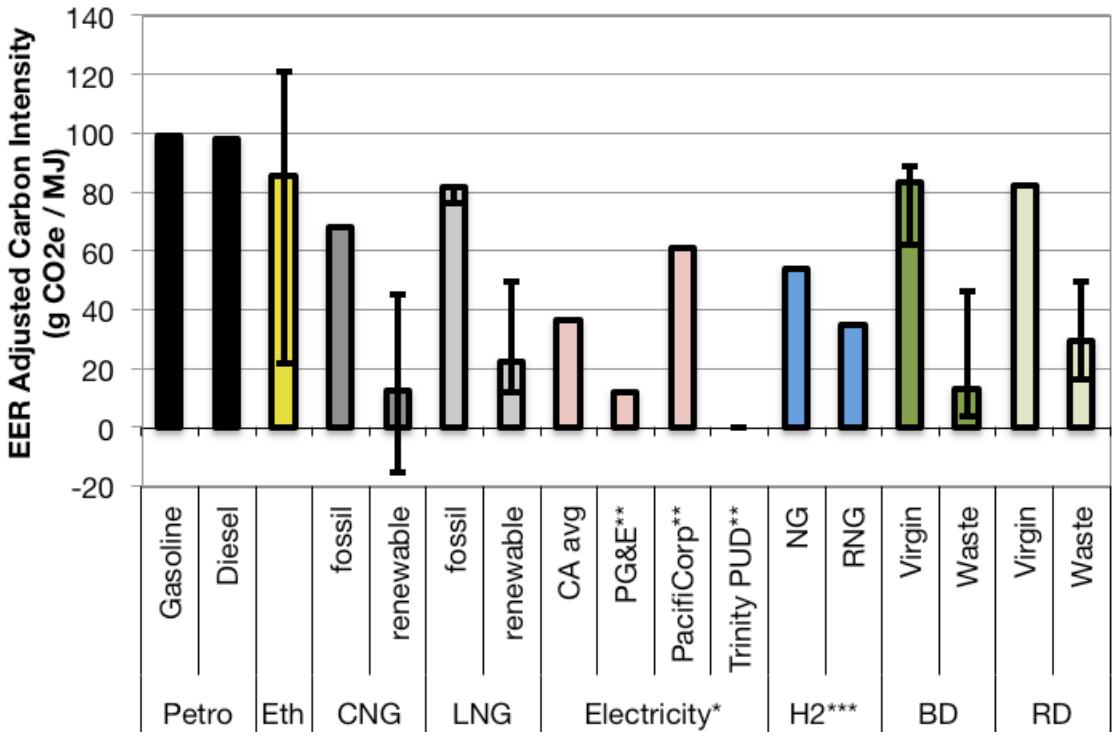
This Plan focuses on fuels with approved pathways under the Low Carbon Fuel Standard (LCFS). LCFS is developed by the California Air Resources Board (CARB), and is a primary guiding policy driving this Plan because it is well established and drives state policies associated with the carbon intensity of transportation fuels. Figure 1 shows a comparison of the greenhouse gas emissions intensity of commercially available transportation fuels as reported under LCFS. A snap shot of the number of locations that sell transportation fuels in the project region is shown in Table 6.

Table 6: Number of existing and near-term planned publically accessible locations offering low carbon fuels. Locations selling gasoline and diesel are shown for comparison.

	Fossil Fuels[a]			EVCS[c]		Biofuels[d]			H_2
	Gas / Diesel[b]	CNG	LPG	L2	L3	Eth	BD	RD	
Del Norte	14	---	1	3	2	---	---	---	---
Humboldt	87	---	2	29	5	---	1	---	---
Mendocino	60	---	2	34	7	---	3	---	---
Siskiyou	45	---	2	5	7	---	---	---	---
Trinity	15	---	1	1	---	---	---	---	---

a: Gas and diesel are included for comparison. Compressed natural gas (CNG) and propane (LPG) are included.
b: Estimated number of fueling stations taken from 2012 survey data collected by the California Energy Commission. Data available at http://energyalmanac.ca.gov/gasoline/retail_fuel_outlet_survey/reporting_stations.html.
c: Electric vehicle charging stations (EVCS) include Level 2 (L2) stations which operate at below 20kW, and Level 3 (L2) stations which operate above 20kW.
d: Included biofuels are ethanol (Eth), biodiesel (BD), and renewable diesel (RD).

Figure 1: Comparison of the carbon intensity of commercially available transportation fuels reported under the Low Carbon Fuel Standard[2]



* Carbon intensity of electricity is reduced by an energy efficiency ratio (EER) of 3.4.
** Carbon intensity of specific utilities is not reported by LCFS. These are taken from emissions reported under voluntary reporting systems and are shown here for comparison and demonstration of regional variation.
*** Carbon intensity of hydrogen is reduced by an energy efficiency ratio (EER) of 2.2.

2.4.1. Commercially Available Alternative Fuels

Alternative fuels are typically defined as fuels other than petroleum-derived gasoline and diesel. Current commercially available alternative fuels are described below. For more detailed and up-to-date information on fuels, visit afdc.energy.gov/fuels.

Biodiesel (20% blend and up): A type of biofuel that can be made from vegetable, fish, and algal oils, as well as waste cooking oil and animal fat and has similar properties to petroleum diesel. Advantages of biodiesel include the fact that it is domestically produced from non-petroleum, renewable resources, can be used in most diesel engines, produces less air pollution than conventional diesel (other than nitrogen oxides), is biodegradable, and is non-toxic. Some disadvantages include that it is not yet approved at

2 Values represent fuel pathways approved by the California Air Resources Board Low Carbon Fuel Standard. Method 1 default values, shown as bars, are taken from the December 2012 LCFS lookup tables. Method 2 values, the max/min ranges of which are shown as whiskers, are taken from pathways approved as of February 29th, 2016.
For biodiesel (BD) and renewable diesel (RD), "virgin" and "waste" refer to the feedstock sources. Approved ethanol (Eth) feedstocks do include molasses, which is responsible for the lower intensity values and can be considered a waste product, although it is not labeled as such here. Since new Method 2 pathways are being approved on a regular basis, this comparison is only a snap shot in time in a very dynamic industry.

high blend rates for use by many auto makers, it results in lower fuel economy and power, is currently more expensive than petroleum diesels, may not be suitable for use at high concentration in low temperatures, may have some impact on engine durability, and can produce increased nitrogen oxide emissions in some circumstances. In addition, there are potential social impacts associated with growing food crops to produce ethanol, making its source an important consideration when determining actual emissions reduction gains.

Electricity: Used to power electric motors, which are the most energy efficient vehicle option available. Electric vehicles produce zero tailpipe emissions, and have the potential to produce zero net operating emissions if the electricity comes from a renewable source. Electricity also provides the lowest fuel cost per mile due to their superior efficiency. Some disadvantages with currently available vehicles and charging technologies include a shorter driving range and long recharge time compared with liquid and gaseous vehicle fuel options. However, longer driving ranges (200-plus miles) are anticipated to become standard in new models within the next three years.

Ethanol, Methanol, and other alcohols: A combustible fuel produced from non-petroleum, renewable resources. It produces lower emissions of some air pollutants compared with the combustion of gasoline and is resistant to engine knock because of its higher octane content. Because of these advantages, along with a lower carbon intensity on average compared with gasoline, all gasoline sold in California is a 10% blend of ethanol (E10). Most newer (2001 and later) conventional internal combustion engine (ICE) vehicles can accept ethanol blends of up to 15% (E15). Flex-fuel vehicles can use ethanol blends above 15%, and are comparable in cost to gasoline vehicles. Most flex-fuel vehicles can use up to 85% ethanol (E85). A disadvantage of ethanol is that it has lower energy content than gasoline, resulting in lower fuel economy in currently available flex-fuel vehicles. There are potential social impacts associated with growing food crops to produce ethanol, making its source an important consideration when determining actual emissions reduction gains.

Hydrogen: Can be produced using almost any existing energy source, but currently almost all commercially hydrogen is produced from natural gas. Benefits of hydrogen include the ability to produce it from renewable biomass feedstocks or from renewable electricity. Hydrogen fuel cell vehicles produce zero tailpipe emissions with the exception of water. Key disadvantages include the high costs of producing fuel and fuel supply infrastructure.

Natural Gas and Renewable Natural Gas: Can be sourced either from fossil fuel wells or from the controlled decomposition of biomass such as from wastewater treatment, anaerobic digesters, or in landfills. Fossil fuel-sourced

natural gas is a domestically produced, relatively cheap petroleum fuel that produces fewer emissions of some criteria pollutants. Disadvantages of fossil fuel-sourced natural gas include the fact that it is non-renewable, and its use potentially results in higher greenhouse gas emissions from leakage of methane during fuel extraction.

Renewable natural gas sourced from the controlled decomposition of biomass, however, offers a significant reduction in lifecycle greenhouse gas emissions compared with fossil fuels. Lower criteria pollutants than those seen with fossil fuel-sourced natural gas, is also a major benefit. Currently the cost to produce renewable natural gas is generally more expensive than fossil natural gas as of the time of this report.

Propane (a.k.a. Autogas and Liquified Petroleum Gas (LPG)): A domestically produced fuel from oil and natural gas wells that, when used as a gasoline or diesel replacement, produces reduced emissions of some criteria pollutants. Disadvantages include that it is non-renewable and that there are currently few commercially available vehicles that use it.

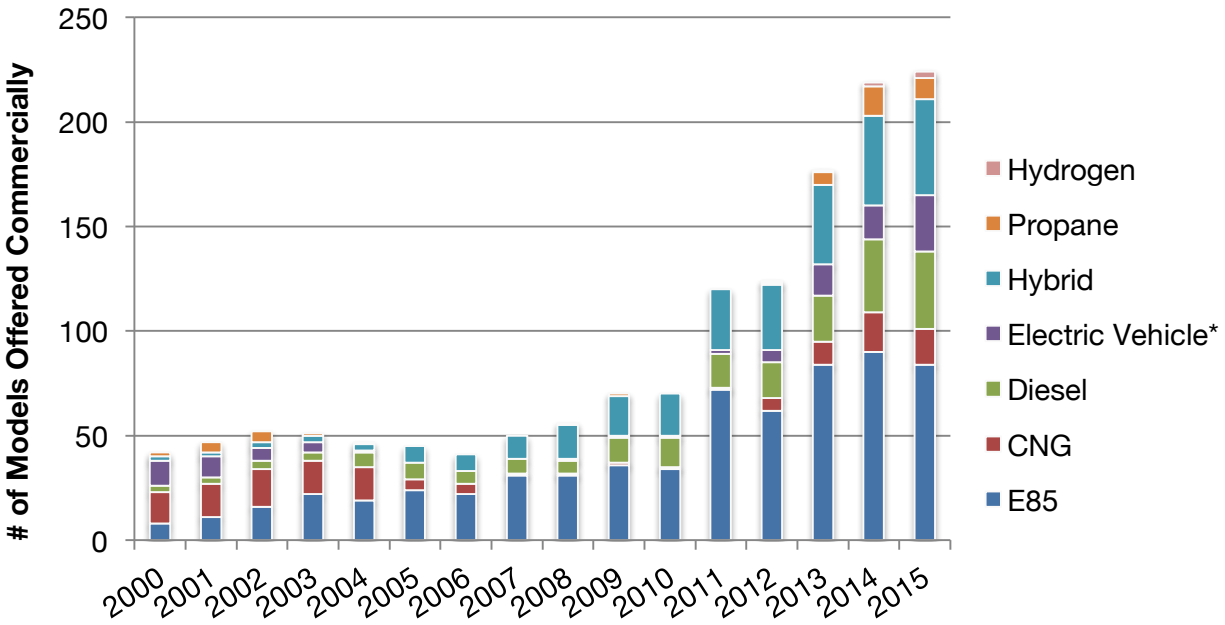
Renewable Diesel: A broad category of diesel that includes biodiesel, hydrogenation-derived renewable diesel (HDRD), as well as emerging technologies including biomass-to-liquid using cellulosic feedstock. Most commonly referred to as HDRD, renewable diesel is made from the same types of oils and animal tallow as biodiesel. HDRD is produced domestically as well as imported from non-petroleum, renewable resources. Advantages of HDRD include that it can be used in all existing diesel engines with no blend wall limit, and many manufacturers approve its use in their vehicles. HDRD produces fewer air pollutants compared to diesel, and meets the ASTM D975 standard, which is the same standard for petroleum diesel. The only main concern is supply availability as there are currently only two approved bulk suppliers for California. Additionally, it may have a slightly lower BTU content than petroleum diesel.

2.4.2. Commercially Available Alternative Fuel Vehicles

An alternative fuel vehicle is a hybrid, dedicated, flexible fuel, or dual-fuel vehicle designed to operate on at least one alternative fuel. All current vehicles have an Internal Combustion Engine (ICE), an electric motor, or both, that power the transmission. The number of available models of alternative fuel vehicles is expected to continue to rise. For light duty vehicles, hybrid and flex-fuel vehicles are a readily available technology, while the electric and compressed natural gas vehicle offerings are growing quickly. For heavy-duty vehicles, such as buses, tractor-trailers, and garbage trucks, there are numerous propane, diesel-electric hybrid, and compressed natural gas options. Hydrogen fuel cell, hybrid hydraulic, and pure electric vehicle choices are available for medium-duty vocational vehicles such as delivery vans. Hybrid and bi-fuel retrofit and modification kits are also becoming increasingly available.

There are already a significant number of commercially available alternative fuel vehicles that may be available to stakeholders and the general public in the region (see Figure 2. The following describes the various alternative fuel vehicle technologies available. For more detailed and up-to-date information on commercially available vehicle models, visit afdc.energy.gov/vehicles/search/.

Figure 2: AFV/HEV/Diesel light duty model offerings by fuel type, model years 2000-2014. *Data from www.afdc.energy.gov/afdc/data/, last updated 2/12/2015.*



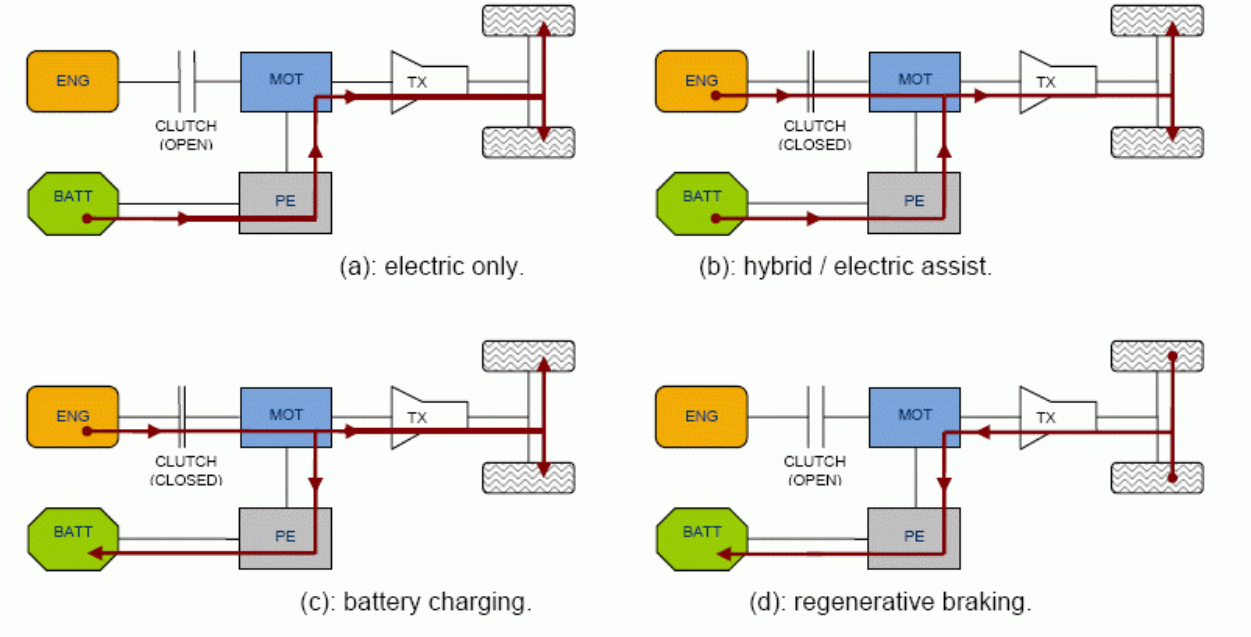
* EVs include plug-in HEVs, but do not include Neighborhood Electric Vehicles, Low Speed Electric Vehicles, or two-wheeled electric vehicles. Only full-sized vehicles sold in the U.S. and capable of 60mph are listed.

Hybrid Vehicle Technologies: A hybrid vehicle has an onboard power source that utilizes some fuel such as gasoline or hydrogen, and an electric motor powered by electricity stored in on-board batteries. The onboard power source recharges the battery, and regenerative breaking is also utilized to recharge the battery. See Figure 3 for a graphical representation of this.

For gasoline-electric hybrids there are three subsets of HEVs:

> Standard Hybrid-Electric Vehicle (HEV): An HEV has an on-board battery and electric motor, but the battery can only be recharged by the on-board gasoline engine. It cannot be plugged to an electrical outlet. For this reason, standard HEVs are not considered an alternative fuel vehicle, rather as an efficient gasoline vehicle.
>
> Plug-In Hybrid Electric Vehicle (PHEV): A PHEV has a bigger battery than an HEV, providing more all-electric miles, and has a plug enabling the vehicle to connect to an electricity source and recharge the battery.

Figure 3: Graphic representation of different driving modes of an HEV and PHEV. Some ER-PHEVs differ in that the engine (ENG) is not connected to the transmission of the vehicle and is only used to re-charge the battery, and the electric motor (MOT) is the only motor that delivers power to the transmission. *Image obtained from Wikimedia Commons under a Creative Commons Attribution-Share Alike license.*



Extended-Range Plug-In Electric Vehicle (ER-PHEV): An ER-PHEV has an even bigger battery than a PHEV, providing many more all-electric miles. Common ER-PHEVs only use the ICE as an onboard generator that charges the battery. In other words the ICE does not directly power the vehicle.

