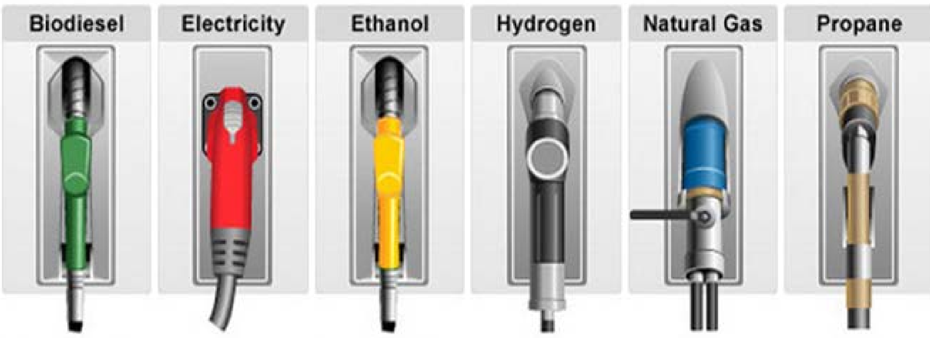
refuel



Alternative Fuels for Public Agencies

This Alternative Fuel 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 San Diego), 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 (AFV) 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:

- Replacing vehicles in government and contractors' fleets with AFVs
- Increasing the number of alternative fuel stations available for the public
- Increasing the number of AFVs in government fleets
- Streamlining permitting for alternative fuel infrastructure (AFI)

How do I use this Alternative Fuel Toolkit?

This Alternative Fuel Toolkit provides resources that public agencies have identified as being desirable for further training and assistance in the transition into AFVs. This includes:

- Guidance on availability of funding for AFVs and AFI 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.

Biodiesel

FACTS ABOUT BIODIESEL

What is biodiesel?

Biodiesel is a non-petroleum-based diesel that is made from vegetable oil, recycled restaurant grease, or animal fats. Pure biodiesel is renewable and a clean-burning form of diesel.

Typically, biodiesel can be blended with petroleum diesel. Biodiesel blends range from B2 (2% biodiesel, 98% petroleum diesel) to B99 (99% biodiesel, 1% petroleum diesel). B20 is the most common biodiesel blend in the United States.

Renewable diesel has been growing in popularity. Renewable diesel is also made from biomass feedstocks, but is processed in a different way that makes it more chemically similar to diesel than biodiesel.

How many public stations are in the San Diego region?

There is currently one public Biodiesel station in the San Diego region; however, there are many private fleets that have B20 delivered to their own facilities.

How much does it cost to fuel my vehicle?

Biodiesel is generally less expensive than diesel. Below are the 24-month averages of both fuels.

4-month average*	
iesel	3.44
20	3.15
avings	0.31

*June 2013-June 2015

- Biodiesel is biodegradable, nontoxic, and safe for handling
- Biodiesel is produced from co-products and byproducts of crops already being grown; it also can be produced with used cooking oil
- B20 provides similar fuel economy, horsepower, and torque as diesel fuel
- Between 2004 and 2014, 8.2 billion gallons of biodiesel have been used in the U.S. Carbon emissions were reduced by 75.5 million metric tons. This is equivalent to removing 15.9 million cars off the road.
- Biodiesel reduces lifecycle carbon emissions by up to 86%

What types of vehicles can use biodiesel?

Any vehicle that runs on diesel can also use biodiesel, including, but not limited to:

- Passenger vehicles
- Vanpool – shuttles
- School buses
- Refuse haulers
- Sweepers
- Construction equipment
- Other medium/heavy-duty vehicles

Did you know…

Many light-duty diesel vehicles also can take low percentage blends of biodiesel. 85% of all manufacturers will allow B20 in newer model vehicles. Visit the National Biodiesel Board for more information: http://www.biodiesel.org/using-biodiesel/oem-information.

Where can I learn more?

- Alternative Fuel Data Center - www.afdc.energy.gov/fuels/biodiesel.html
- National Biodiesel Board – www.biodiesel.org
- Biodiesel Education Network – www.askben.info
- Drive Biodiesel – www.drivebiodiesel.net
- National Biodiesel Foundation – www.biodieselfoundation.org

