

Toolkit Development

October 15, 2015

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Center for
Sustainable Energy™

How did we get here?

2009
SANDAG
Regional
Alternative
Fuels,
Vehicles, and
Infrastructure
Report



Fall 2014
Kick-off of
Alternative
Fuel
Readiness
Project

Spring 2015
Development
of San Diego
Alternative
Fuel
Assessment



Summer 2015
Development
of Alternative
Fuel Toolkits

2011-2013
Plug-in
Electric
Vehicle
Planning/R
EVI



Fall 2014
Creation
of Refuel

refuel

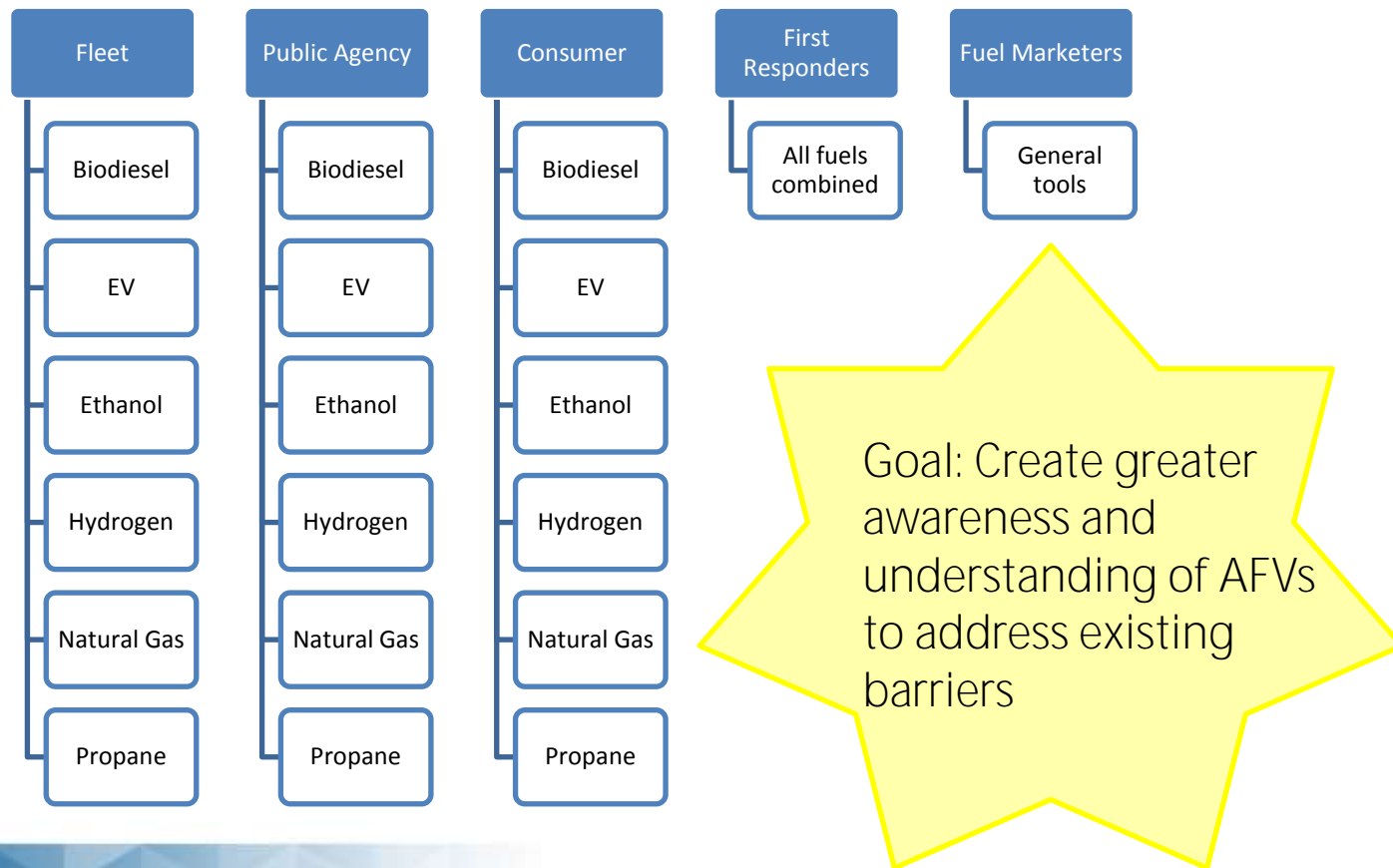


July 2015
Kick-off of
Plug-in SD



What is a toolkit?

Wants to inform select audiences about alternative fuel vehicles and infrastructure



Toolkits: A Glance

refuel



Alternative Fuels for Public Agencies

This toolkit was developed as part of the San Diego Regional Alternative Fuel Readiness Plan with support from the San Diego Regional Alternative Fuel Coordinating Council (Refuel), which seeks to reduce barriers to alternative fuel adoption in the region.

As California works toward achieving its ambitious climate goals, transitioning from gasoline and diesel vehicles into alternative fuel vehicles is an important facet in lowering greenhouse gas emissions (GHG).

In the San Diego region, several public agencies and municipalities are taking the lead in developing strategies and goals to include alternative fuel vehicles into their policies. Many jurisdictions have noted alternative fuels as a key substitute to conventional fuels in their Climate Action Plan (CAP) or other planning or fleet management policy document.

Among the several planning documents available and developed by jurisdictions, there are key strategies that are prevalent among them all, including:

- Increasing the number of alternative fuel stations available for the public
- Increasing the number of alternative fuel vehicles in government fleets
- Streamlining permitting for alternative fuel infrastructure

How do I use this toolkit?