Hydrogen-electric hybrids use an on-board fuel cell stack rather than a gasoline engine to recharge the on-board batteries. Currently available vehicles come in two different forms:

Fuel Cell Hybrid Vehicle (FCHV): A has an electric motor that is powered by electricity generated by an onboard hydrogen fuel cell stack, which also charges an onboard battery that also provides power to the motor. The fuel cell stack utilizes hydrogen gas stored in a refillable tank. The design is exactly the same as an HEV except with a fuel cell stack rather than an ICE. The motivation for using a fuel cell rather than an ICE is that fuel cells are more efficient than ICEs at converting their fuel into power to drive the vehicle.

Fuel Cell Electric Vehicle (FCEV): A fuel cell electric vehicle (FCEV) operates similar to a FCHV, except the hydrogen fuel cell stack charges the battery only, which is the sole power source for the electric motor. This is the same design as most ER-PHEVs except with a fuel cell stack rather than an ICE.

Dedicated Fuel Vehicles: These vehicles are designed to use a single alternative fuel. Commercially available vehicles include the following.

Battery Electric Vehicle (BEV): A BEV has only an electric motor and a substantially bigger battery than a hybrid since it is the single source of power to the transmission. It plugs in to an electricity source to recharge its battery, and also utilizes regenerative breaking.

Compressed Natural Gas (CNG), Liquified Natural Gas (LNG), and Propane (LPG or Autogas): CNG, LNG, and LPG vehicles are identical to gasoline and diesel vehicles except their ICE is designed to combust a gaseous fuel rather than a liquid fuel.

Flex-Fuel and Dual-Fuel Vehicles: Commercially available vehicles in this group all utilize ICEs, but the ICE is able to combust either a mixture of different fuels (Flex-Fuel) or combust more than one fuel in pure concentration.

Flex-Fuel: This term refers specifically to ICE vehicles that can combust a blend of ethanol and gasoline that contains greater than 10% ethanol. However, technically vehicles that can run blends of biodiesel and renewable diesel also fall under this category. However, in practice the term Flex-Fuel does not refer to these vehicles.

Multi-Fuel: A multi-fuel ICE vehicle is equipped with two separate fuel tanks to provide fuel flexibility. It may use a domestic fuel source, such as natural gas or propane, and/or a non-petroleum fuel source, for increased efficiency or to offset petroleum consumption. Most multi-fuel vehicles also have a gasoline or diesel fuel tank. Both tanks are able to power the IC engine.

2.5. Stakeholders

Because transportation vehicles and fuels are deeply integrated in every community, successful adoption of alternative fuels ultimately requires participation from all community members. In other words, every individual is a key stakeholder in the implementation of this plan. However different people, groups, and agencies are impacted differently. Therefore, it is useful to broadly categorize stakeholders into five main groups: government agencies, vehicle fleets, fuel distributors, supporting businesses and services, and the general public. The roles these different stakeholder groups play in the implementation of this plan are described below.

2.5.1. Government Agencies

There are multiple government agencies throughout the region that have a vested interest in alternative fuels planning. These agencies include:

- Transportation planning agencies (California Department of Transportation, California State Transportation Agency, MPOs, RTPAs, and tribal agencies)
- Air Quality Management Districts and the California Air Resources Board
- Local city and county planning and permitting departments
- Community development, economic development, and public health agencies (Governor's Office of Business and Economic Development)
- Special districts (energy authorities, waste management authorities, and transit authorities)

- Environmental agencies (Natural Resources Agency, California Environmental Protection Agency)

Local representatives of many of these agencies across the project region participated in a Strategic Plan Working Group[3] during the project period. This group collaboratively developed the preferred focus and trajectory of this project to best meet the unique and varying needs of the region. The group crafted the mission statement, outlined the strategic plan accordingly, and offered feedback during its development.

Primary Role: The primary overarching role of government agencies in the implementation of this plan is to promote a welcoming and streamlined regulatory environment for the development of alternative fuel vehicles and infrastructure across all fuel types. There are many moving parts to accomplishing this that requires an inclusive, sustained, and coordinated effort across many agencies holding jurisdiction. Finally, local governments have a primary role in promoting to and educating their community members.

Primary Needs and Challenges: The main challenges faced by local government agencies include the need for guidance on including alternative fuels in land use planning documents.

2.5.2. Fleet Managers

Opportunity for quick and widespread adoption of alternative fuels and vehicles exists within vehicle fleet operations due to their representative scale (see the case study conducted for Mendocino County). Furthermore, federal, state, and local government fleets play an important early adopter role in supporting early market development. Through proactive adoption of alternative fuels and vehicles government fleets can create a dependable fuel demand to support local fuel availability, and demonstrate the viability of commercially available vehicles all the while tackling numerous related planning goals and targets.

Several mandates exist that require agencies and fleet operators to become familiar with alternative fuel and vehicle options. The U.S. and state governments have placed a great deal of responsibility for meeting petroleum fuel reduction goals on fleets, although to date have limited the majority of mandates to federal and state agencies. However local government and private fleets can certainly benefit from the information put forth in response to these mandates, and local fleet operators will continue to be important stakeholders in determining opportunities and barriers that exist in those sectors.

3 For details regarding the various working groups formed that informed the development of this plan see the final report submitted to the California Energy Commission under contract CEC-ARV-13-012. This report is available from any of the project team members listed at the beginning of this report.

Primary Role: Public fleets need to act as early adopters both for vehicles and fueling infrastructure to prove the efficacy of the technology and establish a dependable fuel demand that supports fuel distributor's ability to bring the fuels into the region. Private fleets can support early adopter efforts, and play a key role in raising public awareness.

Primary Needs and Challenges: Fleet managers need guidance and assistance on assessing the incremental costs and return on investment of alternative fuels and vehicles. Fleet maintenance departments need awareness of and access to training sources.

2.5.3. Fuel Distributors

Fuel distributors transport motor vehicle fuels between production or import facilities and retail outlets, and/or sell, offer for sale, or supply motor vehicle fuel to motor vehicle fuel retailers. Some distributors also refine, blend, or otherwise produce motor vehicle fuels, as well as own and operate retail locations. Fuel distributors are integral to achieving the long-term goals of this project. They have a key role in determining the accessibility of currently available alternative fuels and the adoption of new technologies as they become available.

Representatives from a handful of local fuel distribution companies participated in a Fuel Distributors Working Group[3] during the development of this plan. The workgroup discussed challenges and opportunities related to brining alternative fuels to market in the North Coast Region. This included the key role and business activities of local fuel distributors in achieving long-term goals of the project as well as supply and demand of alternative fuels in the region. Input from the working group contributed to the recommended actions provided in this plan.

Primary Role: With the exception of conventional natural gas and electricity, fuel distributors are the primary commercial pathway for delivering transportation fuels to the region. These businesses are key players in any effort to increase the availability of low carbon fuels. Regarding conventional natural gas and electricity, utilities are the primary stakeholder that distributes these fuels.

Primary Needs and Challenges: The primary near-term challenge that fuel distributors face is the risk associated with investments in new infrastructure in an early market with little demand.

2.5.4. Supporting Businesses and Services

Supporting businesses and services is an extremely broad stakeholder group that includes the numerous agencies and businesses that support the automotive sector. These stakeholders are further categorized as Safety and Non-Safety groups, although there is overlap. Entities in this group include:

Safety and First Responders	Non-Safety
Firefighters	Auto repair shops
Law enforcement	Dealerships
Ambulance services and EMTs	Towing and wrecking
Offices of emergency services (OESs)	Banks and financing institutions
	Auto part supply shops
	Community colleges

Numerous representatives of many of these agencies and businesses participated in a Training Materials Working Group[3], which provided guidance and insight on their needs related to alternative fuel and vehicle training. The input from this group guided many of the recommended actions included in this plan.

Primary Role: The primary role of this stakeholder group is to pursue the training needed to effectively continue their role in supporting the automotive sector.

Primary Needs and Challenges: The primary challenge faced by these groups is access to funding to support training efforts. Furthermore, there are numerous changes within existing safety and first responder training regulations that need to be addressed to streamline the ability to integrate the necessary training. Finally, many challenges are associated simply with a current lack of demand of specialized services due to current low adoption of alternative fuels and vehicles in the region.

2.5.5. General Public

Members of the community are also a key stakeholder group as a high adoption percentage of alternative fuels and vehicles will not be possible without their active interest in and purchase of fuels and vehicles. The public includes key groups such as consumers that buy alternative fuels and alternative fuel vehicles, business owners concerned with the economy, as well as voters that elect representatives who decide on policies and regulations. The stakeholders and working groups engaged during the development of this plan contributed numerous recommended actions in this plan that can help inform and engage the general public.

Primary Role: The main role of the general public is to remain actively engaged in the regional effort to change the fuels and vehicles that our communities choose to use. This can be done through civic engagement, state and local policy making, and voting with their wallet when choosing their next vehicle.

Primary Needs and Challenges: The primary challenge the general public faces is awareness to information sources that assist them in making informed customer choices. All public and private stakeholder groups discussed have a role in addressing this challenge by increasing public awareness and understanding.

3. LOOKING FORWARD

In addressing the mission of taking the most efficient approach to reducing greenhouse gas emissions from the transportation sector, this plan focuses on developing a least-cost path to foster a local vehicle and fuel market that meets the Low Carbon Fuel Standard (LCFS) goal of reducing the carbon intensity of the total fuel mix by 10% by 2020. This approach was chosen because the LCFS provides an established and quantifiable framework and target that aligns with state goals and regulations. However, the least-cost path is only one of many possible benchmarks the region can use to accomplish the mission proposed here, and should be considered as a tool for guiding stakeholders rather than a proposed regulation or mandate.

It is worth keeping in mind that the incremental cost of the proposed mix of fuels and vehicles is significantly influenced by market fuel prices and advancements in technology, which are constantly changing. While the modeling effort underpinning this plan simulated this variability, the estimates reported here are subject to significant uncertainty. As such, the values shown in the following sections are rough estimates, intended to help provide regional stakeholders a sense of the potential impact from these changes to the transportation sector, and should not be considered a hard target. Any regional policies that are based on the estimates in this plan should be flexible enough to allow the mix of fuels and vehicles used in the community to change substantially from those presented here.

3.1. Modeling a Portfolio of Fuels and Vehicles through 2020 that Meet the Low Carbon Fuel Standard with the Lowest Incremental Societal Cost

A modeling effort was undertaken to identify a potential lowest incremental societal cost mix of fuels and vehicles needed to meet the statewide LCFS target of a 10% reduction in the carbon intensity across all transportation fuels combined by the year 2020. The results of this effort are shown in Figure 4.

The vertical axis represents the marginal (or incremental) cost above business as usual per metric ton of reduced carbon dioxide equivalent emissions ($MTCO2_2e$). The horizontal axis represents the cumulative total reduced carbon dioxide equivalent emissions as each different fuel and/or technology is adopted in the region.

The average marginal cost of implementing this fuel mix portfolio is $180 per metric ton of offset carbon dioxide equivalent emissions, in 2015 dollars. The costs considered are the total lifecycle cost to society for each fuel and technology above the fossil fuel that it would displace. This includes estimates of incremental:

- Vehicle cost
- Fuel infrastructure cost
- Fuel cost, which includes the cost of distribution

The total incremental cost of achieving this fuel mix portfolio is estimated to be $43 million, representing a 4% increase above the total cost of business as usual of an estimated $1.16 billion per year across the five-County region.

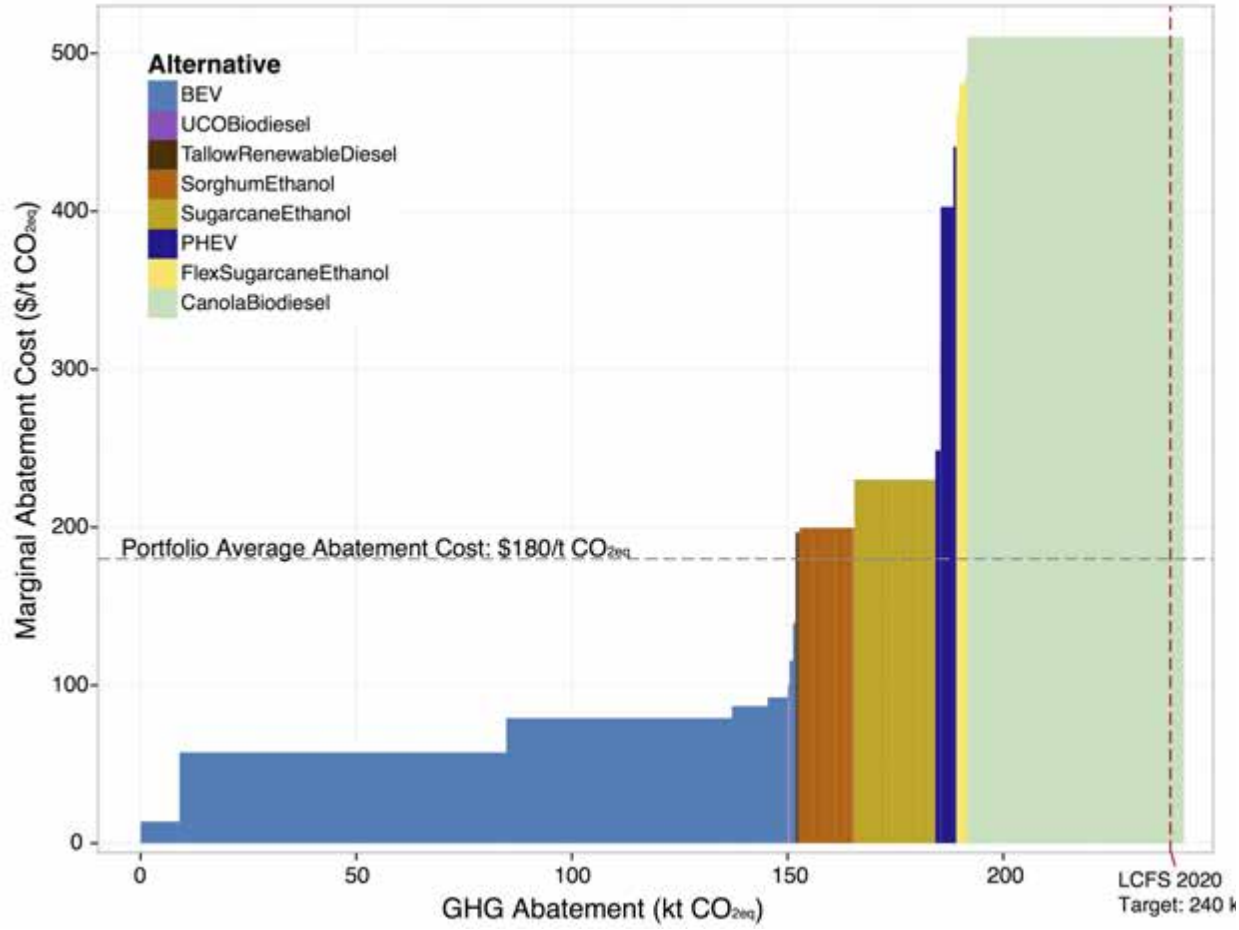


Figure 4: Estimated lowest incremental societal cost low carbon fuel portfolio for the region, associated marginal cost, and total offset emissions.

3.1.1. Regarding Fuels Not Recommended by the Modeling Results

The modeling effort was conducted to make fuel mix recommendations for the region over the next five years, and required reliable and defensible data on lifecycle greenhouse gas emissions and incremental costs of vehicles, fuel, and infrastructure. Data was available for most commercially viable alternative fuels, but not all.

Furthermore, this document makes recommendations for changes in the fuel mix of the transportation sector over a relatively short time span of five years. It is expected that technology and costs will change significantly over the next five years, opening doors for some fuels and closing them for others. The lifecycle emissions and economics of fuels have changed significantly for some fuels, and will continue to do so.

Natural Gas: Natural gas was considered in the modeling effort. Since this analysis focused on reducing greenhouse gas emissions, compressed natural gas did not result in sufficient reductions in GHGs to be competitive with other fuels on a basis of incremental cost per ton of

avoided CO_2e. There is additional concern around natural gas leaks occurring in extraction and transport. However, natural gas does offer additional benefits such as potential lower cost and a reduction in some criteria pollutants.

Renewable natural gas is an appealing alternative with significant potential to reduce lifecycle greenhouse gas emissions. It currently offers the lowest carbon intensity option of any fuel included under LCFS. However, because commercial scale production of this fuel is still in its infancy there was insufficient cost data to make a direct comparison with the other fuels assessed in this plan.

Hydrogen: Hydrogen is an increasingly viable option with zero tail pipe emissions and the potential to offer significant reductions in lifecycle greenhouse gas emissions depending on the hydrogen production method. According to the model, the incremental vehicle cost is competitive with other technologies. However, the fuel station cost is substantially higher which causes this technology to be too expensive relative to other options on a basis of incremental cost per ton of avoided CO_2e.

3.1.2. Quantity of Vehicles Needed

The estimated total number of existing and new vehicles needed to meet the fuel portfolio is shown in Figure 4 is shown in Table 7. Electric light duty vehicles are overwhelmingly the largest quantity of low carbon fuel vehicles anticipated. Although the upfront capital cost is currently relatively high for electric vehicles, the low cost of fuel and fueling infrastructure results in EVs demanding the lowest total incremental societal cost.

Table 7: Estimated Number of new and existing on-road vehicles running low carbon fuels by 2020.