Deciding whether to install fueling stations

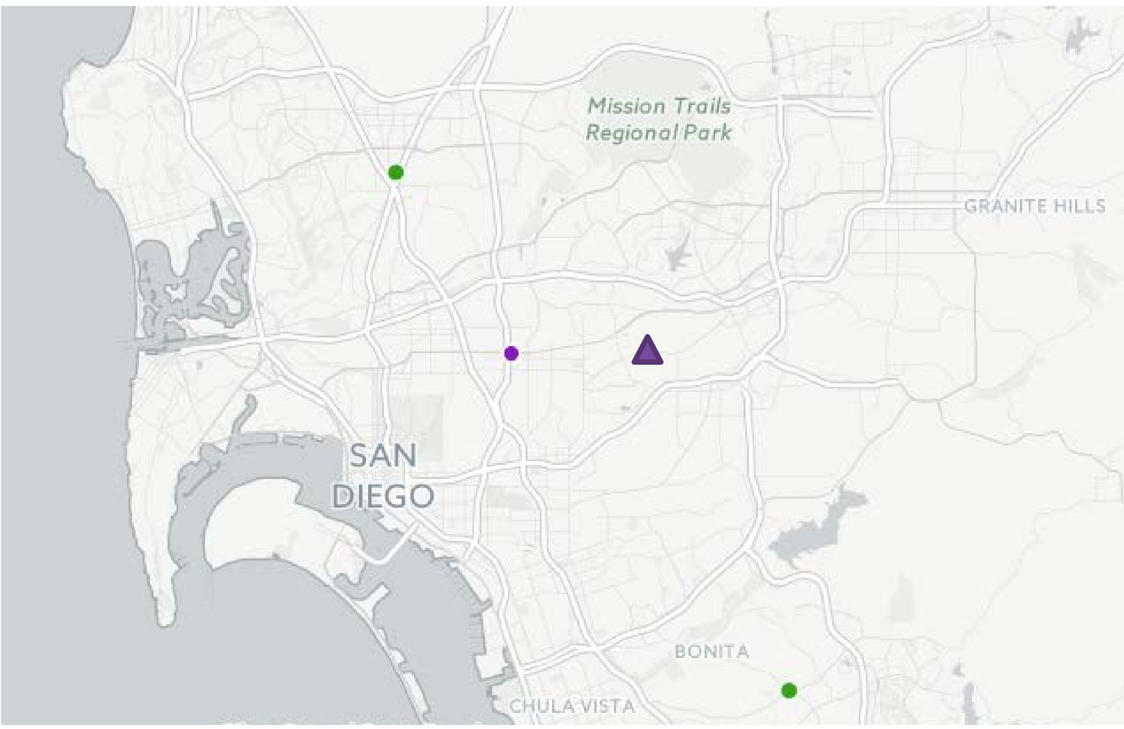
The following tools and resources are available to help guide you through the decision-making process when considering installing a biodiesel fueling station or adopting the fuel into your fleet.

Case Studies

Biodiesel Helps Cut a City's Carbon Footprint: The City of Asheville, NC cut its carbon footprint by 4.5% from the prior year by switching from B5 to B20. The increase biodiesel use accounted for 40% of the carbon footprint improvement. Read more at http://www.government-fleet.com/channel/green-fleet/news/story/2015/02/biodiesel-use-helps-city-meet-carbon-reduction-goals.aspx.

Study Shows Air-Quality Benefits of Biodiesel in City Buses: The Mineta National Transit Research Consortium has found that transit buses operating on biodiesel emit less particulate matter and gases than those using conventional diesel. Read more at http://www.biodieselmagazine.com/articles/226058/study-shows-air-quality-benefits-of-biodiesel-in-city-buses.

Map of Public Biodiesel or Renewable Diesel Fueling Stations in San Diego Region



*Triangle indicates biodiesel station; circles indicate renewable diesel station
(Map updated as of September 2015)
http://www.afdc.energy.gov/fuels/biodiesel_locations.html

Permitting biodiesel fueling stations

The siting of a biodiesel fueling station and the actual electrical and mechanical work all require permits. Along with permits, fueling stations also need to follow specific fire codes and developers need to work closely with the fire marshal or local fire department to ensure the safety of the station and its users.

Biodiesel Equipment

Biodiesel that is to be stored in an underground storage tank must follow underground storage tank (UST) regulations. Beginning October 13, 2015, operators must inform the California State Water Resources Control Board of the compatibility of the UST system to hold regulated substances containing greater than 20% biodiesel.

Compatibility must be demonstrated by:[1]

- Certification or listing of UST system equipment or components by nationally recognized, independent testing laboratory.
- Written equipment or component manufacturer approval.

Above-ground tanks must also have the equipment manufacturer provide statements of compatibility with all biodiesel blends.

How is Biodiesel Blended?

Most biodiesel is purchased as finished B20 or lower blends from the biodiesel marketers or petroleum distributors. When this happens, the distributor/marketer is responsible for ensuring that biodiesel has been properly blended before the fuel reaches the retailer or jobber. Biodiesel is only intended for use in diesel applications and should not be blended with gasoline.