This toolkit provides resources that public agencies have identified as being desirable for further training and assistance in the transition into alternative fuel vehicles. This includes:

- Guidance on availability of funding for alternative fuel vehicles and infrastructure installation projects;
- Case studies of jurisdictions or private fleets that use alternative fuels; and
- Fact sheets or reference guides on general information about alternative fuels.

- Replacing vehicles in government and contractors' fleets with alternative fuel vehicles

Biodiesel

What is biodiesel?

Biodiesel is a renewable, non-toxic, and safe for handling. It is a carbon-neutral public fuel that can be used in existing diesel engines without modification. It is made from renewable resources like soybeans and can be used in any diesel engine.

Advantages:

- Renewable and sustainable
- Reduces greenhouse gas emissions
- Biodegradable and non-toxic
- Improves engine performance
- Reduces particulate emissions

Energy	130.0
CO2	80.0
GHG	80.0
Water	10.0

Electric Vehicles

What is a PEV?

PEV stands for Plug-in Electric Vehicle. It is a vehicle that can be driven on electricity and has a gas engine as a backup. It is a zero-emission vehicle when driven on electricity.

Advantages:

- Zero tailpipe emissions
- Lower operating costs
- Quieter operation
- Lower maintenance costs

Energy	33.7
CO2	0.0
GHG	0.0
Water	0.0

E85/Flex-Fuel

What is E85?

E85 is a blend of 85% ethanol and 15% gasoline. It is a renewable fuel that can be used in vehicles designed for E85 or flex-fuel vehicles.

Advantages:

- Renewable and sustainable
- Lower operating costs
- Lower GHG emissions

Energy	90.0
CO2	80.0
GHG	80.0
Water	10.0

Hydrogen Fuel Cells

What is hydrogen?

Hydrogen is a clean, renewable energy source that can be used in fuel cells to generate electricity. It is a zero-emission fuel when used in a fuel cell.

Advantages:

- Zero tailpipe emissions
- High energy density
- Renewable and sustainable

Energy	120.0
CO2	0.0
GHG	0.0
Water	0.0

Natural Gas

What is natural gas?