	Light Duty						Heavy Duty	
	BEV[a]	PHEV[a]	E15[b]	E85[a]	B20 / RD[b]	H_2[a,c]	E15[b]	B20 / RD[b]
Del Norte	600	---	100	50	---	20	200	100
Humboldt	10,000	400	600	150	50	70	1,100	600
Mendocino	6,900	100	450	100	50	70	850	500
Siskiyou + I-5	1,000	---	200	50	---	20	500	350
Trinity	900	100	100	---	---	20	150	100
Total	**19,400**	**600**	**1,500**	**350**	**100**	**200**	**2,800**	**1,650**
% of All On-Road Vehicles in 2020[d]	**17% of LDVs**						**2.7% of HDVs**	

a: Represents number of new vehicles sold between 2015 and 2020

b: Represents both new vehicles sold between 2015 and 2020, and existing vehicles on the road in 2020 that are capable of running E15 (for gasoline vehicles) or B20 (for diesel vehicles). Columns labeled B20 / RD represent the fact that diesel vehicles could run either B20 or renewable diesel (RD)

c: Hydrogen vehicles (FCEVs) were modeled, yet are not expected to be cost competitive by 2020 such that they do not contribute to a low cost scenario. However, state policies are paving the way for FCEVs, and other modeling efforts predict a limited presence of FCEVs in the region. Therefore, they are included to acknowledge this possibility. The distribution of hydrogen vehicles is a guesstimate based on NREL's modeling estimate of 200 FCEVs on the North Coast and 300 FCEVs in Upstate. Because the Ukiah and Eureka areas are the largest population density centers in the region it is assumed these cities will see the highest number of vehicles. For the remaining 300 vehicles predicted by NREL, it is assumed that Shasta and Sonoma counties will receive the majority of the remaining vehicles.

d: Percentage based on a total estimated vehicle population in 2020 of 130,100 LDVs and 164,300 HDVs, obtained from the EMFAC2014 model.

3.1.3. Quantity of Low Carbon Fuels Needed

The total gallons of fossil fuel to be offset annually by 2020 in order to meet the LCFS target are estimated to be:

- Gasoline: ~17 million gallons offset per year
- Diesel: ~4 million gallons offset per year

The proposed mix and quantity of low carbon fuels needed to offset 21 million gallons of gasoline and diesel is shown in Table 8. There are numerous different combinations of low carbon fuels and vehicles that can meet the LCFS target, some having a higher incremental cost than others. The mix of fuels and vehicle technology types in Figure 4 shows what is believed to be a low cost scenario that the region could reasonably implement by 2020. The estimated quantity of fuels this mix represents is shown in Table 8. It is worth noting that the I-5 corridor is considered separately from the rest of Siskiyou County since the on-road fleet that uses this freeway is significantly different given the high traffic volume and high number of tractor trailers transporting goods.

Table 8: Estimated quantities of low carbon fuels needed to meet LCFS by 2020.

	Electricity[a] End-use MWh/year	Liquid Fuels Unblended Gallons / year			H_2[e] kg / year
		E15[b]	E85[c]	B20 / RD[d]	
Del Norte	3,800	34,000	19,700	19,600	7,300
Humboldt	66,600	165,000	125,100	208,300	25,600
Mendocino	44,900	126,100	57,100	256,700	25,600
Siskiyou	7,000	37,600	46,600	61,600	7,300
I-5	200	38,400	1,200	218,500	
Trinity	8,600	24,000	0	41,400	7,300
Total	**131,100**	**425,100**	**249,700**	**806,100**	**73,100**
% Impact	**~6% increase in regional electricity consumption**	**~10% reduction in regional consumption of gasoline and diesel**			

a: End use MWh estimated by converting total gallons of gasoline and diesel offset to MWh, then reducing by a factor of 3.4 to account for the increased efficiency of electric vehicles.

b: Unblended gallons of E15 means quantity of pure ethanol required to make E15. Recognizing that gasoline currently sold contains 10% ethanol as mandated by the state, the quantity of additional ethanol that would need to be imported is 30% of the gallons shown here.

c: Unblended gallons of E85 means quantity of pure ethanol required to make E85. Recognizing that gasoline currently sold contains 10% ethanol as mandated by the state, the quantity of additional ethanol that would need to be imported is 88% of the gallons shown here.

d: RD stands for Renewable Diesel. Project modeling efforts assumed the availability of RD would be very constrained thereby assuming biodiesel would be the primary replacement for the diesel engine sector. However, renewable diesel is gaining significant traction such that the goal of a 10% reduction in carbon intensity could be achieved using renewable diesel as well.

e: Quantity of hydrogen consumed estimated by assuming 1kg per vehicle per day for the number of vehicles listed in Table 7.

3.1.4. Fueling Infrastructure Needed

Based on the calculated quantities of low carbon fuels as shown in Table 8 the number of fueling stations needed in the region are estimated in Table 9. These estimates represent a best estimate based of fuel throughput for different fueling stations and the fuel demand of

each vehicle. The actual infrastructure needed can vary substantially due to variables such as location, station design, and the density of alternative vehicles near the stations.

Table 9: Estimated number of fueling stations needed to meet LCFS by 2020.

	Electricity Number of charging stations			Liquid Fuels Number of stations with new infrastructure that supplies a throughput of 74,000 gallons per year			H_2[f] Number of stations with a throughput greater than 70kg per day
	Home[a]	Public L2[b]	Public L3[b]	E15[c]	E85[d]	B20 / RD[e]	
Del Norte	600	9	1	0	1	1	1
Humboldt	10,400	157	19	0	2	3	1
Mendocino	7,000	106	13	0	1	4	1
Siskiyou	1,000	15	2	0	1	1	1
I-5				0	1	3	
Trinity	1,000	15	2	0	0	1	1
Total	**20,000**	**303**	**36**	**0**	**6**	**13**	**5**
% Impact		**~10x current number of stations in the region**		**~10% of existing stations offering gasoline and/or diesel**			

a: The number of home charging stations is assumed to be equal to the number of BEVs and PHEVs.

b: Number of EV charging stations estimated based on the following factors derived from modeling efforts for Humboldt and Siskiyou counties: 0.015129 L2 stations per vehicle, and 0.0017923 L3 stations per vehicle.

c: It is assumed that E15 can be sold in existing tanks that currently sell E10. Therefore, no new infrastructure is needed. However, existing pumps and tanks would likely have to be dedicated to the sale of E15 since many on-road vehicles cannot utilize E15.

d: The assumed throughput of a liquid biofuel station of 74,000 gallons per year was taken from an NREL report[4] as a recommended benchmark for assessing the business case for an E85 station. It is worth noting that the average throughput for gasoline stations in Del Norte, Humboldt, and Trinity counties is roughly 600,000 gallons per year. However, it is likely that E85 will be sold at an existing gas station that will also sell gasoline.

e: While B20 and RD are not interchangeable, either fuel could accomplish LCFS goals. The throughput of a station is assumed to be equivalent to that of an E85 station as discussed above.

f: Number of hydrogen stations based on a statewide report conducted by the University of California, Irvine under grant CEC-600-2015-005 which estimates the demand for the Sonoma/Napa/Lake Tahoe regions to be 55kg per day. Currently, the smallest commercial stations in California are 74 kg/day. Therefore, a station size of 70 kg/day is assumed to be sufficient to serve the expected small vehicle population in 2020.

4 C. Johnson and M. Melendez. E85 Retail Business Case: Why and When to Sell E85. NREL/TP-540-41590, December, 2007.

Assessing Fleet Impact Potential: A Mendocino County Case Study

This analysis looked at the potential fuels and emissions impacts associated with Mendocino fleets converting to a low-carbon fuels mix. The fuels penetration targets described in Section 3.1 were used to frame the impact of this vehicle sector. Fleet vehicles were chosen due to their near-term potential to establish a baseline demand for alternative fuels and fueling infrastructure. This first level of demand and fueling infrastructure would in turn allow for alternative fuels to be made available for early adopters from the general population.

The total number of fleet vehicles identified during this study was 1,018 – although it should be noted that this only a portion of the total vehicles operated by Mendocino fleets and is based on the available information gathered during this study. Fleet information was gathered via placing cold calls and conducting interviews with fleet operators. Information such as fleet size, type of vehicles, and annual miles traveled was gathered to evaluate the potential AF demand and assess opportunities for replacing aging vehicles with new, alternative fuel vehicles.

Potential fleet impact calculations are based on information collected through interviews, California Air Resources Board (CARB) Low Carbon Fuel Standard (LCFS) documents, Argonne National Labs GREET model, and Google Earth satellite images as well as information presented in this plan. Gallons of alternative fuel demanded, fossil fuel use reductions, and estimated number of vehicles by type were calculated. Additionally, the total annual greenhouse gas (GHG) and particulate matter (PM) emissions reductions potential were evaluated to produce a complete picture of the opportunity presented by alternative fuels use in local fleets.[5]

The modeled results were then used to compare Mendocino County's fleet impact potential relative to the targets set forth in this plan. The purpose of this comparison is to assess the viability of the near term alternative fuels targets. The key findings of this effort include:

- Fleets operating in Mendocino County can be a significant part of achieving a near-term baseline level of demand for alternative fuels; particularly E85, renewable diesel and biodiesel fuels.
- The 2008 Truck and Bus Rule will require all fleets to have 2010 model year engines or newer by 2023. The state could target funding to assist fleet operators who replace vehicles engine technologies that run off of both low carbon fuels and produce low to no PM emissions. Funding could be front-loaded to incentivize fleet operators with aging (high emissions) vehicles.
- The Mendocino fleet potential impact on electricity demand is likely very small, <1%, partially due to the lack of fleet data for this vehicle type, as well as the relatively large portion of BEVs anticipated in the AFRP 2020 fuel mix compared to other alternative transportation fuels. Data on public fleet vehicle types and annual mileage would increase the percentage of electricity demanded from fleets due to the use of passenger vehicles in city and county operations. However, the balance of the BEV uptake target will have to be met by widespread BEV uptake by the Mendocino County population in general.

[5] For details regarding this analysis effort see the final report submitted to the California Energy Commission under contract CEC-ARV-13-012. This report is available from any of the project team members listed at the beginning of this report.

- Fueling Mendocino police car fleets with E85 cars would alone provide nearly 1/3 of the demand needed to meet the AFRP E85 2020 fuel demand targets.

- Replacing diesel fuel with drop-in fuels such as biodiesel and renewable diesel for heavy-duty vehicle fleets represents an immediate opportunity to reduce GHG emissions while avoiding the incremental cost of purchasing a new vehicle. The potential Mendocino heavy-duty fleet demand for drop-in diesel fuels far exceeds the AFRP target. Further, achieves 50% of the AFRP Heavy- Duty fleet vehicle target for Mendocino County. This suggests that the AFRP targets for renewable diesel and biodiesel fuels could be increased.

- The feedstock (e.g., corn, soy, tallow, used cooking oil etc.), location and processing required to make drop-in biofuels and Ethanol have a significant impact on realized GHG emission reduction gains.

- Converting roughly 40% of Mendocino fleet vehicles to run off of a mix of low carbon fuels over the next five years could reduce GHG emissions by 58 kilo tons CO2e / year and would achieve 25% of the 2020 regional greenhouse gas emissions targets presented in this plan.

- Use of BEV, PHEV, and E85 and renewable diesel fuels will all result in reductions in GHGs, PM, CO, and NOx emissions reductions.

Reaching the California LCFS 2020 target for a 10% reduction in average fuel carbon intensity will require the deployment of a mix of alternative fuels to support a variety of low-carbon fuel vehicle technologies. The low-carbon fuels demand targets laid out in this plan for electricity, E85 and drop-in biofuels are ambitious, yet potentially attainable through a coordinated program that has a strong fleet focus. Reaching these targets can be facilitated by incentives and mandates requiring early fleet uptake. Early adoption of alternative fuels in fleet application can help to provide a baseline of demand for alternative fuels, support the development of new fueling infrastructure, and increase the vehicle offerings at local dealerships. Fuel diversification can occur faster than anticipated with the provision of technical assistance and access to fleet conversion funding assistance.

Electric vehicles provide the greatest emissions reductions potential and “least societal cost” overall. Public fleet vehicles such as County, Office of Education, Environmental Health and Human Services, and City staff passenger vehicles represent a fleet-focused opportunity for BEVs to reduce agency carbon footprints, reduce criteria pollutant emissions and grow the market. As battery technologies improve and BEV range increases, using BEVs for all local light duty fleet functions is expected to be a viable alternative.

Reaching PHEV targets can be easily achieved due to the quantity of vehicle options currently in use and on the market. However, potential emissions reductions achieved from conversion to PHEVs will be dependent on operators plugging them in at night. It may therefore be useful to have PHEV adoption in fleets that will remain in a corporation yard plugged in at the end of each day.

Assuming police cars and/or other light to medium-duty vehicles are replaced with engine technologies tuned to run off of E85, demand targets presented for this fuel would be easily achievable in the short term. Variable E85 fuel availability, and minimal GHG emissions reductions gains are the main limiting factors associate with widespread use of this fuel.

Many fleets analyzed use diesel-fueled vehicles representing an immediate opportunity to reduce in fossil fuel use and GHG emissions by using renewable diesel fuels. Renewable diesel fuels appear to not require new fueling infrastructure, and supply is already increasing due to the recent directive from the Governor's office that requires all public fleet bulk diesel purchases be renewable diesel fuel. Direct marketing between fleets and fuel distributors can help to establish additional demand for this fuel.

In the case of smaller, rural private fleet operators, it is worth noting that there is a key social barrier to the uptake of alternative fuel vehicles is the residual frustration and distrust stemming from the implementation of the 2008 California Air Resources Board (CARB) Truck and Bus Regulation. Designed to reduce diesel particulate matter emissions, this regulation required fleet managers to either purchase newer vehicles with cleaner-burning engines or retrofit existing trucks with diesel particulate filters (DPFs) to delay new vehicle purchase. Fleet operators with retrofitted DPFs experienced engine issues resulting in vehicle towing costs, operational downtime, and repair expenses. CARB staff investigated this issue and found that two-thirds of the DPF problems were associated with upstream engine failures due to component durability issues or inadequate maintenance. The remaining third of DPF issues were not attributable to any other cause. CARB also found that subsequent engine models (i.e., newer trucks) had fewer durability problems and were not subject to the downtime issues associated with the retrofitted DPFs. While CARB does provide financial fleet modernization assistance to encourage the purchase of new vehicles, fleet operators surveyed in the Northwestern California region reported that they were not able to access the funds needed due to the low prioritization of funding for operators in the high attainment (clean) air basins. In some cases this has placed rural operators at a further disadvantage relative to their competition.

These experiences with the 2008 state-led emissions reductions efforts have created a barrier to alternative fuel vehicle penetration in the small to medium private fleet operators in that they are reticent to be the state's early adopters for new AFV technologies. Among the fleet operators surveyed, there is a general sense that emissions reduction efforts will be costly, create uncertain maintenance issues, and that any funds allocated to assist with a transition to new vehicle technologies will be targeted at higher population centers and areas of low attainment for air emissions.

Public fleet operators and large fleet operators are more willing to consider adoption of AFVs into their fleets. However, these fleet operators are either skeptical or unaware of AFVs that are suitable for their specific vocations (i.e., police cars, garbage trucks, fire trucks etc.), and can meet performance requirements for their operational needs (e.g., ability to haul heavy loads up hills, drive on uneven and flooded unpaved roads, or accelerate quickly). Further, local agency budgets are tightly constrained and without knowledge of, or access to incentives, the incremental cost of the AFV replacement vehicle becomes the less economically feasible option.

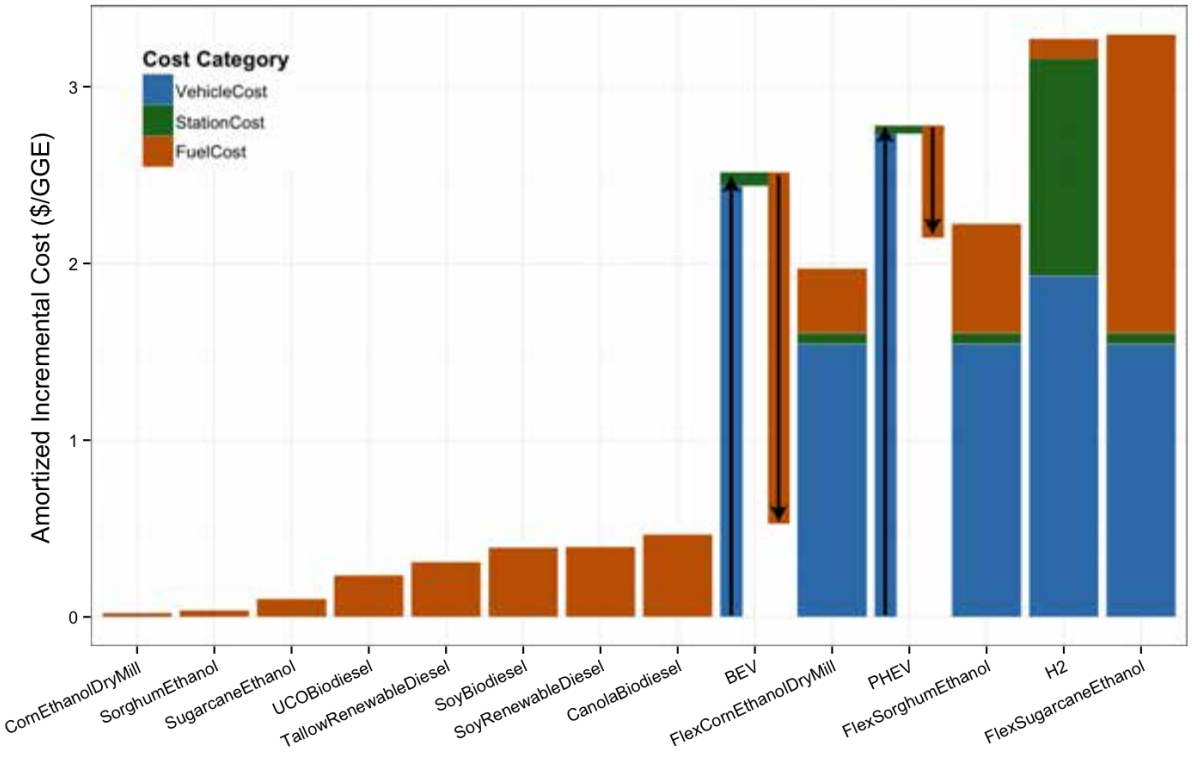
Effective marketing, education, and outreach activities are critical to inform and encourage consumers. This is especially important to help overcome many of the actual and perceived barriers associated with alternative fuel vehicles. Demonstrations, case studies, and interactive events can be effective in helping to overcome many social barriers.