Permits for a Station

The permitting process of installing a biodiesel station is similar to that of a conventional gasoline or diesel station. Notably, these are the types of permits likely necessary:

- Encroachment
- Land use
- Safety
- Grading
- Plumbing
- Electrical
- Public Works
- Noise
- Environmental Health
- Building
- Industrial Wastewater Discharge
- Fire Department

Biodiesel is blended into diesel in three primary ways:

- Splash Blending: Biodiesel and diesel are loaded separately. The fuels mix and blend together in a transport or storage truck as the fuels are agitated during transportation and delivery to the end user.
- In-Line Blending: Biodiesel is slowly added to a stream of diesel as it flows through a pipe. The two fuels are blended together as they move through the pipe.
- Rack Blending: Biodiesel is put directly into the storage or transport truck at the rack and delivered to the end user.

[1] http://epa.gov/oust/ustsystm/compat.html

Codes and Standards

When installing a fueling station, it is important to adhere to the necessary codes and standards. This guidance document provides a thorough list of codes and standards when developing biodiesel infrastructure: http://www.afdc.energy.gov/pdfs/48603.pdf.

The general standards for the dispensing and storage of biodiesel fall under the National Fire Protection Association (NFPA) 30 Flammable and Combustible Liquids Code.[2] It covers fire and explosion prevention, storage of liquid in containers, storage systems, and processing facilities. Some specific codes and standards for other aspects of biofuel stations are found in the following table. Many of these codes and standards also apply to conventional gasoline fueling stations.

Fueling Station Aspect	Pertinent Codes and Standards
Containers	NFPA 30 American Society for Testing and Materials (ASTM) Standards for Containers American National Standards Institute (ANSI)/ Underwriters Laboratory (UL) Standards for Containers US Department of Transportation (DOT) 10CFR49
Dispensing Operations	NFPA 30 NFPA 30A NFPA 385 NFPA 10
Storage of Liquids	UL 2245, 2080, 2085 NFPA 91, 30A Steel Tank Institute (STI) Corrosion Control Standards

2 http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=30

Relevant Policies and Laws

There are several reasons to install a public fueling station for your jurisdiction. One reason is that installing an alternative fueling station and promoting the alternative fuel helps California achieve its climate mitigation goals.

Strategy Origin	Year	Objectives	Goals and Milestones
Federal Clean Air Act	1970	Air Quality	80 percent reduction of NOx by 2023
Federal Energy Policy and Conservation Act	1975	Petroleum Reduction	Set into place the Corporate Average Fuel Economy to improve fuel economy.
Federal Energy Policy Act	1992	Petroleum Reduction	Defined alternative fuels and required certain fleets to increase alternative fuel vehicle acquisitions
AB 1493 (Pavley regulations)	2002	GHG Reduction	17 percent reduction in climate change emissions from light-duty fleet by 2020 and 25 percent overall reduction by 2030
Petroleum Reduction and Alternative Fuel Goals (*Reducing California's Petroleum Dependence)*[3]	2003	Petroleum Reduction	This document was developed In response to AB 2076 (Shelley). It set goals to reduce petroleum fuel use to 15 percent below 2003 levels by 2020, and recommended the State adopt a goal of 20 percent nonpetroleum fuel use in the year 2020
AB 1007 (*State Alternative Fuels Plan*)	2005	GHG Reduction	Develop and adopt a plan that sets increased alternative fuel use goals for years 2012, 2017, and 2022
Energy Policy Act of 2005; Energy Independence and Security Act of 2007	2005	Renewable Fuel Standard	36 billion gallons of renewable fuel used in the US by 2022
Executive Order S-3-05	2005	GHG Reduction	By 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels
AB 32 (Global Warming Solutions Act)	2006	GHG Reduction	Reduce GHG emissions to 1990 levels by 2020
Executive Order S-06-06 (*Bioenergy Action Plan*)	2006	In-State Biofuels Production	Produce in California 20 percent of biofuels used in state by 2010, 40 percent by 2020, and 75 percent by 2050
Low Carbon Fuel Standard	2007	GHG Reduction	10 percent reduction in carbon intensity of transportation fuels in California by 2020
Governor Brown Inaugural Address 2015	2015	Petroleum Reduction	Reduce petroleum use in cars and trucks by up to 50 percent within the next 15 years (2030)

[3] Reducing California's Petroleum Dependence, an Energy Commission and ARB, joint agency report, August 2003, publication #P600-03-005F.

Electric Vehicles

What is a PEV?