Natural gas is a clean-burning fossil fuel that can be used in vehicles designed for natural gas. It is a lower-carbon fuel compared to gasoline and diesel.

Advantages:

- Lower operating costs
- Lower GHG emissions
- Lower maintenance costs

Energy	115.0
CO2	80.0
GHG	80.0
Water	10.0

Propane Autogas

What is propane autogas?

Propane autogas is a clean-burning fossil fuel that can be used in vehicles designed for propane autogas. It is a lower-carbon fuel compared to gasoline and diesel.

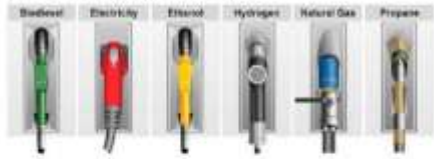
Advantages:

- Lower operating costs
- Lower GHG emissions
- Lower maintenance costs

Energy	115.0
CO2	80.0
GHG	80.0
Water	10.0

Toolkits: A Glance

refuel



Alternative Fuels for Fleets

This toolkit was developed as part of the San Diego Regional Alternative Fuel Readiness Plan with support from the San Diego Regional Alternative Fuel Coordinating Council (Refuel), which seeks to reduce barriers to alternative fuel adoption in the region.

What is the value of alternative fuels?

Alternative fuel vehicles offer long-time cost savings and can have the same performance quality of conventional vehicles, but without the air pollution that comes with them.

Policies for the acquisition of alternative fuel vehicles may already be in your organization's larger long-term energy or Climate Action Plan. A majority of municipalities and public agencies throughout the San Diego region have already referenced the increased procurement of alternative fuel vehicles as a way to reduce

greenhouse gas (GHG) emissions and to support the State's climate goals.

Not only are local governments thinking about alternative fuels, there are several state-level policies and strategies that promote the increased use of them.

How do I use this toolkit?

This toolkit includes resources identified by fleet managers for further training and assistance in the transition to alternative fuel vehicles. This includes the following resources:

- Guidance on the available funding for alternative fuel vehicles and infrastructure installation projects
- Fact sheets or reference guides on general information about alternative fuels
- Case studies of fleets that use alternative fuel



Biodiesel

What is biodiesel?

Biodiesel is a non-petroleum-based diesel fuel made from vegetable oil, animal waste, or algae in a process called transesterification. It is a renewable and biodegradable fuel that can be used in diesel engines without modification. Biodiesel is made from a variety of feedstocks, including soybean oil, rapeseed oil, and animal waste. It is a clean-burning fuel that produces fewer greenhouse gas emissions than petroleum-based diesel.

- Biodiesel is a renewable, biodegradable, and safe for handling.
- Biodiesel is produced from a variety of feedstocks, including soybean oil, rapeseed oil, and animal waste.
- Biodiesel can be used in diesel engines without modification.
- Biodiesel produces fewer greenhouse gas emissions than petroleum-based diesel.
- Biodiesel is a clean-burning fuel that is safe for handling.



Electric Vehicles

What is a PEV?

A plug-in electric vehicle (PEV) is a vehicle that can be charged from an external power source. PEVs can be used as a primary mode of transport or as a secondary mode for short trips. They are powered by a battery pack and can be charged at a charging station. PEVs produce zero tailpipe emissions and are quieter than internal combustion engines.

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E85/Flex-Fuel

What is E85?

E85 is a blend of 85% ethanol and 15% gasoline. It is a renewable fuel that can be used in vehicles designed for E85 or Flex-Fuel. E85 has a higher octane rating than gasoline and can improve engine performance. It is a clean-burning fuel that produces fewer greenhouse gas emissions than gasoline.

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- E85 has a higher octane rating than gasoline and can improve engine performance.
- E85 is a clean-burning fuel that produces fewer greenhouse gas emissions than gasoline.



Hydrogen Fuel Cells

What is hydrogen?