3.2. Metrics for Estimating Funding Allocation

From a full portfolio perspective, cumulative estimated incremental cost above business as usual is $43 million (in 2015 dollars) between 2015 and 2020 for the baseline scenario described in Section 3.1. On a per-vehicle basis, this cost is roughly $1,600 per alternative fuel vehicle[6], across all fuel and vehicle types modeled[7]. This estimate can be useful for assessing the cumulative cost performance of all activities supporting and encouraging an alternative fuels market. This incremental cost includes the amortized cost of the fueling infrastructure, quantity of fuel sold, and vehicles.

Because the incremental cost varies widely across fuel types, it is also useful to look at the total incremental cost for each fuel type since different technologies and fuels require different amounts of subsidies and incentives to move them forward in the market. These incremental costs are shown in Figure 5 and can be used to assess the relative funding required to move each technology and fuel forward in the region.

Figure 5: Amortized incremental cost of alternative fuel pathways over conventional fuels. Units are 2015 dollars per gallon of gasoline equivalent (GGE). BEVs and PHEVs have negative incremental fuel costs.



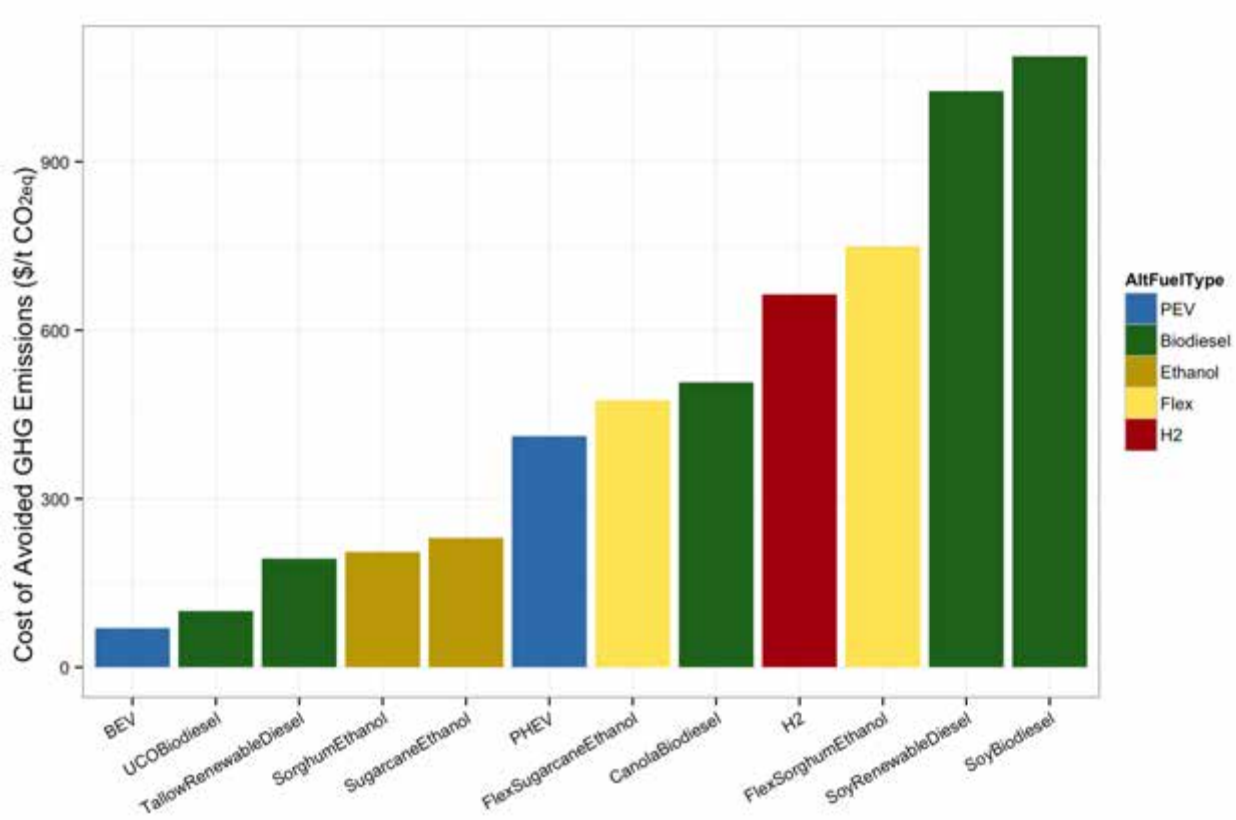
Furthermore, the estimated cost of avoided greenhouse gas emissions averages $180 per metric ton of avoided carbon dioxide equivalent ($MTCO_2e$) as shown in Figure 4. The estimated

6 Estimated by taking the total combined incremental cost of $43 million divided by the total number of vehicles running alternative fuels as shown in Table 7.

7 Note that hydrogen is not included in the baseline scenario due to the high cost of infrastructure. Therefore, this cost does not assume investment in hydrogen.

cost of avoided $MTCO_2e$ for each fuel type and feedstock is shown in Figure 6. These values can be compared with the current market price for carbon in California's cap-and-trade market and LCFS credit market.

Figure 6: Average marginal abatement cost of alternative fuel pathways.



3.3. Potential Barriers to Success

Identifying existing and potential barriers is critical for identifying next steps. Barriers may be technical, social, or economic. Some are common across several alternative fuel vehicle types (e.g., higher initial costs), while others are specific to only one vehicle or fuel type (e.g., limited range and charge time for BEVs).

The following sections identify a set of barriers, which are organized into the following categories:

- Vehicles - These include barriers that inhibit the penetration of alternative fuel vehicles into the market. This category includes both technical and consumer acceptance factors as well as vehicle availability.
- Infrastructure - A lack of fueling infrastructure can pose a barrier to vehicle penetration. In this section, we identify barriers that inhibit alternative fuel infrastructure deployment, and potential solutions to address these barriers.
- Fuels - The fuels themselves can also present barriers. In this section we identify fuel-related barriers and solutions.

In the following paragraphs, each barrier is described briefly and the types of AFVs to which it applies are identified in parenthesis (i.e., BEV, PHEV, FCEV, flex-fuel/biofuel). Note that where the term PEV is used, this applies to both BEVs and PHEVs.

3.3.1. Barriers to the Uptake of Low Carbon Fuel Vehicles

B1. *Higher capital cost (PEV, FCEV, flex-fuel):* Most alternative fuel vehicles command a higher up-front cost than a comparable conventional ICE vehicle.

Rebates and tax credits that directly reduce the incremental cost have been effective in addressing this issue. Financing incentives such as loan guarantees and/or preferential loan rates can incentivize buyers as can, free or preferential parking, and reduced registration/smog fees. Another option is to facilitate a robust used vehicle market by incentivizing dealerships to bring vehicles from areas that have a larger pool of used alternative vehicles. Educate consumers on the cost savings of operating PEVs.

B2. *Limited range (BEV):* Limited driving range can be a real or perceived barrier for potential BEV drivers, as most BEVs cannot be driven long distances without recharging. Currently, battery all-electric vehicles typically achieve an 80 to 100 mile range on a full charge, with the one current exception being the Tesla Model S, which gets an EPA rated 265 miles per charge with the premium battery package. Other manufacturers such as Nissan and Chevrolet are claiming to release vehicles with a 200-mile range by 2017. Cold weather conditions can exacerbate this problem, because battery capacity can decrease by 25 to 50% in freezing weather conditions.

Two key approaches to overcoming range limitations for electric vehicles are 1) provide an extensive public charging network, including DC fast chargers, and 2) improve battery performance and/or thermal management systems to reduce battery range limitations. Local governments can really only significantly influence the first approach, but can lobby state and federal agencies to continue and/or increase funding for battery R&D.

B3. *Limited product offerings (PEV, FCEV, biofuel):* The variety of alternative fuel vehicles available on the market today is relatively limited, covering only a small subset of the wide range of end-use activities that vehicles serve. For example, there are no battery all-electric light duty trucks offered. For many categories this barrier will diminish as market share grows and additional vehicle models are offered.

This barrier can be addressed by encouraging or requiring manufacturers to offer more alternative fuel vehicle product offerings. In addition, local governments, business, and fleets can incentivize vehicle manufacturers by working collaboratively together to actively voice consumer demand for a wide range of alternative fuel vehicles.

B4. *Long charging times (PEV)*: The time required to charge electric vehicle batteries is long in comparison to the time required to refuel vehicles that utilize liquid or gaseous fuels (e.g., conventional gasoline and diesel, biofuel, natural gas, propane, and hydrogen powered vehicles). Typical charging times for an all-electric passenger vehicle might be 4 to 5 hours with Level 2 charging or about 30 minutes with DC fast charging. This can present a barrier to consumers accustomed to a fueling time of 3 to 5 minutes. However, this barrier may be more a matter of perception and habit rather than an

actual physical constraint. For example, many drivers are accustomed to filling their gasoline tanks once every week or two. Electric vehicle owners typically recharge at home each night, and this daily recharge is often sufficient to cover their daily driving needs (the 2009 National Household Transportation Survey estimated that the average daily vehicle miles traveled per driver is less than 30 miles)[8]. Furthermore, many fleet vehicles spend a significant time at "home base," presenting an opportunity to spend that time recharging for the next day's use.

This barrier can be overcome by providing a robust network of public DC fast chargers that allow rapid charging, as well as public and workplace Level 2 chargers that allow charging during the day while vehicles are parked. There is also a need to educate consumers about the various charging options that can provide them sufficient range to cover their daily driving needs, emphasizing that these vehicles require a change in habit and perception.

B5. *Risk aversion, market inertia, and lack of awareness (PEV, FCEV, biofuel):* Social factors can inhibit the deployment of a new technology, such as alternative fuel vehicles, into an existing market. These include potential customers being unfamiliar with the technology, uncertain about its costs and benefits, unaware of its market status and availability, unaware of available incentives, averse to risk, and thwarted by personal and/or market inertia. Succinctly put, conventional vehicles can be difficult to unseat; consumers know their attributes and are accustomed to buying, driving, and fueling these vehicles.

Alternative fuel vehicles, on the other hand, may have many different operational characteristics with which drivers must become familiar. For example, with PEVs some of the operational differences include: cheaper electricity costs relative to gasoline costs, use of a home re-fueling process, a need to understand battery charge states and how they relate to remaining driving range, knowledge of recharging times, using different types of re-fueling infrastructure, and locating/accessing public charging stations.

B6. *Information gap at the primary point of sale* (PEV, FCEV, biofuel): Barriers can also occur at various points in the supply chain, such as with sales personnel. For example, some auto dealers have been reluctant to aggressively market PEVs, citing a greater time commitment required to sell them and lower profit margins compared to conventional vehicles with internal combustion engines[9]. A survey of over 2,000 PEV buyers in California in December 2013 showed the vast majority was "dissatisfied" with their purchase experience[10]. According to a study by the National Research Council, "Dealerships are independent franchises that are not owned or operated by the automobile manufacturers. Training and educating dealership personnel -- salespersons, mechanics, financial specialists, and managers -- entail substantial costs to a franchise. Given those costs, many dealerships do not appear to be fully prepared to explain PEVs and educate customers about them. As a result, there appears to be an

8 http://nhts.ornl.gov/2009/pub/stt.pdf
9 http://electrificationcoalition.org/sites/default/files/EC_State_of_PEV_Market_Final_1.pdf
10 EV Owner Demographics & Diffusion Survey. 2014: Center for Sustainable Energy.

information gap at the primary point of sales."[11] In addition, many dealerships have only one or two PEVs on the lot at any given time, making immediate purchase of a vehicle more difficult. Rural customers also may lack confidence in local dealerships' expertise with service and support of these vehicles, so may choose to accept the costs of obtaining service at a more distant dealership that has more current training.

Incentives targeted to franchise dealerships might help overcome these barriers. They could be in the form of monetary awards and local publicity benefits (i.e., part of a public awareness campaign, green business campaign, etc.). A dealership education and training campaign could also help overcome some of these barriers. Ride and drive events can also support commission-based salespersons in the extra work to educate and inform the buying public about new vehicle technologies. Vehicle buyers guides can also help assist sales staff.

B7. *Road usage charges* (PEV): Currently the funding to develop and maintain roads and highways relies heavily on gasoline and diesel taxes. At the federal level, the "costs to repair and upgrade the system to meet current and future demand is estimated in the hundreds of billions of dollars."[12] At the state level, over the next 10 years, there will be a funding shortfall of nearly $57 billion for needs on the state highway system.[13] Individuals who drive more fuel-efficient vehicles tend to pay less in gasoline taxes, and electric vehicle drivers don't pay any. This is currently a de-facto subsidy to PEV drivers, although a very indirect one that is generally not readily obvious to the vehicle owners. On top of this, the gas tax is currently not designed to increase over time and is not indexed with inflation. This has resulted in reduced purchasing power associated with the tax money collected while demands on the highway system have increased.

The current federal transportation bill encourages states to explore alternative revenue mechanisms using a user-fee structure.[14] A number of states have adopted fees for EV drivers, and many others are considering legislation to close this loophole. This may be politically difficult if it appears to be a tax targeted at alternative fuels. Both California and Oregon are experimenting with mileage-based road user fees. California's pilot road charge program was required in Senate Bill 1077, and will be implemented statewide no later than January 1, 2017.[15]

These types of use-based fees would be more equitable for all drivers, but may reduce an incentive for PEV drivers. Something in this vein will probably need to be phased-in, as alternative fuel vehicles become a larger share of the transportation market.

3.3.2. Barriers to Infrastructure Development

B8. *Lack of public fueling infrastructure (PEV, FCEV, biofuel):* The lack of public infrastructure is in part due to the classic "chicken-or-the-egg" conundrum. Fuel providers will not deploy fueling infrastructure if there are not enough vehicles to utilize it, and consumers will not buy alternative fuel vehicles if they can't refuel them. For fuel providers, this results in an unviable business model, at least for the early years of

11 National Research Council (2013), Overcoming Barriers to Electric-Vehicle Deployment: Interim Report
12 http://www.gao.gov/key_issues/funding_nations_surface_transportation_system/issue_sum
13 http://www.dot.ca.gov/hq/paffairs/news/pressrel/2015/15pr042.htm
14 https://www.fhwa.dot.gov/fastact/nofo_stsfa_20160322.pdf
15 http://www.dot.ca.gov/road_charge/

fueling station operation. With regard to electric vehicle charging infrastructure, the National Research Council Study found that “publicly accessible charging infrastructure provides several important benefits, such as extending the electric range of all PEVs, relieving range concerns of BEV owners, and providing increased visibility of both PHEVs and BEVs. However, the high cost of installing public charging stations and the little revenue obtained from providing electricity present challenges for developing sustainable business models.”[16] Similarly, infrastructure development costs for other fuels such as hydrogen and biofuels can be so high that it makes it difficult for fuel distributors to obtain a reasonable return on investment even if there is sufficient demand to utilize the station.

According to some regional fuel distributors, the key element needed to establish a regional alternative fuel market is demand. They indicate that they would need evidence of significant demand for alternative fuels before they would be willing to sell them, as they have made unsuccessful forays into AF sales in the past. While fleet applications could be a good arena for jump-starting demand, fuel providers indicated that there is not enough demand from fleets alone to support the investment required for AF infrastructure.

Many fuels require new storage and distribution infrastructure, which increases operation costs, making it more difficult to generate a profit. Also, there are often unintended consequences associated with fuel switching (e.g., higher criteria emissions, material compatibility problems, etc.), and this adds early adopter risk to the distributor of AFs.

Local fuel distributors will supply fuel if there is demand and reasonable financial risk. They prefer to serve an existing market rather than take the risk of kick starting the market. They recommend that state fleets should have their own AF stations (and offer public access to the nascent market) before private fuel distributors are to be involved and that state fleets can be used as the "guinea pigs" for testing the viability of new fuels.

A number of approaches can be used to address this barrier, including:

- Incentivize landowners, retailers, and public agencies to offer host sites for installing EV charging infrastructure, including incentives for the installation of workplace electric vehicle charging.
- Consider the formation of a non-profit regional fueling station model where stations that don’t get a lot of use but are critical to enable public use of AF vehicles are subsidized with revenues from heavily used stations. This is the model proposed in the Mendocino County ZEV Regional Readiness Plan.
- Encourage installation of EV chargers as a green building attribute. One example is the LEED certification program.[17]
- Provide recognition for government agencies and businesses providing public access to fueling infrastructure (e.g., a “green business" designation).

16 NRC(2015). Overcoming barriers to deployment of plug-in electric vehicles. http://www.nap.edu/catalog/21725/overcoming-barriers-to-deployment-of-plug-in-electric-vehicles

17 http://www.usgbc.org/node/2613735?return=/credits

- Develop strategic partnerships between economic development agencies, vehicle dealerships and fuel distributors to help build infrastructure and build demand for vehicles.
- Develop economic zoning incentives for alternative fuel facilities.
- Advocate for public funds to be spent in a geographically and economically equitable way to enable AF market development in areas that are less attractive to early market investors.
- Facilitate streamlined permitting and government review processes for fueling infrastructure.
- Subsidize micrositing efforts to identify ideal locations and interested site hosts, and encouraging local, state, and federal fleets to take the risk of early adoption to kick-start the AF market. Furthermore, identify and conduct micro-siting analyses at candidate locations, and inventory existing utility infrastructure, such as at idle industrial sites, which can be repurposed for DC fast charging stations.
- Directly subsidize new infrastructure equipment.
- Encourage innovative new business models such as the one used by Propel Fuel's Clean Fuel Points program, which allows existing fuel stations to host a new fuel with minimized associated risk.

B9. *Barriers to residential charging infrastructure (PEV):* The main barriers to widespread adoption of single family residential charging for PEVs appears to be the cost and effort of installing wiring and equipment, including upgrades to electric service panels in some cases. Permitting requirements can be an additional hurdle. Residential charging can also be problematic for rental properties and for the multi-family residential sector where the benefits of EV charging are often not realized by the same entity that bears the cost of installing the charging infrastructure.