A plug-in electric vehicle (PEV) is a vehicle in which there is an onboard battery that is powered by energy delivered from the electricity grid. It is commonly referred to as just an electric vehicle (EV). There are two types of plug-in electric vehicles: a battery electric vehicle (BEV) and a plug-in hybrid electric vehicle (PHEV). BEVs run exclusively on the power from their onboard battery. PHEVs have both an onboard battery and a gasoline tank that is used when the car's battery is depleted.

There are upwards of 17,500 PEVs in the San Diego region (as of Summer 2015).

How many stations are in the San Diego region?

Currently there are over 600 public charging stations in the San Diego region.

How much does it cost to fuel my vehicle?

It generally costs less than half as much to drive an electric vehicle as a conventional gasoline vehicle.

24-month average*	
Gasoline	$3.35
Electricity**	$1.22
Savings	$2.13

*June 2013-June 2015
**Gasoline gallon equivalent at $0.12/kWh

WHAT IS CHARGING?

Level 1 Charging

Level 1 charging uses 120 volts AC. A PEV can be charged with just a standard wall outlet.

Level 2 Charging

Level 2 charging uses 240 volts AC. This is the same type of voltage as an outlet used for a dryer or electric range.

DC Fast Charging

DC fast charging is very quick. Some PEVs can charge up to 80% of its battery in 30 minutes.

What types of vehicles can use electricity?

PEVs come in all shapes and sizes. They are not limited to light-duty passenger vehicles (of which there are over 25 models!) anymore.

- Passenger vehicles
- Vanpool shuttles
- Pickup trucks
- Medium-duty vehicles
- Transit buses
- Forklifts
- Low-speed vehicles (like a golf cart)

TYPES OF ELECTRIC VEHICLES

Battery Electric Vehicle (BEV): Battery electric vehicles run entirely on the energy stored on an onboard battery. The vehicle is charged by electricity from the grid. On average, the vehicle's range is upwards of 80 miles on a single charge.

Plug-in Hybrid Electric Vehicle (PHEV): A plug-in hybrid electric vehicle runs on electricity and a gasoline. The vehicle's onboard battery is charged using electricity from the grid, and when the battery is depleted, the gasoline engine is used.

Where can I learn more about plug-in electric vehicles?

You can learn more about PEVs on the following websites:

- Alternative Fuel Data Center - www.afdc.energy.gov
- Plug-in Electric Vehicle Collaborative- www.pevcollaborative.org
- Plug-in America – www.pluginamerica.org
- Plug-in Cars – www.plugincars.com
- Go Electric Drive – www.goelectricdrive.org

Deciding whether to install charging stations

The following tools and resources are available to help guide you through the decision-making process when considering installing PEV charging stations.