Hydrogen is a clean-burning fuel that can be used in fuel cell vehicles. It is produced from water and electricity through a process called electrolysis. Hydrogen fuel cell vehicles produce electricity on-board to power the motor. They produce only water vapor as a byproduct. Hydrogen is a renewable fuel that can be used in a variety of applications.

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- Hydrogen fuel cell vehicles produce electricity on-board to power the motor.
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- Hydrogen is a renewable fuel that can be used in a variety of applications.



Natural Gas

What is natural gas?

Natural gas is a clean-burning fuel that can be used in vehicles. It is produced from fossil fuels and is a major source of energy. Natural gas vehicles produce fewer greenhouse gas emissions than gasoline. They are a clean-burning fuel that is safe for handling.

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- Natural gas vehicles produce fewer greenhouse gas emissions than gasoline.
- Natural gas is a major source of energy.
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Propane Autogas

What is propane autogas?

Propane autogas is a clean-burning fuel that can be used in vehicles. It is produced from natural gas and is a major source of energy. Propane autogas vehicles produce fewer greenhouse gas emissions than gasoline. They are a clean-burning fuel that is safe for handling.

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Toolkits: A Glance

refuel



Alternative Fuels for Consumers

This toolkit was developed as part of the San Diego Regional Alternative Fuel Readiness Plan with support from the San Diego Regional Alternative Fuel Coordinating Council (Refuel), which seeks to reduce barriers to alternative fuel adoption in the region.

As California works toward achieving its ambitious climate goals, transitioning from gasoline and diesel vehicles into alternative fuel vehicles is an important facet in lowering greenhouse gas emissions (GHG).

Alongside public agencies, consumers can also begin to empower themselves with more knowledge about alternative fuel vehicles. This may encourage consumers to make more well-informed choices in their next vehicle purchase.

Driving an alternative fuel vehicle often has the following benefits:

- Cost savings
- Protection against petroleum price volatility and supply uncertainty
- Reduction of greenhouse gas emissions
- Improves local air quality

- Decreased reliance on foreign oil sources

How do I use this toolkit?

This toolkit provides resources and general information about alternative fuel vehicles for consumers. Within this toolkit, six different alternative fuels are discussed, detailing fuel-specific information such as:

- Guidance on availability of funding for alternative fuel vehicle purchases;
- Maps of public infrastructure locations;
- Diagrams of how an alternative fuel vehicle works;
- Fuel savings comparisons.



Biodiesel

What is biodiesel?

Biodiesel is a renewable diesel alternative to petroleum-based diesel. It is made from vegetable oils, animal fats, and recycled cooking greases. Biodiesel is a clean-burning, biodegradable diesel fuel that can be used in any diesel engine without modification.

Year	Price per gallon
2010	\$3.14
2011	\$3.16
2012	\$3.16
2013	\$3.16



Electric Vehicles

What is a PEV?

A plug-in electric vehicle (PEV) is a vehicle that can be charged from an external power source. PEVs can be used as a regular car or as a taxi. They are more expensive than regular cars but have lower operating costs.

Year	Price per kWh
2010	\$0.12
2011	\$0.12
2012	\$0.12
2013	\$0.12



E85/Flex-Fuel

What is E85?

E85 is a blend of 85% ethanol and 15% gasoline. It is a renewable fuel that can be used in any gasoline engine. It has a lower carbon footprint than gasoline.

Year	Price per gallon
2010	\$2.15
2011	\$2.15
2012	\$2.15
2013	\$2.15



Hydrogen Fuel Cells

What is hydrogen?

Hydrogen is a clean-burning fuel that can be used in a fuel cell to generate electricity. It is made from water and natural gas. It has a lower carbon footprint than gasoline.

Year	Price per gallon
2010	\$1.15
2011	\$1.15
2012	\$1.15
2013	\$1.15



Natural Gas

What is natural gas?

Natural gas is a clean-burning fuel that can be used in a vehicle. It is made from natural gas. It has a lower carbon footprint than gasoline.