This barrier can be addressed by providing rebates/incentives for the installation of residential chargers, including the charger purchase and installation as a package deal as part of the vehicle purchase, providing incentives for charger installation in multi-family settings, and streamlining permitting requirements for charging infrastructure. Rebates could also be offered to help buy down the cost of residential panel upgrades to allow higher- powered electric vehicle charging stations (EVCS) at home.

B10. *Zoning/permitting barriers for alternative fuel stations (PEV, FCEV, biofuel):* Biofuel dispensing facilities will typically be added to existing gasoline stations and uses the same or similar equipment. Therefore, zoning and permitting for biofuels should not be much different than for existing gasoline stations. Hydrogen fuel poses additional zoning and permitting challenges, as it has unique physical characteristics (it is a gas, is dispensed at up to 10,000 psig, and has different flammability characteristics) and is less well understood by the general public.

Electric vehicle charging infrastructure can be installed anywhere there are adequate electric services, and for the most part can be treated like any other large electrical appliance. However, DC fast charging stations have large, and variable, electric power demands and therefore require larger capacity electrical services. Permitting for EV charging stations is still relatively new, but has not proven to be a significant barrier in the region. EV charging stations are usually considered to be an auxiliary use and do not require special zoning approval. However, for larger EV charging station

installations (i.e., numerous chargers), it is possible that a conditional use permit may be required.

To address the zoning and permitting barriers alternative fuel proponents should work with planning, zoning and permitting officials to make sure they are well informed about the various alternative fueling facilities and how they can fit into the existing regulatory landscape. Efforts should include encouraging best practices among planning, zoning and permitting officials, and conducting education and outreach to fuel distributors to inform them of potential challenges.

B11. *Lack of standardization in public charging infrastructure (PEV):* A lack of standardization of PEV charging infrastructure can present difficulties for PEV drivers. Examples of this lack of standardization include: multiple plug types for DC fast chargers, various payment methods, and charger access restrictions (such as charging network membership requirements). Standardization and consistency throughout the public charging network will tend to lead to a better user experience. To promote charging infrastructure standardization, PEV advocates should plan for and coordinate the installation and management of local charging networks to achieve regional consistency.

B12. *Lack of fuel production and distribution infrastructure (FCEV, biofuel):* In addition to a lack of alternative fuel retail providers in the Northwest California region, there is also a lack of local alternative fuel producers. According to the National Renewable Energy Laboratory's "transatlas,"[18] there are no ethanol plants in the Northwest California region and there are very few if any small biodiesel plants. Also, there are no commercial scale hydrogen production facilities in the region. This can affect the availability and cost of alternative fuels in the region.

To address this barrier, stakeholders can reach out to fuel providers/distributors and work collaboratively to develop markets and supply chains. Note that local distributors feel that alternative fuel supplies that are available in the San Francisco Bay Area could be integrated into our region provided there was sufficient demand for the fuels. Incentives that encourage the local production of transportation fuels within the region could also be helpful in addressing this issue.

3.3.3. Barriers to the Commercialization of Fuels

B13. *Blend wall (biofuel):* A blend wall is a maximum percentage of ethanol that can be blended into gasoline per EPA regulation. This limit to ethanol content of fuels results from a political debate hinging on the design characteristics of vehicles as well as the interests of both biofuel and petroleum industries.

Increasing the percentage of biofuels in conventional/biofuel blends, such as ethanol in gasoline or biodiesel in petroleum diesel, could be a low cost approach to increasing the penetration of low-carbon biofuels, and thereby could reduce greenhouse gas emissions and lessen our dependence on petroleum fuels. For example, the Mendocino Alcohol Fuel Group is conducting research and testing on the viability of increasing the blend of ethanol in conventional gasoline engines. However, ethanol cannot at present

18 http://maps.nrel.gov/transatlas

be legally blended beyond 10% with gasoline unless it is separately labeled, stored and dispensed. Biodiesel cannot be blended beyond 5% with conventional diesel without being separately labeled and handled. As of the writing of this report, most vehicles on the road are not approved by their manufacturers to accept higher percentage blends without modification.

One approach to overcoming this barrier would be to provide incentives reducing the added cost of separate labeling, storage and handling of higher biofuel blends. Furthermore, incentives could be targeted at vehicle manufacturers, encouraging them to design their conventional vehicles to allow higher biofuel blends.

B14. *Feedstock price volatility (biofuel)*: Supply risk of biofuels can be significant and can adversely affect both producer and consumer welfare[19]. The yield and price volatilities of biofuel feedstocks affect the availability of raw materials for biofuels production, which in turn impacts biofuel supply and cost. Adding biofuels to the current petroleum-based energy sector may initially lower supply risk by diversifying the fuel mix. However, in a scaled up scenario, biofuels could increase overall transportation energy supply risk as these agricultural supply variations are compounded with the existing volatility in oil prices driven by geopolitical and economic fluctuations.

To address this risk, policies should be designed to mitigate the impact of biofuel feedstock supply risks. Major biofuel firms should be encouraged to use several risk management strategies, including: more resilient production technologies, feedstock crop diversification, feedstock geographical diversification, storage technologies, and financial contracts. Public policy can play a role in a producers' risk management strategies by funding R&D to develop higher yield and more resilient feedstock crops, as well as by incentivizing crop and geographical diversification of feedstock, and by facilitating risk sharing with the fossil fuel sector. Public policy can also reduce the impact of fuel supply volatility by enabling consumers to shift their purchasing patterns between biofuels and fossil fuels. This may require supporting the development and deployment of flex-fuel vehicles, increasing biofuel blend walls, or requiring adjustments to the formulation of targets for the share of biofuels in the total fuel portfolio[20].

B15. *Public perception (biofuel)*: First generation biofuels are made from sugar crops (sugarcane, sugar beet), starch crops (corn), oilseed crops (soybean, rapeseed, palm oil), and animal fats. While it was originally thought that there would be significant environmental gains by using these fuels made from domestic biomaterials, careful analysis has shown that some first generation biofuels may not offer much in the way of environmental benefits, as they can compete with food crops, harming food security and indirectly causing GHG emissions through land use change. Because of this, biofuels in general have acquired somewhat of a tarnished name. However, some first generation biofuels, as well as second-generation cellulosic biofuels can offer substantial environmental benefits. In order for these biofuels to achieve substantial market share they may need to overcome some of these market-spoiling issues

19 Ghoddusi, Hamed and Roy, Mandira and Trancik, Jessika E., Biofuels Supply Risk and Price Volatility (December 20, 2014). Available at SSRN: http://ssrn.com/abstract=2540274

20 http://www.afdc.energy.gov/uploads/publication/ethanol_handbook.pdf

associated with first generation fuels.

This barrier can be addressed via an education and outreach campaign targeted to policy makers and advocacy groups that acknowledges the shortcomings of some first generation biofuels and points out the benefits of other first and second-generation biofuels. Getting buy-in from key environmental organizations would be particularly helpful. Efforts could include use of a product certification and marketing campaign for biofuel products that have been shown to result in lower greenhouse gas emissions and to avoid other adverse impacts (e.g., competition for food and land). One strong example of such a scheme is the Roundtable on Sustainable Biomaterials certification.

B16. *MPG reduction (biofuel):* Ethanol contains approximately 30% less energy than gasoline per unit volume, so vehicle fuel economy of E85 can be reduced by about 25%, depending on gasoline formulation and vehicle characteristics. Biodiesel contains 8% less energy per gallon than typical No. 2 diesel in the United States. The lower energy content per gallon in liquid biofuels will result in reduced vehicle range and increased fuel consumption.

Education and marketing campaigns should acknowledge these shortcomings associated with biofuels while making a strong case for their overall benefits. Incentives that subsidize biofuels in the short term to bring the price per mile on par with petroleum fuels could help address the issue of increased fuel use.

B17. *Pure and blended biofuel property issues (biofuel):* There are numerous fuel-related issues associated with some biofuels, all of which become more problematic for higher proportion biofuel blends.

- Biodiesel: The freeze point of biodiesel is significantly higher than that of petroleum diesel, and when it begins to gel it can clog filters and prohibit effective pumping. Most biodiesel blends have adequate storage stability for normal use, but if the fuel will be stored for more than a few months a stability additive is recommended. Also, biodiesel is generally more susceptible to microbial degradation than petroleum diesel. Storage and handling procedures for B100 are very different from those for B20 and lower biodiesel blends. B100 is a solvent that can loosen varnish and sediments in fuel tanks and fueling systems, and it is incompatible with some hose, gasket, pipe, and tank materials[21].
- Ethanol: Ethanol is hygroscopic (i.e., attracts water). A small amount of water is soluble in E85, but at higher concentrations, the gasoline portion will separate from the ethanol/water mixture. The separated ethanol can cause corrosion of some soft metals and can degrade some plastic and rubber materials. Ethanol acts like a cleaning agent and can mobilize sludge in fuel storage and dispensing systems. Cross-contamination between fuel types can also cause issues. For example, fuel haulers conventionally practice “switch hauling” where the same tank is used for delivering different fuels. In the case of ultra low sulfur diesel (ULSD), studies show that “Cross contamination of diesel tanks with small amounts of ethyl gasoline was leading to bacterial contamination (specifically, a kind of bacteria called

21 http://www.nrel.gov/transportation/pdfs/43672.pdf

Acetobacter) of the fuel tanks, leading to acid production and subsequent tank corrosion."[22]

Proper storage, dispensing and use of biofuels are critical to ensure that fuel related problems are not experienced. This will require proper education and training for fuel providers, fleet operators, and others using or providing biofuels. Biofuel users/providers must practice proper operation and maintenance procedures, adhere to fuel quality standards (e.g., ASTM), perform quality assurance procedures (e.g., periodic fuel testing), ensure proper material compatibility in vehicular, storage, and fueling system equipment, and provide adequate labeling and signage to help ensure that various biofuel blends are only used with compatible vehicular and fuel storage/supply systems.

B18. *Lack of carbon intensity accountability (PEV, FCEV, biofuel):* Petroleum-based fuels have a long history of externalized societal costs, which sustains an artificially low price point for this incumbent fuel. Emerging vehicle technologies also present challenges for legislation that relies on petroleum-based fees, such as the Highway Trust Fund. The switch to low carbon fuels presents an opportunity to create a universal costing system for transportation fuels.

3.3.4. Barriers to Educating and Facilitating Support Services

B19. *Lack of vehicle maintenance support (PEV, FCEV, biofuel):* A lack of trained mechanics can be a barrier to the uptake of alternative fuel vehicles. Vehicle manufacturers and associated dealers are, in general, providing adequately trained mechanics at their dealerships. However, many consumers prefer to frequent their local independent mechanic. In addition, fleet operators typically have their own in-house mechanics. This presents a need to train independent mechanics so they can work on PEVs, FCEVs, and biofuel vehicles. This can be addressed by promoting alternative fuel vehicle maintenance and repair trainings for independent mechanics, especially through existing training channels.

B20. *Lack of safety and first responder training (PEV, FCEV, biofuel):* Fire, police, ambulance, and other first responders need to receive regular training regarding safety issues related to alternative fuel vehicles they are likely to encounter. Currently there are some limited training options available to different groups, with firefighters having the most developed course available through the National Fire Academy. However, there are numerous challenges including:

- Hours-based training mandates pose difficult challenges particularly for volunteer departments. Topic-based requirements would make it easier for departments to cater to the training needs of different departments, and also make it easier to add topics to the training curriculum.
- Bringing people to locations where training is happening can be a challenge, again particularly with volunteer departments and with departments in rural areas. Time availability, including backfilling for employees away on training, wage compensation, and travel expenses pose a significant barrier.

22 http://www.bellperformance.com/bell-performs-blog/ultra-low-sulphur-diesel-problems-corrosion-in-systems-storing-and-dispensing

- There isn't consistency across first responder groups regarding the sources of training information.
- Train-the-trainer and hands-on training events are lacking in the area.
- Currently there is no training curriculum developed for first responders that has a focus on fueling equipment and infrastructure.
- The labeling of equipment is not standardized across manufacturers. Coloring high voltage cable orange is an example of an existing standardization, but there is more work that can be done to assist first responders in the field.

B21. *Lack of towing and salvage training (PEV, FCEV, biofuel)*: towing and salvage companies are a critical part of the automotive support industry. However, these companies are often overlooked when considering safety and vehicle requirements. Towing companies assisting stranded alternative fuel vehicles will need to know where the local fueling stations are, which dealerships and mechanics service the vehicles, specific details of how electric and hydrogen vehicles behave when they run low or out of fuel, and any unique safety considerations when towing or hauling these vehicles.

In addition, salvage companies need to be educated on many of the safety issues that first responders are trained on. Wrecking and salvaging vehicles requires knowledge of specific safety issues, and this information must also be conveyed to this industry.

B22. *Lack of standardization of proprietary vehicle software (PEV, FCEV, biofuel):* Computers have become increasingly important in vehicles, with microprocessors controlling numerous processes including sophisticated engine controls, on-board diagnostic sensors, cabin climate control, theft deterrence systems, safety features such as traction and braking control, complicated transmission systems, and many other technological advancements. These computer systems all require software to operate them.

A lack in standardization of software development has resulted in numerous challenges including:

- Difficulty interpreting on-board diagnostic codes from engine and powertrain control modules. Although the current OBD-II standard is widely used, significant manufacturer discretion is allowed. This often means that different diagnostic equipment is required for different vehicle makes in order to fully interpret all diagnostic signals provided by the on-board diagnostic equipment. This is proving to be an increasingly significant barrier for independent automotive mechanics and fleet operators.
- Proprietary theft deterrence systems are increasing in complexity without standardization. When these systems fail specialized equipment is often required to address the problem. Often only dealerships have access to this equipment particularly in rural areas like this region making it difficult or impossible for local mechanics or roadside assistance to assist stranded drivers.

Feedback from Local Government Stakeholders and the Training Materials Working Group

While alternative fuel vehicles are the primary components needed to forge a low carbon transportation market, it is just as important to enable the numerous industries that support the auto industry. These include government planning and inspection agencies, first responders, dealerships, maintenance and repair businesses, towing and salvage businesses, fleet operators, and fuel distributors.

Zoning, Codes, and Permitting:

Information about permitting challenges was gathered to identify strategies to reduce permitting barriers in order to encourage low-carbon fuels deployment in the Northwest California region. To accomplish this goal, interviews were conducted with regional permitting and planning departments, low-carbon fuels providers, as well as California, Oregon, and Utah communities that have established low-carbon fuels deployment programs through the U.S. Department of Energy Clean Cities Coalition program.

Key findings from this research are:

- There are many pathways for a community to streamline the permitting process in order to encourage the adoption of low-carbon fuels without reducing protections for environmental health and safety.
- Collaboration between city / county planning and permitting staff, public safety agencies, fuels providers and community stakeholders can lead to increased awareness and understanding of existing codes and regulations for low-carbon fuels.
- Modernized land use codes and low-carbon fuels-specific permitting requirements can provide fleet operators and fuels distributors with opportunities to help accelerate the development of a thriving low-carbon fuels market.

Specific actions that address these recommendations can be found in this plan. Some of the recommended can be undertaken by a local coalition of agency representatives, low-carbon fuel facility developers and other entities with the mission of accelerating the development of a low-carbon fuels market in the region. Other actions such as procedural and code changes will need to be executed by agencies with broader authority such as City Councils, Boards of Supervisors and local permitting and planning departments. Some actions, if undertaken at the state level could eliminate the need for developing new local permitting policies.

Training for Safety and Non-Safety Stakeholder Groups:

An assessment of the availability of both safety and non-safety training materials for relevant stakeholders, including first responders, fleet managers, emergency planning offices, fuel distributors, dealerships, and towing and auto repair shops. Training materials were found by performing a literature review and surveying stakeholders about training on AFs and AFVs. A list of existing training materials and services was generated, with particular emphasis on freely available resources. Stakeholders were chosen based on their potential engagement with AFs and AFVs. For each county the project team attempted to survey at least two entities from each relevant stakeholder category.

The key results are:

- Sufficient materials and resources were found for training technicians as well as code and permitting officials. Sufficient materials are available to educate key decision makers and the general public regarding the basics of AFs and AFVs.

- Many free safety-training materials on AFs are available. In addition, there is an official 16-hour course through the National Fire Academy that is recognized by the state and local fire departments. However, there are challenges with existing materials that need be addressed through the proper state agencies. Furthermore, mandated training for alternative fuels and vehicles do not exist for all other safety and first responder groups.

- Firefighters are the most likely to encounter alternative fuels and vehicles in an emergency situation, and some have had training in the past on AFs, in particular with electric vehicles (EVs), but considerably more training is needed. All other first responder and safety stakeholder groups have received little-to-no training on AFs.

- There is a need for non-safety training across all relevant stakeholder groups, particularly automotive mechanics, in the region. Non-safety training refers to training planning and permitting agencies on their role regarding alternative fuel adoption, training auto mechanics on vehicle repair, training sales staff at dealerships on vehicle differences and required behavior changes specifically for electric vehicles, and training relevant to other stakeholder groups that support the transportation sector.

In discussion with stakeholders numerous key challenges were identified which are captured in Section 3.3. The following is a breakdown of the number of challenges identified by stakeholder group:

- First responders: 8 identified primary challenges

- Auto Industry Service Sectors: 5 identified primary challenges

- Local Government Agencies and the General Public: 2 identified primary challenges

In general, training needs stem from insufficient funding and specific challenges within the existing training industry and existing training materials. However, lack of dissemination of information is also a critical challenge, as well as a relatively minor yet important need for supplementary material development.

There are number of suggested actions that could address the identified primary challenges. The majority of these are likely best implemented by a dedicated local agency or coalition of agencies dedicated to preparing the region for the adoption of alternative fuels and vehicles. However, a number of the actions are best implemented by Federal and State training agencies as well as private training organizations.

4. COMMITMENT TO ACTION

This section is devoted to detailing 69 different specific actions that can be used to address the barriers listed in Section 3.3. Agencies with authority to execute the recommendations are noted alongside each posited solution. The following notation is used to identify the agencies and parties who can adjust procedures or amend codes to streamline the permitting process for alternative fuel infrastructure:

S = State of California departments and agencies,

L = Local government, such as planning and permitting departments, City Councils and Boards of Supervisors,

C = Coalition of local agencies, AF developers, and non-profit entities supporting the efficient development of alternative fuels in the region.

4.1. Market Development Actions, Funding Mechanisms and Incentive Programs

The following are proposed recommendations to promote deployment of alternative fuels in the Northwest region of California. Funding mechanisms and incentives are heavily emphasized, with a focus on actions that regional stakeholders can take. These actions and incentives include those aimed at increasing purchases of alternative fuel vehicles, increasing installation of alternative fueling infrastructure, and increasing availability of the alternative fuels themselves.

It should be noted that many incentives should be structured to phase out over time as the alternative transportation fuel market matures. Incentives should be tied to program success metrics, and planned incentive reductions tied to these metrics. This ensures a more productive use of public funds and helps to avoid creating a market that is dependent on incentive programs.

4.1.1. Actions Addressing Challenges to the Commercialization of Vehicles

The actions described here address challenges associated with vehicles such as production, purchasing, and fleet adoption.

A1. Work with local and State financing entities to create, or to increase access to, AF vehicle financing incentives such as loan guarantees or preferential rates for AFV loans. S L C

A2. Work with local and State financing entities to create, or to increase access to, AF vehicle financing incentives such as loan guarantees or preferential rates for AFV loans. S L C

A3.	Create incentives for used vehicle dealers to source used AFVs from the SF Bay Area where economic and demographic circumstances have led to a larger pool of such vehicles on the market.	S	L	C
A4.	Provide perquisites such as free or convenient parking for AFVs in publically owned lots and/or metered spots. Provide access to HOV lanes where appropriate for AFVs. Also, collaborate with other jurisdictions to enable reciprocity in those perks.	S	L	
A5.	Consider subsidizing alternative fuel costs. For example, businesses could provide free electric vehicle charging for customers. Subsidies for other fuels could be provided at comparable subsidy levels to encourage a range of alternative fuels.	S	L	
A6.	Work actively to transition publicly owned fleets to AFVs as defined in Executive Order B-16-2012. State agencies have been active in this regard, targeting a 25% ZEV share of light duty vehicle purchases by 2020. Local agencies should follow suit; this will stimulate the local market for the vehicles and their fuels as well as increasing their visibility and familiarity in local communities. State funds, many of which are earmarked for economically disadvantaged communities, should be leveraged to bring down the cost associated with these purchases. One effective way to accomplish this is to set maximum vehicle age limits for public fleets.	S	L	C
A7.	Initiate AFV phase-in for heavy-duty vehicles (e.g., >14,00lbs. GVWR) in large fleets to prove efficacy of alternative fuels in different applications and across fleet vehicle types. Communicate performance data, reduced fuel costs, and emissions control compliance advantages to smaller fleet operators.	S	L	C
A8.	Vehicle purchase incentives are currently after purchase rebates and tax breaks. Point-of-sale incentives have been found to be more effective and are recommended. In addition, income eligibility guidelines that can help improve the cost effectiveness of incentive programs are also recommended.	S	L	
A9.	Advocate for manufactures to offer a greater variety of vehicle types. One potential approach could be to collaboratively work with local governments, businesses, and fleets to identify needs, and voice a possible commitment of purchase should the vehicles become available.	S	L	C
A10.	Replace “least first-cost” procurement policies in public fleets with language that allows price flexibility, price preferences, life cycle costing, or other approach that considers benefits beyond initial price.	S	L	
A11.	Implement a “buy local” requirement, contingent on vehicle availability, for public fleets to encourage local dealerships to increase the availability of AFVs and relevant maintenance services.	S	L	
A12.	Engage auto manufacturers in an effort to improve on existing on-board diagnostic code standards, and begin discussion around ways to address challenges associated with proprietary on-board software and the increased automation of vehicles.	S		

4.1.2. Actions Addressing Fuel Distribution Infrastructure Challenges

The actions listed here address challenges associated with installing and commercializing fueling infrastructure, such as capital costs, business models, and end-user education. The majority of infrastructure-related recommendations are associated with EVCS. This is because the process of charging an EV deviates significantly from the traditional "gas station" model such that there are larger ranges of issues that need to be addressed to facilitate a robust EV market. The remaining recommendations that do not specifically address EVs are applicable across all AFs including electricity.

A13.	Advocate for government funding for AF fueling infrastructure in Northwest California. Given the low population density and economic circumstances in the region, private markets may not provide for this infrastructure. However, its presence in the region would provide a public good, both to local residents and to others who may want to travel to Northwest CA, warranting government investment.		L	C
A14.	Collaborate with local electric utilities, local EVCS installers, and private companies to standardize the end-use customer interaction with EVCSs installed for public use, focusing on consistent payment methods and charger access.	S	L	C
A15.	To ensure adequate geographic coverage, subsidize critically located but underutilized fueling stations.	S	L	
A16.	Remove barriers to creation of AF infrastructure through fast-tracked permitting, consistent codes and standards, and waiver of key fees. Collaborate regionally on development of model permitting and zoning process to accelerate the deployment of AF infrastructure. Seek support from state agencies, notably the Governor's office. See Section 4.2 for more permitting and zoning actions.	S	L	
A17.	Promote installation of EV charging infrastructure at targeted, high-impact locations where drivers spend significant time parked away from home (examples include workplaces and public transportation hubs) and in multi-family settings.		L	C
A18.	Create incentives for businesses to install AF infrastructure, and lead by example by installing such equipment at public agency offices. For example, provide recognition as a "green business" for businesses incorporating alternative transportation fuels into their operations.	S	L	C
A19.	Mandate that EVCS be installed at any significant new parking lot development, requiring at least one charger per set number of new parking stalls. Provide technical and/or procurement support to enable this. Mandating EVCS be available at multi-unit dwellings greatly expands the potential market for EVs. See Section 4.2 for more permitting and zoning actions.	S	L	
A20.	Collaborate intra- and inter-regionally on the installation of AF fueling infrastructure along major highway corridors, facilitating both intra- and inter-regional travel.		L	C
A21.	Incentivize local public and private fleets to host fueling infrastructure that is	S	L	C

accessible by the public.

A22.	Encourage PEV dealerships to offer package deals to single-family homeowners that include the installation of a residential PEV charger.	S	L	C
A23.	Offer incentives that help offset the cost of new AF equipment or the conversion of existing equipment to support AFs.	S	L	C
A24.	Mandate that any AF infrastructure built with public funds to be accessible to the public and be built to be compatible with as many vehicle types as possible. In the case of EVCS, require that it be built on the OCPP 2.0 standard. Encourage the same level of accessibility for privately funded AF infrastructure through incentives such as fast-tracked permitting and fee waivers. See Section 4.2 for more permitting and zoning actions.	S	L	
A25.	Develop highly visible AF infrastructure markings and signage beyond currently available signage standards. An example is the Washington State requirement that EVCS spaces be identified with green pavement markings. In addition, ensure that the presence of AF supply infrastructure is clearly marked along nearby traffic corridors using standardized signage detailed in the CA-MUTCD. This involves collaboration between infrastructure installers, local agencies, and Caltrans to help make this infrastructure visible to the general public.	S	L	

4.1.3. Actions Addressing the Commercialization of Fuels

These actions address challenges associated specifically with the commercialization and adoption of low carbon fuels, such as pricing, feedstock challenges, and blend walls.

A26.	Where utilities are operated by local government entities, offer TOU pricing or other attractive EV rate schedules.		L	
A27.	Explore the possibility of localized production and distribution of alternative fuels and encourage feasible options through incentives, subsidies, or other mechanisms.	S	L	C
A28.	Establish a service that assists fuel sellers in claiming emissions credits from alternative fuel sales. This may incentivize an increase in AF availability as this additional funding stream could alleviate the potential additional costs or risks associated with providing alternative fuels. Consider also leveraging tools that assist fuel sellers and buyers in assessing additional social and environmental impacts and benefits of fuel feedstock sources.	S	L	C
A29.	Encourage biofuel policies that can mitigate feedstock supply risks.	S	L	
A30.	Encourage the use of renewable diesel fuels that have no blend wall limit thereby eliminating fuel compatibility issues with exiting diesel vehicles, equipment, and infrastructure.	S	L	C
A31.	Remove the unintended incentive for alternative fuel drivers associated with road usage fees that are not collected from fuels used to fuel AFVs. For example, work towards replacing the existing gas tax with a carbon tax, such as The Gas Tax Replacement Act of 2015 (H.R. 309), that can help bring all fuels, including petroleum based fuels, onto a level pricing playing field by internalizing environmental impacts. Note that attention should be	S	L	

paid to California's Road Usage Charge pilot program when considering this option.

A32. Actively support State and Federal efforts that address blend wall issues. S L C

4.2. Land-Use, Zoning and Permitting Changes

Amending zoning codes and streamlining the local permitting process presents an opportunity to proactively support and accelerate the deployment and use of alternative fuels. Permitting approaches should include all alternative fuels, all known alternative fuel use applications (e.g., both on-road and off-road), and be revisited periodically to include new technologies as they come online.

4.2.1. Streamline Permitting Processes

The following actions address challenges associated with permitting fueling infrastructure.

A33. Document, centralize, and make publically accessible the details about the permitting procedures for alternative fueling infrastructure for all jurisdictions in the region. L C
   a. Address all agency questions so that they are comfortable with the technologies before they even see an application.
   b. Contact CalFire and ask what concerns they have well in advance.
   c. Provide on-line and in-office resources explaining the process for permitting each type of alternative fuel dispensing or charging infrastructure at each individual city or county branch office.
   d. Train planning and permitting department staff about the AF infrastructure permitting process so they can explain it clearly to any entity seeking a permit.

A34. Form a Uniform Code Committee where members of nearby cities and counties develop permitting and inspection guidelines intended to enhance regional consistency in application and enforcement of existing codes. L C
   a. Encourage planning and permitting staff to contact their peers in neighboring cities with AF stations to discuss how they handled permitting.
   b. Include input from transit agencies, fleet operators, utilities, planning departments and fuels providers.
   c. Adopt clear local ordinances, permits, and procedures to minimize administrative burdens.
   d. Standardize permitting and inspection fees for all AF infrastructure.
   e. Provide clearinghouse of permit process information and where to go to get more information.

A35. Create a template for local governments on existing cores and standards for permitting and inspection of AF infrastructure. S L C
   a. Provide standard forms that request all pieces of information that will be required by the different agencies with permitting oversight.
   b. Establish reasonable permitting fees; the cost of the permit should cover the time necessary to issue the permit (including necessary plan checks), as well as the time to inspect the installation.

A36. Leverage existing codes when drafting codes specific to alternative fuel stations — S L C

a. All alternative fuel regulations, codes, and jurisdictions with enforcement authority in the state of California are listed in the "Cal/EPA Fuels Guidance Document, Version 1.0" (2011). This document contains information specific to every type of alternative fuel, contacts for each agency with oversight, and provides standards and requirements for fuel use, labeling, dispensing, vapor recovery and other aspects of AF use.
b. The most commonly used codes pertaining to AF infrastructure are:
    i. The California Building Standards Code, Title 24, California Code of Regulations (CCR),
    ii. Title 24, CCR, California Fire Code Chapter 43,
    iii. The National Fire Protection Association (NFPA) 52 Vehicular Gaseous Fuel Systems Code,
    iv. NFPA 70 National Electrical Code,
    v. NFPA 30A code for Motor Fuel Dispensing Facilities and Repair Garages,
    vi. NFPA 57, 59A codes for Liquefied Natural Gas Vehicular Fuel Systems,
    vii. NFPA 50A, 50B codes for Hydrogen Fuel,
    viii. The International Fire Code, and
    ix. Health and Safety codes.

A37. Make online and over-the-counter permitting available for basic AF installations and upgrades. — L

a. Establish a unique permit for installing each type of alternative fuel infrastructure; this will allow AF providers and fueling station developers to know exactly what is required to complete the permit process.

A38. Consider the following recommendations for streamlining the permitting process of EV charging stations: — L

a. List EV charging as a permitted use across a broad range of zoning classifications. If a zoning review is triggered, consider EV charging infrastructure as an "accessory" to another permitted use whenever possible.
b. Allow for new EV charging infrastructure to be added to existing building permit / viewed as an additional "common utility" to existing permitted building.
c. Avoid requiring an electrician to be present during an EV charging infrastructure inspection.
d. Allow electricians to self-certify their installations using a standard checklist for inspecting EV charging installations.
e. Create an "EV charging station permit" even if it is the same permit needed to install a washing machine in garage, and put this permit application on the city or agency website.
f. Consider "bulk sticker" permitting for EV charging infrastructure with random inspection process.

A39. Allow for on-line or over-the-counter permits where applicable. This approach allows contractors to purchase permits online and follow the same — L

inspection procedures as a regular permit

A40. Consider passing policy to wave requirements for other improvements for AF infrastructure upgrades at existing fueling facilities — L

A41. Develop fueling facility design standards (such as compressor noise abatement requirements) for gaseous fuels — S L

4.2.2. Land-Use, Zoning and Permitting Recommendations

The following list potential land-use and zoning decisions that local governments can make to facilitate regional adoption of fueling infrastructure.

A42. Develop and/or amend codes to provide specific requirements for all types of alternative fuels infrastructure — L
   a. Start with the most common AF fueling / charging applications.
   b. Allow for flexibility in the zoning code; eliminate the need for new building permits for straightforward AF infrastructure (e.g., re-purposing an underground fuel tank to E-85 or Biodiesel).
   c. Allow flexibility in parking space requirements when the facility owner installs AF fueling / charging infrastructure (e.g., decrease the number of parking spaces required for a facility or increase the amount of retail space allowable per parking space).

A43. Require new construction permits to have EV charging conduit and/or pre-wiring installed in all structures, meeting or exceeding CA building code. Even if EVCS isn't being installed at the outset, ensuring that necessary wiring, conduit and panel capacity are in place from the outset removes a barrier to later installation of chargers. — S L

A44. Make sure there is sufficient land zoned to allow for new alternative fuel supply stations to be developed (L). For example, amend zoning codes to explicitly: — L
   a. Allow alternative fueling infrastructure at existing gas stations, truck stops and corporation yards as these sites are already designed for large fuel truck ingress, egress, and turn-around, and already have ADA compliant features.
   b. Encourage alternative fuel dispensing / charging equipment at existing gas station locations within one mile of any major transportation corridors.
   c. Allow alternative fueling infrastructure in certain commercial and/or industrial zoned properties.
   d. Allow compressed natural gas fueling stations where there is a viable gas supply line running along the property; permitting at these sites is more straightforward as natural gas is already there.

4.3. Safety, First Responder and Auto Support Industry Training

The following recommendations are specific to first responder stakeholders, auto support industry stakeholders, and the general public. Actions focus on education and outreach that can encourage stakeholder success when interacting with vehicles and fueling infrastructure.

4.3.1. Safety and First Responders

This set of actions focuses on addressing the identified needs of the safety and first responder stakeholder groups. These include fire, police, EMTs, and others.

A45.	Actively engage with first responder training material development organizations to encourage the creation and mandating of time-scalable alternative vehicle and fuel courses that can be implemented in a range of scenarios (for example from a one hour "awareness" course to a full 16 hour "train-a-trainer" course) a. Material development organizations include California Specialized Training Institute (CSTI), Peace Officer Standards and Training (POST), California Training Officers Association (CTOA), California State Fire Training, and National Fire Academy. Mandates through these organizations will increase level of local training.	S		
A46.	Explore the potential for incorporating alternative fuel training material into existing mandated first responder courses by creating focus tracts where different personnel can take the same course but with a different focus depending on an agency, department, or first responder's needs.	S		
A47.	Identify an agency, State or local, that is capable of centralizing training material resources across all safety and first responder stakeholder groups.		L	C
A48.	Work with local OES chapters to coordinate and channel funding for training across safety and first responder stakeholder groups.	S	L	
A49.	Treat alternative fuels trainings as "Perishable Skills" training in the near term since safety and first responder teams will likely not use many of the skills in the field in the near future. Encourage or require refresher courses when appropriate or needed.	S	L	
A50.	Develop mechanism for first responders to easily identify different types of AF vehicles. For example, require a sticker or other identifying feature on alternative fuel vehicles.		L	C
A51.	Educate building officials and Fire Marshalls about the changes that are required for maintenance facilities that work on low-carbon fueled fleets – especially compressed gas vehicle maintenance. For example, address venting, doors, safety and sensor requirements.		L	C
A52.	Communicate with all regulatory and safety agencies early in the permitting process of alternative fuel stations to address concerns and questions. Address all agency questions and concerns with supporting documentation and examples from other projects.		L	C
A53.	Train fire personnel to do inspections on alternative fuel storage and	S	L	

dispensing equipment; invite fire inspectors from a jurisdiction that already has the relevant infrastructure to participate in training and answer questions.

A54. Train safety and first responder stakeholder groups on safe fueling procedures for different types of low-carbon fuels. S L

4.3.2. Auto Support Industry Stakeholders

The auto support industry is a catchall stakeholder group that includes dealerships, towing and salvage companies, general contractors, automotive technology programs at community colleges, automotive repair shops, and many other businesses that provide key services to the transportation sector.

A55. Earmark and/or search for funding that provides training to dealership sales staff that addresses information gaps at the point of sale. S L C

A56. Promote trainings for contractors for AF station installations. Work with State and local officials to earmark funding to support these trainings. S L C

A57. Promote alternative fuel vehicle trainings for independent mechanics, towing companies, and salvage companies, perhaps through local community colleges, local auto parts suppliers, or private training companies or vocational centers S L C

A58. Bolster the alternative fuel training capacity of local Community College Automotive Technology programs by funding the following: S
   a. Certification of instructors in existing automotive technology departments that results in their ability to offer certified courses on alternative fuel vehicles.
      i. Ensure that certification meets any accreditation requirements of the College. For example, Automotive Service Excellence (ASE) is a common certification pathway, and is required for a program to be accredited by the National Automotive Technicians Education Foundation (NATEF).
   b. Integration of alternative fuel vehicle information into existing courses.
   c. Development of separate courses devoted to alternative fuels when the level of demand is appropriate.