Year	Price per gallon
2010	\$1.15
2011	\$1.15
2012	\$1.15
2013	\$1.15



Propane Autogas

What is propane autogas?

Propane autogas is a clean-burning fuel that can be used in a vehicle. It is made from natural gas. It has a lower carbon footprint than gasoline.

Year	Price per gallon
2010	\$1.15
2011	\$1.15
2012	\$1.15
2013	\$1.15

Toolkits: A Glance

FUEL MARKETERS AND RETAILERS



Fuel Marketers and Retailers

Why Alternative Fuels?

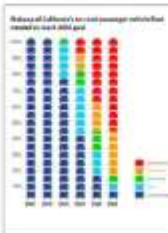
Alternative fuels are growing in use in California to meet the Governor's state goals.¹ In 2014, there were over 40,000 alternative fuel vehicles in the San Diego region alone. Further, there are over 3,700 fueling stations in California that offer alternative fueling options.

Alternative fuels include biodiesel (B20), compressed natural gas (CNG), ethanol (E85), electricity, hydrogen, and propane autogas (propane). They serve as more cost-effective and cleaner-burning options to conventional diesel or gasoline fuel. They also perform just as well as any conventional vehicle.

Installing alternative fuel infrastructure may not only increase the throughput of your fueling station, but it can also signal your

commitment to the environment.

The state's commitment to alternative fuel includes several federal and state laws² and policies that signal the increase in alternative fuel use (below).



Federal Resources for Fuel Retailers:

The California Energy Commission offers grant opportunities to fund the development of a variety of alternative fuel infrastructure. Visit <http://www.energy.ca.gov/tech/infrastructure> to stay up-to-date with their activity.

Learn more about alternative fuels at the Department of Energy's Alternative Fuel Data Center (AFDC): <http://www.afdc.energy.gov/>

Fuel Marketers and Retailers 1

FUEL MARKETERS AND RETAILERS

Propane

Before adding propane autogas to your retail fuel site, consider the following tips:

- Aboveground propane autogas tanks must be separated by at least 15 feet from tanks that dispense liquid or gaseous motor fuels.
- Market the availability of propane autogas by using the tools found here: <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.
- Learn basic information about propane autogas as well as a discussion about the barriers to greater propane autogas adoption and solutions to these barriers: <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.
- Ensure you have fuel to safely use and maintain propane equipment: <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.



E85

Consider the following tips:

- How much E85 are other stations selling?
- Can you access low-cost E85 that is sold by a regional blender?
- Do you have a mid-grade tank or a regular unleaded tank that can be converted?
- What is the estimated throughput for the E85 station?
- What incentives are available for the installation?
- Are gasoline or diesel sales are low? E85 may be a better selling item.

This information and more is found, "The AFDC offers a study that creates a business case for selling the fuel": <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.

Visit www.afdc.energy.gov/ to download Fuel of Purchase materials like customer signs (multiple sizes) and nozzle banners, as well as learn more about how to market E85 at your site.

Biodiesel

To market and sell Biodiesel, obtaining BQ (Biodiesel Quality) is the best way to show your product is manufactured at the industry standard, ASTM D675 and also helps promote public acceptance of biodiesel. Learn more about the accreditation at www.bq.org.

As a biodiesel retailer, remember the key points:

- Biodiesel blends will work in any diesel engine without the need for modifications.
- B100 provides similar horsepower, torque, and mileage as diesel.

The Department of Energy has developed Handing and Use Guidelines for Biodiesel that is found here: <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.



FUEL MARKETERS AND RETAILERS

CNG

When preparing to open a CNG station, consider the following points:

- Will you own the station?
- What type of fuel delivery service will you offer: tank-fill, fast-fill, or a combination?
- Who will maintain and operate the station?
- Who can access the station (public, private)?
- How will the station be funded, and how to charge for fuel?

All of this is addressed in NGV Association's guide on CNG Station Business Models: <http://www.ngva.com/cng-station-business-models/>.