A59. Work with training and employment programs, such as the California Employment Development Department or the Siskiyou Training and Employment Program, to fill the gaps in local training needs. S L C

A60. Explore ways to encourage auto manufacturers to offer trainings on their alternative fuel vehicles in the local region as trainings straight from the manufacturer are preferred by many industry groups. S C

A61. Explore ways to create a local lending library of tools and technical manuals needed by mechanics. Cost is often the primary barrier to obtaining the necessary equipment and information for newer vehicles. This service could be useful to dealerships, independent auto mechanics, roadside assistance and salvage companies, and community colleges. S C

4.4. Outreach and Promotion

The following recommendations relate to marketing, education, and outreach efforts targeted and key stakeholders as well as the general public.

A62. Promote the availability and marketing of AFVs regionally through outreach to and collaboration with dealerships. Collaborate with dealerships in conducting outreach to the community through environmental and automotive events. S L C

A63. Conduct and coordinate extensive AFV outreach and education campaigns in local communities throughout the region. S L C

A64. Highlight dealerships that have taken innovative action or have had unusual success in promoting AFVs. Recognize them locally through local media or events and nominate them for statewide recognition. A contest for AFV sales might stimulate participation of dealers as well as media interest. S L C

A65. Reach out to fleet owners/managers to encourage their uptake of AFVs through training, incentive programs, support and recognition. Encourage collaboration between dealers, fleet operators, and fuel providers. S L C

A66. Develop a biofuel education and outreach campaign that distinguishes the differences between first second generation biofuels, and promotes the benefits of second-generation biofuels. Consider the encouraging uptake of a biofuel certification program that distinguishes and promotes environmentally and socially responsible biofuels. S L C

A67. Facilitate biofuel trainings for fuel providers, fleet operators, and others using or providing biofuels that clearly addresses the proper storage, dispensing and use of biofuels. S L C

A68. Develop a sustained education campaign that informs all sectors of the AF market about blend wall issues, and the do's and don'ts with flex-fuel vehicles and high percentage ethanol blends. S L C

A69. Employ the "Ladder of Engagement" at all city / county planning departments: L C

a. The basic level of engagement is awareness of existing AFs brochures and permitting information fact sheets; make sure all counter staff informed about alternative fuels information available.
b. The second level of engagement is to increase AF friendliness; create a dedicated permit form and a dedicated person(s) on staff that can answer questions.
c. The third level of engagement is to dedicate city staff time to go after prime installation sites and partners. The goal of this effort is to identify and market to owners of sites that are in AF-appropriate zones or already have appropriate use permits for AF infrastructure installations (e.g., gas stations, truck tops, corporation yards etc.).
d. The fourth level of engagement is to partner on pilot programs, grant applications, and promotion activities to accelerate the deployment and use of alternative fuels.

A Focus on the Current and Potential Future Challenges of Private Heavy Duty Vehicle Fleet Operators

Fleet operators that were contacted during the development of this plan generally expressed support for cleaner fuels and reduced emissions coming from the smoke stacks of their trucks. Public fleet operators were excited to see the clean vehicles options on the market, and expressed interest in incorporating alternative fuels vehicles into their fleets. This is especially true for fleets that were largely comprised of light and medium-duty vehicles such as the local utility fleet as well as county and city / township staff operations vehicles. Incremental cost was cited as a common barrier, but if resolved through incentives and/or incremental cost buy-down programs, public agency fleet operators were generally interested in incorporating alternative fuel vehicles into their fleets.

The private heavy-duty fleet operators were also generally supportive of clean fuels and reduced emissions, but were also frustrated by the increased expense and reduced business viability that has occurred as a result of the state's previous emissions reductions efforts – specifically related to the Statewide Bus and Truck Rule and the Tractor-Trailer GHG Reduction Measure. Any new requirements on private heavy-duty fleet operators to switch to alternative fuels and buy new vehicle engine technologies fuels will be met with a very challenging financial obligation given that most firms have recently purchased new trucks. Without careful transition to the low carbon fuels economy, new regulations on this industry risk driving increasing quantities of small-to-medium California trucking companies out of business - reducing the states' trucking capacity overall, and slowing California's movement of goods thus slowing the state's economic growth potential in the medium term.

The following summary was taken directly from conversations with private trucking firms, owners and drivers. This feedback expressed the fleet manager and truck driver perspectives regarding air emissions regulations compliance issues and the potential for alternative/low-carbon fuels use.

Key Feedback Regarding Fleet Vehicle Conversions and Emissions Reductions Requirements:

Feedback has been organized into the following sections: operational impacts, economic challenges, safety concerns, and proposed solutions.

Operational Impacts: Truck owners are increasingly facing two sets of vehicle issues: manufacturer's engine technology issues and emissions reduction technology issues. Examples of these issues include:

- It used to be a hauling company could depend on running a new vehicle 5 years without maintenance issues. Now it is common for vehicles to require significant maintenance every 6 months.

- Exhaust Gas Re-circulators (EGR) back up periodically causing other sensors to fail. In addition, EGR filters have to be serviced once per week because the pressure differential valve gets soot in small holes that then get clogged. This additional maintenance causes significant increases in maintenance costs.

- Diesel Exhaust Fluid (DEF) systems require additional routine maintenance related to the "doser valve" which injects DEF into exhaust converting NOx to nitrogen and water.

If doser valves don't work, the DEF crystalizes in the lines causing a backup as filters get plugged. The doser valve itself also plugs up and requires additional maintenance.

- NOx sensors meeting compliance requirements periodically fail causing involuntary mandated engine shut-off events. This results in significant additional operation costs.

- Additional filters and sensors can create maintenance challenges due to reduced access to engine components that require frequent maintenance.

- Safety impacts associated with diesel particulate filters (DPF) have been experienced due to the filter regeneration cycle which creates a significant amount of heat. Because the regeneration cycle cannot be controlled local fuel haulers have experienced significant safety impacts during fueling events.

Economic Challenges: When costs increase to hauling companies, it is the taxpayer and the consumer who ultimately pays in increased costs of goods such as food and other commodities. Around 80% of all goods produced in CA are trucked at some point. Costs of all goods hauled by trucks will be going up – and this includes nearly everything produced in CA. Many private fleet operators attribute a much of these increasing costs to state regulations. Examples of these impacts include:

- Larger companies can spread the cost of increased maintenance and periodic engine shut-downs over the entire fleet, smaller companies cannot; some firms only have one truck – if that engine needs maintenance due to a clogged filter and needs to be towed, all profits from the day's run can be lost and business stalled until the truck is back on line again. Smaller firms can't afford the "down time" as they do not have other trucks to send out while the filter is being maintained or fixed.

- Vehicle turnover in smaller companies is much lower making it more difficult to meet changing regulations. Big companies typically turn over vehicles every 3 years so the new vehicle requirements are less challenging, but for the small operator, the costs associated with the emissions reductions requirements are difficult to meet.

- Some emissions control devices have reduced heavy-duty truck fleet fuel economy which impacts operational costs.

- DEF can increase total vehicle weight by 1,000 lbs or more, which reduces total cargo load size due to on-road vehicle weight restrictions. The additional costs of DEF also increase operational costs.

- Many fleet operators have found incentive funds to be challenging to access. Both the application processes as well as requirements to be met by the fleet operator can be challenging, particularly for smaller companies.

- Many operators see California regulations as both making CA-based companies less competitive with out-of-state companies, and exporting emissions to neighboring areas such as Nevada or Mexico where used non-compliant vehicles are being sold by CA-based companies trying attain compliance.

Stakeholder-proposed solutions for encouraging the adoption of alternative fuels in fleets:

The following solutions were suggested by private fleet operators. These are included in Section 4 at a high level. The following provide more specific recommendations than those found in Section 4.

- Provide truck engine manufacturers a chance to competently design and develop solutions to regulatory changes by providing sufficient time for a full systems design rather than forcing the attachment of multiple accessories to existing technology.
- Advocate for emissions regulations to be part of a nation-wide system, not just a CA system.
- Use annual mileage as a better way to address compliance timelines – give smaller companies and companies that haul intermittently (e.g., logging, agriculture, and construction) more time to comply with new vehicle purchase requirements.
- Make incentives and incremental cost "buy-down" funds easier to access.
- Focus on assisting all heavy-duty transportation firms by offsetting incremental vehicle cost. Use a commensurate percentage of Cap and Trade auction revenues to invest in heavy-duty transportation greenhouse gas reduction projects, specifically assisting with the buy-down incremental cost of purchasing new alternative fuel vehicle technologies.
    - Early adopters should also be provided incentives associated with risks, not just up-front capital costs.
    - Higher-value incentives should be provided for projects that include fueling infrastructure along with new vehicle technology purchases.
- Consider CARB certification of proven dual-fuel conversion kits for diesel engines so that a lower cost option is available to smaller firms during the transition to alternative fuels.

Conclusion:

Overall, private heavy-duty vehicle operators expressed ongoing frustration with the state as they are incurring increasing operation and maintenance costs in order to comply with new regulations. They also do not feel they have a voice at the state level during emissions reductions policy discussions. Given that the heavy-duty trucking industry is responsible for both a large portion of the state's greenhouse gas emissions (20%) and provides the vast majority of transportation services for the products grown and manufactured in CA, it is imperative that the state involve industry stakeholders of all sizes in the implementation of new regulations that will shift the transportation industry to the use of low-carbon fuels and vehicle technologies.

The overarching issues expressed through meeting with stakeholders from the trucking industry are summarized in the California Trucking Association' s report on "Delivering Sustainable Freight; Infrastructure, Economy and the Environment"[23] which states:

> "Trucking is currently the #1 most utilized freight mode in California, moving 82% of all goods (by weight) with more than 80 percent of all communities depending

[23] http://www.caltrux.org/uploads/4/0/1/9/40197121/delivering_sustainable_freight_fall_2013.pdf

> solely on trucks for delivery of goods and commodities. The Federal Highway Administration has predicted a 92.5% growth in freight demand from 2002-2035. Because of this anticipated growth, demand for all commercial freight modes (truck, ship, rail) will increase, with the expectation that trucking will continue to have the most dominate share of the activity.
>
> However, California's trucking industry is at a crossroads of regulatory burdens, added costs, labor concerns, and crumbling infrastructure. The entire industry is changing at a rapid pace with new industry practices taking hold. After the deregulation of the industry during the 1980's, the barrier for entering the trucking marketplace was dramatically lowered. The end result was the dramatic boom of micro trucking firms operating in California across all segments of the industry. However, due to a number of factors, most notably California's air quality regulations, these micro firms are increasingly finding it difficult to operate in today's business environment. As a result, trucking in California is undergoing a consolidation of operations and activity."

The report goes on to state that in 2013 over half of the CA trucking industry was made up of these same micro trucking firms that are currently going out of business. This has the potential to dramatically reduce transportation services in CA in the short term, and reduce overall transportation service coverage and capacity for growth in the long run. Furthermore, currently small business owners are able to earn more as a business owner than as a truck driver for another firm; representing a potential for reduced economic flows in the state and local communities as these businesses close. The impacts of the reduction in transportation services will be further complicated by the state's continued shortage of qualified drivers and the predicted growth of the agriculture sector. Maintaining a diversity and depth of low-carbon heavy-duty transportation services will be essential for maintaining the state's recovering economy, and will require broad stakeholder input, and consideration of (and mitigation for) the disparate impacts of emissions regulations on small and medium sized heavy-duty vehicle fleet operators.

5. NEXT STEP: ESTABLISH A CLEAN CITIES COALITION

The project team that lead the development of this plan identified the opportunity to leverage the framework and resources of the U.S. Department of Energy's Clean Cities Program to move forward with alternative fuels readiness efforts in the region. Interest in becoming part of the Clean Cities Program was a result of the cohesiveness and interest of the core stakeholders who participated in the planning work. As such, one of the key next steps identified is to establish a formal coalition to access the technical and programmatic support of the Clean Cities Program, and formalize the implementation of the mission presented in this plan. A Clean Cities Coalition can help the region realize the following outcomes:

- Create a regional resource and point of contact to support community stakeholders;
- Advocate for a regional approach through coordination across regional players when planning for new fuels infrastructure, thereby avoiding duplicative efforts and facilitating myriad regional entities to find areas of overlapping interest and need;
- Position the region to respond to alternative fuels funding solicitations to help bring funds to our area. By forming a coalition, the region can coordinate on funding applications, leverage purchasing power, and align readiness plans to create more value as a larger, regional entity;
- Reduce petroleum use by establishing and implementing regional targets, and securing funding to meet the region's share of the state's low-carbon and renewable fuels mandates;

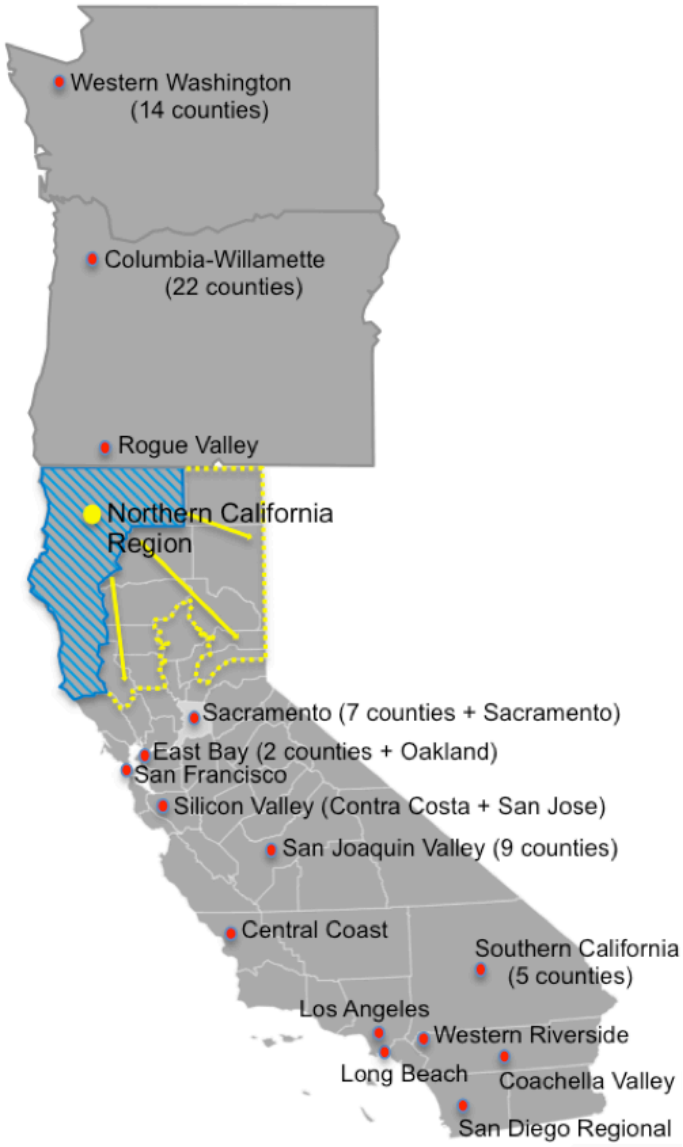


Figure 7: Proposed coalition region (shaded) and potential expansion region (dotted line). Existing coalitions also shown.

The Clean Cities Program mission aligns well with the goals of the Northwest California Alternative Fuels Readiness Project, and the tools and support available through Clean Cities will add significant impact and effectiveness to regional efforts to accelerate the use of alternative fuels. To that end this readiness plan has been structured to both capture the strategic planning outcomes of the Northwest California Alternative Fuels Readiness, and meet the requirements of a regional Clean Cities Program Plan to allow designation as an official U.S. DOE Clean Cities Coalition. The following sections capture specific information related to the formation of a regional Coalition that is known at this time. Furthermore, a complete application and 3-year plan is in development as of the writing of this plan. The current status of this effort is available from any of the project partners listed in the beginning of this plan.

5.1. Coalition Structure

One or more coordinators are designated to oversee the day-to-day efforts of the coalition. One or more steering committees and/or working groups are also typically formed to help guide the efforts of the coordinator. The following describe this structure.

5.1.1. Coordinators

Due to the broad geographic dispersion encompassed by the Northern California Coalition as well as available bandwidth of core agencies, two coordinator positions have been identified: one inland coordinator, and one coastal coordinator. As the coalition expands, it may be necessary to add a third coordinator to ensure that coordination, outreach, and technical assistance are available and relevant to all the geographic areas represented.

Ideally the coordinator positions will consist of part-time (~ 10 hours per week) paid staff funded through existing agency grants and funded directives that overlap with Coalition activities (e.g., meeting grant objectives related to outreach about alternative fuels and vehicle technologies, installation of fueling infrastructure, and working to streamline the EV charging infrastructure permitting process etc.). Paid and unpaid interns may be incorporated as needed to support Coalition activities.

Long-tern funding for the primary Coordinator positions will be sustained by the agencies that house them, as well as through grant funding acquired through member entities to support Coalition activities and programs. Currently, the California Energy Commission has shown a strong interest in funding low-carbon transportation initiatives. As the state takes steps to reduce carbon emissions past the 2020 timeline set in AB 32, funding for clean transportation programs will become an increasingly important part of the solution required to reach the goal of an 80% reduction below 1990 carbon emissions levels by the year 2050.

As of the writing of this report, the SCEDC has agreed be the fiscal host, and official home, of the Northern California Clean Cities Coalition, but will not represent the entire region in the coalition itself. SCEDC will handle grant reporting, reimbursements, and other financial matters related to operating the Coalition. The Coordinators will be responsible for communicating with the U.S. DOE through the annual questionnaire and generating quarterly Alternative Fuels Price Reports. Coordinators will also conduct Coalition stakeholder meetings, coordinate joint grant application efforts, assist with the development of a regional EV charging and renewable fuels network. Coordinators will be responsible for tracking relevant legislation, incentives, and grants and updating a Coalition website when new information emerges. Finally, Coordinators will provide outreach and analysis to help fleet operators and consumers make informed

decisions about fuel switching. Coordinators will report directly to the host agencies in which they are based, and to the Steering Committee during scheduled meetings.

Annual Coalition activities will be based on the direction and strategies set by the Coalition Steering Committee. Coalition Steering Committee meetings will be held 2-4 times per year as the Coalition gets established. An annual all-Coalition meeting will be held to provide stakeholders with an update on Coalition and accomplishments as well as discuss the next year's goals and activities. Coalition meeting frequency may be periodically adjusted to provide for maximum regional participation when grant proposal efforts or other collaborative projects are underway.

5.1.2. Steering Committee

The Steering Committee will ensure that Coalition members cooperate in completing the shared vision and goals, and ensure equality in decision-making amongst competing interests. It will be the responsibility of the Steering Committee to:

- Formalize Coalition operations;
- Secure ongoing funding;
- Champion projects and communicate achievements.

The Steering Committee will be made up of volunteer stakeholders representing the local air quality management districts, transportation planning agencies, local government agencies, fuels distributers and other regional stakeholders who are dedicated to diversifying the transportation fuel supply and increasing the use of clean vehicle technologies. The Steering Committee will consist of all-voluntary members until such time as the Committee consists of more than 20 members; at such time appointment to the Steering Committee will be made during any scheduled meeting by a simple majority vote of the active Coalition members.

The coalition will be housed within the SCEDC, a 501(c)(3) non-profit organization that promotes the overall economic development of Siskiyou County, and develops strategies that will result in the constructive, balanced economic growth of the broader region. The Coalition will have non-profit status as a nested component within SCEDC, and members will be able to support Coalition activities through tax-deductible donations.

5.1.3. Working Groups

Coalition working groups are small groups of stakeholders that focus on specific initiatives to achieve important Coalition goals. The working groups formed for this planning project are proposed to continue as active groups under the Coalition in order to advise activities. These working groups are the Strategic Planning Working Group, the Training Materials Working Group, and the Fuel Distributors Working Group. Furthermore, the Coalition will pursue the formation of a Fleet Working Group to advise engagement with fleet operators in the region.

5.2. Setting Goals, Seeking Commitment, and Monitoring Success

There are specific goals identified by the Clean Cities Program that coalitions must address. In order to meet these goals, the Coalition must seek commitments by stakeholders that work towards these goals. Furthermore, the Coalition should monitor success of commitments and progress towards goals on a regular basis, and revise as needed.

5.2.1. Coalition Goals

Guided by the targets specified in this plan, it is proposed that these goals be met in the following ways:

Goal 1 – Increase the number of BEV, HPEV, and hybrid vehicles on the roads by 2020

Meeting the region's target for a 10% reduction in transportation carbon intensity will require an increase in the number of battery electric, plug-in electric, and hybrid electric vehicles on the road each year. The proposed mix of AFVs needed to achieve this target can be seen in Table 4 above. The fuel pathway analysis described in Section 3.1 shows EVs as playing a primary and critical role in the light-duty clean transportation future for this region due to the market-readiness, cost, and low-carbon intensity of electricity. Increasing the use of EVs will also have the greatest impact on petroleum displacement and criteria pollutant emissions reductions. For the heavy-duty sector, increased use of renewable biofuels is seen as the best near term low-carbon fuel approach.

Goal 2 – Develop a coordinated network of AFV refueling and recharging stations across the region so that the "no fueling infrastructure" barrier to AFV uptake and use is eliminated.

Coalition members are actively working to develop EV charging infrastructure in their cities and counties. Coalition members will now coordinate these efforts to create a comprehensive refueling / recharging network by 2020.

Goal 3 – Recruit new stakeholders to form a cohesive Northern California Clean Cities Coalition.

The Coalition region has a variety of stakeholders well suited to collaboration in the regional alternative fuels development space. A full list of stakeholders to be recruited is included in Appendix Table 1 in Section H. Many of these stakeholders were participants in the AFRP project and have already demonstrated a strong interest in alternative fuels. Key stakeholders to be recruited include:

- Transportation commissions & community planning agencies
- Plug-in EV, and EV coordinating councils
- Non-motorized transportation groups such as: Willits Area Cyclists, alternative fuels groups, trails coalitions, walk-able communities groups, and livable neighborhoods programs
- Local renewable fuels producers such as the Mendocino Alcohol Fuels Group
- State and Federal agencies with local fleet operations
- Utilities: Redding Electric, Pacific Power, PG&E, Ukiah City Utilities etc.
- Tribes and Rancherias
- Universities, community colleges, and automotive technology programs
- Public fleet operators: Cities, Counties, and Community Services Districts
- Private fleet operators: trucking, ambulance services, parcel delivery, waste management, and internet service providers etc.
- Police, Sheriff, and Fire departments
- Automobile dealerships
- Automotive parts suppliers
- Local businesses with sustainability plans that include transportation goals
- Gas station owners

Goal 4 – Develop and promote incentives to increase the use of alternative fuels and promote other petroleum reduction programs such as idle reduction, and fuel economy improvement.

The Coalition will promote all available alternative fuel vehicle incentives and seek to reduce petroleum fuel use through promoting fleet fuel efficiency measures.

Goal 5 – Communicate the Benefits of Alternative Fuels to the public.

General public purchase and use of low-carbon vehicle technologies is a critical component to establishing a local alternative fuels market as well as achieving the AFRP 2020 emissions reduction targets. The expected outcome of this effort is an increase in BEV, PHEV, and hybrid vehicle sales and an increase in demand for renewable fuels once they become available. The Coalition strategy for communicating with the general public will be to act as an informational clearinghouse and conduct outreach about AFV availability, benefits, and performance.

Goal 6 – Achieve Coalition financial sustainability.

Ongoing financial stability is a priority for the Coalition as it directly ties into the Coalition's ability to accelerate the adoption of alternative fuels. Currently funded projects will be leveraged in the near term. In the long term the Coalition will review potential grant opportunities on an on-going basis and work towards developing potential regionally sustained funding sources such as membership fees or the like.

Goal 7 – Educate policymakers about the benefits of the Clean Cities portfolio of technologies and provide recommendations to streamline the permitting process for AF infrastructure.

Regional policymakers have the ability to change or adapt local zoning codes and permitting processes to ease the transition towards a clean transportation future. Conducting outreach to local policy makers about the benefits of alternative fuels and advanced vehicle technologies is a key part of achieving widespread, near-term adoption of alternative fuels.

Goal 8 – Identify funding opportunities to provide training for first responders, mechanics and educational institutions.

There is a need for on-site and regionally available training for first responders, mechanics, and fleet operators. The Coalition can help the region prepare for the increase in AFVs and AF use by organizing regional trainings for these AF support groups. The Coalition will leverage the Training Materials Working Group to help guide these efforts.

5.2.2. Potential Stakeholder Commitments

The number of potential commitments that the coalition could seek from stakeholders is nearly infinite. Development of commitments should first be guided by specific stakeholder needs, and then constructed with a specific clear target that can be reasonably attained by stakeholders within a realistic timeline. The Coalition should leverage the Steering Committee and Working Groups in order to ensure stakeholders have a voice in the development of commitments that the Coalition will solicit.

5.2.3. Proposed Monitoring Program

It is proposed that progress toward achieving the Coalition's goals will be monitored by the Coordinators on a monthly basis, by responsible Working Groups on a quarterly basis, and by

the Steering Committee on an annual basis. Monitoring progress will require that the Coalition Working Groups and the Steering Committee establish anticipated outcomes and milestones associated with each goal. Final methods for measuring success will be based on these determinations, and will likely include the following metrics:

Goal 1: Success will be measured by the documented increase in the number of alternative fuel vehicles registered in the region and in the number of Coalition AFV purchases.

Goal 2: Success will be measured by the development of a coordinated EV recharging infrastructure plan, the number of new public EV charging stations installed each year, and the number of fueling stations supplying renewable fuels. Success will further be measured by the closing of identified gaps in regional coverage.

Goal 3: Success will be measured by the number of stakeholders contacted, the number of stakeholder surveys conducted, and the number of new stakeholders recruited to join the Coalition.

Goal 4: Success will be measured by website analytics that measure the number of "hits" on the incentives list on the Coalition website, the number of incentives / idle reduction / fuel economy savings outreach conversations held, and lastly the measured results of the Mendocino County GPS fleet fuel economy / safety improvement Pilot.

Goal 5: Success will be measured by the number of AF outreach events held, website analytics showing the number of "hits" and downloads of online outreach materials, the number of Toolkits disseminated, requests for information, and types of target audiences reached.

Goal 6: Success will be managed by establishing a plan to maintain Coalition financial sustainability.

Goal 7: Success will be measured by the number of AFs conversations held with regional policymakers, and by the number of recommended permitting "best practices" employed and rulemaking outcomes.

Goal 8: Success will be measured by the acquisition of funding to hold regional AF trainings for first responders, mechanics and fleet operators.

Other examples of metrics for measuring general Coalition success include:

- Fleet fuel conversion analyses completed;
- Stakeholder commitments acquired;
- Greenhouse gas emissions reductions achieved by Coalition member activities.

5.3. Funding and Sustainability

Funding the Coordinator position and Coalition activities and initiatives to sustain efforts for three to five years and beyond may come from several avenues. Other Coalitions in California have opted to become non-profit organizations run entirely by volunteers; recruit sustaining partners; solicit sponsorships; or be incorporated into local government departments. The type of available Federal and State funding that has been identified will require the organization to

be part of or in partnership with a local government agency. A local government agency will have the option of pursuing both public and private sector partnerships and donations as well.

5.3.1. Current Funding

Core project partners have multiple active programs that align well with Clean Cities Program goals and can be leveraged to provide initial funding to launch a coalition. Some additional work will be required to achieve specific DOE goals and reporting requirements, which can be funded through RCEA general funds in a limited capacity.

- CEC #ARV-13-029: Development of Electric Vehicle Charging Infrastructure
  - Project Region: Humboldt County.
  - Grant scope: Analyze EVCS ongoing cost / fuel pricing, develop 10% engineering design for EVCSs, and conduct an EV charging equipment market assessment.
  - Agencies Involved: RCEA
  - Project timeframe: Mar 2014- current (ending in Dec 2017)
- CEC #ARV-14-046: PEV Readiness Plan Implementation
  - Project Region: Humboldt, Del Norte, and Trinity counties.
  - Grant scope: Conduct outreach to the community including EV ride and drive and expo events and web-based promotion of PEV information.
  - Agencies Involved: RCEA
  - Project timeframe: Jul 2015- current (ending in Dec 2017)
- CEC #ARV-13-029: Electric Vehicle Charging Infrastructure
  - Project Region: Humboldt County.
  - Project Scope: Provide data and information to support the development of EV charging infrastructure including a charging management policy, and data on job creation, economic development and increased state revenues expected from future EVCS expansion.
  - Agencies Involved: RCEA
  - Project timeframe: Jul 2014- current (ending in Dec 2017)
- CEC #ARV-14-046: PEV Readiness Plan Implementation
  - Project Region: Humboldt, Del Norte, and Trinity counties.
  - Grant scope: Develop an EVCS installation guide and contractor checklist, produce 30-40 10% engineering designs and cost estimates for EVCS installation, install wayfinding signage, and engage with municipalities to streamline the EVCS permitting process.
  - Agencies Involved: RCEA, SERC
  - Project timeframe: Jul 2015- current (ending in Dec 2017)
- CEC #ARV-14-055: North Coast and Upstate Fuel Cell Vehicle Readiness Project
  - Project Region: Del Norte, Glenn, Humboldt, Lake, Mendocino, Shasta, Siskiyou, Tehama, and Trinity counties.
  - Grant scope includes: identify infrastructure required for intra- and inter-regional hydrogen fueled transportation, conduct a micro-siting evaluation for two (2) sites, and conduct fleet vehicle assessments for fleet operators interested in FCEV fleet replacement.
  - Agencies Involved: RCEA, SERC, NCUAQMD, SCEDC, TCAPCD, GCPCD, MCAQMD, LCAQMD
  - Project timeframe: Jul 2015- current (ending in Mar 2019)
- CEC # ARV-14-058: Plug-In Electric Vehicle Readiness Plan Implementation
  - Project Region: Siskiyou, Shasta, Tehama, Glenn, and Colusa counties

    - Grant scope: Develop a PEV infrastructure deployment plan, produce 10% engineering designs and cost estimates for 10 – 20 EVCS installations, estimate GHG reduction potential from PEV adoption, conduct outreach to regional jurisdictions on streamlined EVCS permitting opportunities, conduct outreach to promote PEV awareness, and develop a PEV readiness plan.
    - Agencies Involved: SCEDC, SERC, City of Mount Shasta
    - Project timeframe: 2015 – current (ending Q4 2017)
- Redwood Coast Energy Watch – Strategic Energy Resources
    - Project Region: Humboldt county
    - Grant Scope: RCEA partners with one of our regional utilities, Pacific Gas and Electric Company, to implement energy efficiency programs annually through the Redwood Coast Energy Watch program. The Energy Watch program also provides a range of planning and technical assistance to local governments and tribes with a focus on the nexus of climate and energy. With the passage of California Senate Bill 350, requiring electric utilities to invest in EV charging infrastructure and support EV adoption, there will likely be additional focus on electrifying the transportation sector in the near future, and working with local government partners to implement state goals.
    - Agencies Involved: RCEA
    - Project timeframe: On-going, program funding re-assessed bi-annually.

5.3.2. Other Potential Future Funding Sources

California Energy Commission: RCEA is looking to secure additional grants for the implementation of PEV readiness planning specifically related to level 2 and level 3 electric vehicle charging. The Northwest California region includes several key transportation corridors including Highway 101 and Interstate 5. These two corridors carry the vast majority of road travel between California and the greater northwest United States, and the California Energy Commission (CEC) is methodically releasing grant funds to build out charging infrastructure along major and interregional corridors.

Caltrans, Sustainable Transportation Planning Grants: Caltrans provides funding for projects that focus on Strategic Partnerships, transportation planning, and studies of interregional significance in partnership with Caltrans. RCEA is in ongoing dialog with Caltrans District 1, based in Eureka CA, to seek collaborative opportunities to promote and advance sustainable transportation in our overlapping territories.

North Coast Resource Partnership / Strategic Growth Council, Continued Regional Analysis and Planning: Contracts for specific scopes of work related to energy independence, climate change mitigation, and model policy development will continue to be awarded to support the development of a regional strategic plan.

California Cap and Trade: This program is a potential source of extensive funding in the transportation sector. As outlined in 2015-16 May revision of the Cap and Trade Expenditure Plan, the Governor's Executive Order B-30-15 established a GHG reduction target of 40% below 1990 levels by 2030. One of the Administrative policies to achieve this target is to "Reduce petroleum use in cars and trucks by up to 50 percent." The May Revision further states that "increased proceeds result in a total of $1.6 billion for clean transportation, mass transit and sustainable community development." The most realistic investment category for us to pursue is "Low Carbon Transportation", managed by the Air Resource Board. It will take

time for these relatively new funding streams to propagate through the state, but may prove to be an essential recurring source of funds.

5.4. Outreach and Education

The goal of the Coalition's outreach and education activities is to communicate the benefits of alternative fuels to public and private fleet operators, policymakers, and the general public so that they will engage with Coalition initiatives to increase the availability and use of AFVs. Key components of this outreach will be to provide information on the currently available AFV technologies, incentive programs, fueling station locations, and emissions and cost savings that can be achieved through fuel switching. Avenues for conducting outreach include: presentations, websites, newsletters, working groups, industry meetings, conferences, tabling, radio, public service announcements, and "earned media" (e.g., news stories).

The general outreach strategy will involve four main steps:

1) Elicit Positive Reactions: Create and/or gather materials and tools that are visually appealing, easy to understand and use, impressive, and accurate. Present them in a way that motivates recipients to act, such as relaying a high probability of future satisfaction, easy to implement next steps, or a measurable payoff.
2) Educate to Change Attitudes: Address popular myths, provide outside and unbiased resources, and update information to reflect the latest science. Use this information to engage recipients to be champions for their organizations, thereby increasing their knowledge and skills through educating others.
3) Assist in Changing Behaviors: Decision-makers will be able to use the new information and consider alternative fuel options, change practices, and/or initiate new policies to guide future practices. The Coalition will be a resource to facilitate actions.
4) Publicize Results: Ultimately, long term changes and community-level impacts of the Coalition's efforts will include new policies to promote increased adoption of alternative fuels, more local alternative fuels choices, fleet adoption, and reduced greenhouse gas emissions. Publicizing these accomplishments will attract new stakeholders, reinvigorate efforts, and begin the four-step process all over again.

The Coalition's target audience includes:

- Fleet Managers: High-priority decisions makers and fleet operators in all sectors.
- Fuel Distributors: This group includes combustible fuel distributors, as well as electric utilities and vehicle charging networks.
- Dealerships: Vehicle sales representatives.
- Government Agencies: Including councils and committees affecting policy decisions.
- General Public: This audience includes consumers, business owners, academic institutions, and non-governmental organizations.
- Support Services: Emergency services/first responders and auto industry services.

Initial efforts will be followed up with impact analysis where possible (e.g., with use of Google analytics for web-based outreach), and refined and repeated to new audiences. The Coalition does not currently have an established newsletter, Facebook page or Twitter following. The Coalition does have an Alternative Fuels webpage containing the AFRP and other useful AF information housed on the RCEA website: http://www.redwoodenergy.org/transportation/alternative-fuels.

It is anticipated that the new Coalition Coordinators will establish a periodic newsletter to highlight Coalition member successes, progress towards goals, and emphasize the benefits of reduced petroleum consumption. This newsletter will be released 2-4 times annually, and will then be archived and available on the Coalition website. The website will be updated annually to maintain current information pertaining to vehicles on the market, regional fueling and recharging station availability, and available incentives. The Coalition will use in-person outreach events such as presentations, tabling, and radio interviews as well as digital outreach such as newsletters and the website to build interest and support for Coalition activities.

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