<http://www.ngva.com/cng-station-business-models/>

Hydrogen

Hydrogen fueling can typically be added to an existing fueling station, even those gasoline or natural gas. Hydrogen fueling equipment includes a dispenser, storage tanks, and a compressor. There are basic guidelines to add hydrogen to your station:

- **Redetermine your eligibility** – Visit the Alternative Fuel Data Center to ensure that your space can accommodate the infrastructure: <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.
- **Location location** – ensure that your proposed station location is within a region that has been prioritized by the California Fuel Map³ to increase your chances of receiving government funding.
- **Partner with an experienced company**.
- **Read more about hydrogen** – before installing the infrastructure, make sure you understand the basics: <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.

EV Charging

To host EV charging stations at your site, consider the following:

- **Availability of power** – Can the site's electric panel support the addition of EVSE? If not, is it easily upgradeable? Is it close to a transformer if new service is needed?
- **Landscaping** – How far are the potential EVCS spots from the electric panel? Does the site require extensive landscaping? (Landscaping costs increase when significant trenching is required.)
- **Environmental concerns** – Will the EVCS cause environmental harm to the site?
- **Access** – Will an EV charging station be able to access the charging station safely?
- **Payment** – Will you require a fee for an EV driver to access the charging station?
- **Partners** – Hosts may either obtain and operate all EV charging stations on their own, or work together with an electric vehicle service provider (EVSP) who will maintain and operate the stations on behalf of the host.

More details about being an EVCS host can be found on the Clean Cities Guide: <http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>.

<http://www.afdc.energy.gov/infrastructure/2014/03/13/PropaneChecklist>

Toolkits: A Glance

First Responder



First Responder

This toolkit was developed as part of the San Diego Regional Alternative Fuel Readiness Plan with support from the San Diego Regional Alternative Fuel Coordinating Council (RAFC), which seeks to reduce barriers to alternative fuel education in the region. Emergency personnel are one of the sectors for which a toolkit has been developed. Alternative fuel vehicles (AFVs) are becoming more prevalent in the San Diego region.

There has been a big growth of alternative fuel vehicles in the San Diego region. Each year, more and more light-duty AFVs are being purchased in the region, especially in the electric vehicle (EV) space. As of September 2015, there are upwards of 12,500 electric vehicles on San Diego's roads. The chart below shows the growth of AFV use in the United States.

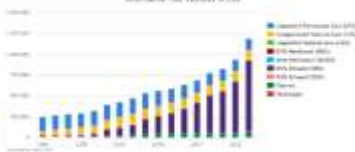
How do I use this tool kit?

This toolkit provides resources and guidance that inform emergency personnel about available training and educational material and events for traveling alternative fuel vehicles.

Though the resources provided in this toolkit, first responders and emergency personnel should be able to find the appropriate content and information in order to:

1. Familiarize themselves with alternative fuels
2. Understand potential hazards unique to individual alternative fuels
3. Safely respond to an incident in which an alternative fuel is present

Alternative Fuel Vehicles in Use



Source: Electric Power Information Administration, alternative fuel vehicle data. <http://www.eia.doe.gov/data.cfm>

First Responder's

Why Emergency Personnel Training?

With an growing number of alternative fuel vehicles on the road today, it is essential that emergency responders have the information they require to respond to accidents involving AFV or being trapped. First responders already face significant challenges, which is why emergency personnel are required to have a vehicle emergency kit in the event of an emergency situation.

Benefits for Training

With training completed, the department can provide support to their emergency calls and maintain safety, being better able and prepared for additional vehicle-related training opportunities.

- Training and support facilities
- Staff scheduling and training programs
- Cost of training for conversion of alternative technology
- Labor integration of AFV training resources

What Training Resources are Available?

Web page with information and training opportunities for Alternative Fuel and Electric Vehicle Emergency Responders

Alternative Fuel Vehicle Emergency Responders

With a dedicated emergency responder training program, the Emergency Responders Institute provides a comprehensive training program for emergency responders, including information on alternative fuel vehicles, electric vehicles, and compressed natural gas vehicles. The program includes a comprehensive curriculum and a certification process.

www.emergencyrespondersinstitute.com

Participants will receive a certificate of completion upon successful completion of the training program.



First Responder's

AFV Readiness

The AFV Readiness Program is a comprehensive program designed to provide emergency responders with the knowledge and skills needed to safely respond to AFV incidents. The program includes a variety of training opportunities, including classroom instruction, hands-on training, and field exercises.

- **California Fire Training Program (CFTF)** - www.firetraining.org
 - CFTF provides emergency responders with the knowledge and skills needed to safely respond to AFV incidents.
 - CFTF offers a variety of training opportunities, including classroom instruction, hands-on training, and field exercises.
- **California Fire Training Program (CFTF)** - www.firetraining.org
 - CFTF provides emergency responders with the knowledge and skills needed to safely respond to AFV incidents.
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For more information on the AFV Readiness Program, visit www.firetraining.org.



First Responder's

AFV Readiness

Alternative Fuel Vehicle Training Curriculum (AFVTC)

AFVTC offers courses and webinars to help emergency and safety training personnel understand the unique risks associated with alternative fuel vehicles. Learn more at www.afvtraining.org.



National Alternative Fuel Training Curriculum
www.afvtraining.org

AFVTC Training Program

National Alternative Fuel Training Curriculum (AFVTC) at Virginia Polytechnic Institute offers a "Train the Trainer" program of courses developed by experts throughout the United States. For more information, visit www.afvtraining.org.

- **Virginia Polytechnic Institute** - www.afvtraining.org
- **Department of Fire Services** - www.afvtraining.org

AFVTC Training Program

The AFVTC, California Fire Training Program (CFTF) provides a comprehensive training program for emergency responders, including information on alternative fuel vehicles, electric vehicles, and compressed natural gas vehicles. The program includes a comprehensive curriculum and a certification process.

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AFV Readiness

Fuel-Specific Training

The National Fire Protection Association (NFPA) offers a variety of training programs for emergency responders, including classroom instruction, hands-on training, and field exercises. For more information, visit www.nfpa.org.

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Organization	Contact Information
Alternative Fuel Vehicle Training Curriculum (AFVTC)	www.afvtraining.org
California Fire Training Program (CFTF)	www.firetraining.org
National Fire Protection Association (NFPA)	www.nfpa.org

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Outreach

Subcommittees

Gaseous Fuels
(June 11)

Biofuels
(July 9)

Electric Drive
(Aug. 28)

Hydrogen
(Sept. 15)

External Stakeholder Meetings

South Bay Energy
Action Collaborative

Fleet Manager
Roundtable

Energy Working
Group

Regional Technical
Working Group

One-on-Ones

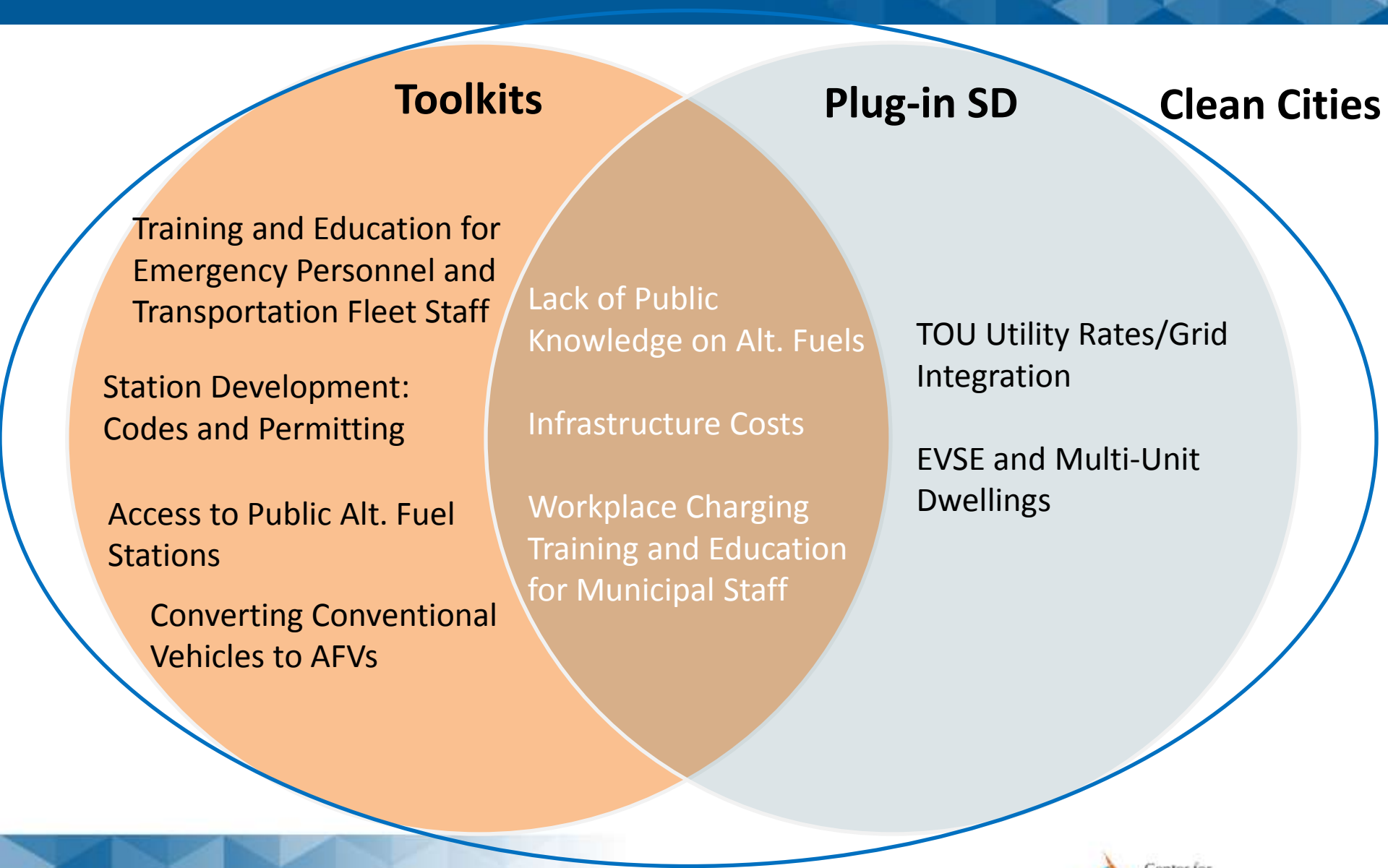
New Leaf Biofuel

EXPO Propane

San Diego Airport

Others

Barriers Addressed



Topics for Plan and Future

Alternative Fuel Readiness Plan

Topics from Toolkits

Alternative Fuel
Technology: Future
technological and
fuel advancements

Alternative Fuel “Expert”?

Station
Development: Site
Assessment

San Diego Clean Cities Coalition/ Southern California Advanced Transportation Center will provide support for all these efforts.

Since the project began...



Two new CNG stations (EDCO) added



More EV Charging Stations



Three more E85/Ethanol Stations to be added in 2016



Two new renewable diesel stations



Growing interest in hydrogen, plus hydrogen station to be added 2016



Fuel prices



Ultra low NOx from new CNG technology

Next Steps/Moving Forward

- Is there something missing that would be helpful?
- We're anticipating CEC funding for alternative fuel implementation work in the future.
 - How do we make it “implementation friendly”?
- How do we get these toolkits used regularly?
- How to support diverse needs of jurisdictions?



Center for
Sustainable Energy™

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