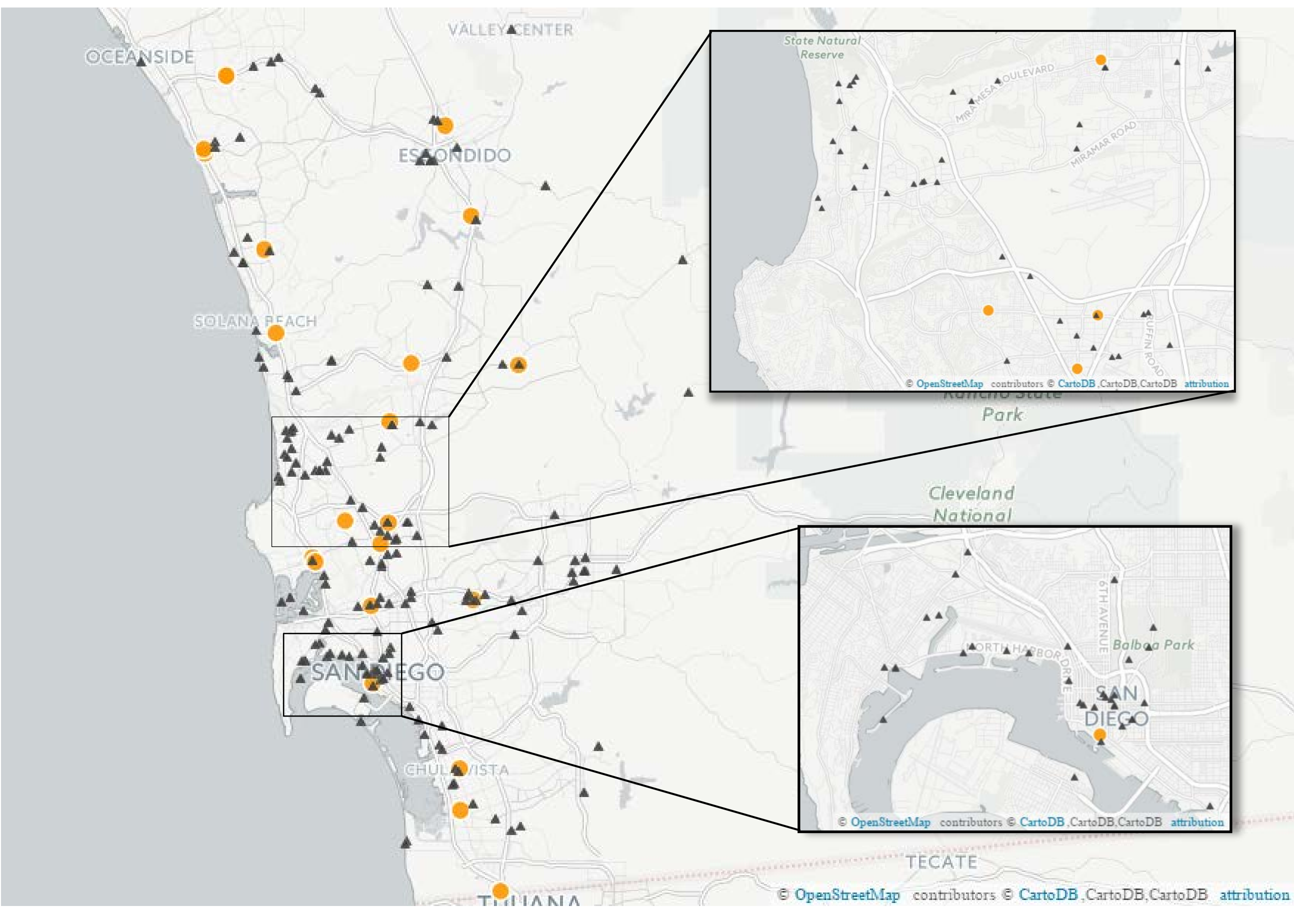
Case Studies

City of Los Angeles: The City of Los Angeles is leading the way in electric vehicle charging station (EVCS) installations and permitting. Read more on the alternative fuel data center: http://www.afdc.energy.gov/case/1002.

City of Burbank: The City of Burbank has added several curbside EVCS throughout the city thanks to a California Energy Commission (CEC) grant of nearly $165,000. Read more about this on the Los Angeles *Times*: http://www.latimes.com/local/california/la-me-electric-car-stations-20150907-story.html.

U.S. Navy Partners with ABM and ChargePoint: The U.S. Navy partnered with ABM Industries and ChargePoint to install charging stations at select Navy Exchange (NEX) locations, including a NEX facility in San Diego. Read more about this on ABM's website: http://www.abm.com/SiteCollectionDocuments/Reprints/CHARGE%20US%20Navy%20Federal%20Construction_Summer%202013.pdf.

Map of Public PEV Charging Stations in San Diego Region



*Triangles indicate Level 2 site; circles indicate DCFC site (Updated as of August 2015)
http://www.afdc.energy.gov/fuels/electricity_locations.html

Installing charging stations

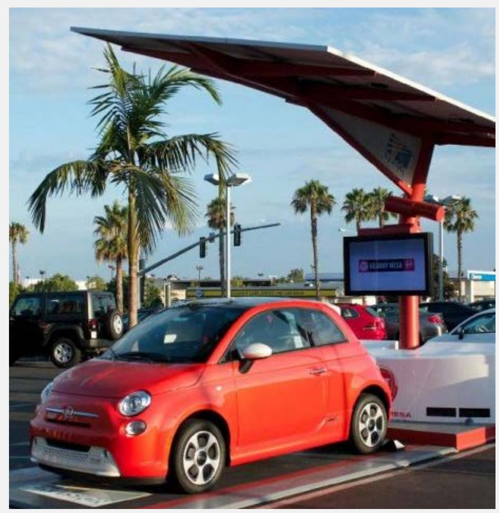
Where to place charging stations?

- Consider the following when assessing the feasibility of charging stations:
  - Availability of power – Can the site's electrical panel support the addition of EVCS? If not, is it easy to upgrade? Is it close to a transformer if new service is needed?
  - Constructability – How far are the potential EVCS spots from the electrical panel? Does the site require extensive trenching? Construction costs increase when significant trenching is required.
  - Environmental protection – Will the EVCS cause environmental harm to the site?
  - Accessibility – Will all PEV drivers be able to access the charging station safely? (see Permitting a charging station)
- Think about dwell time – One critique of PEV charging is that it takes at least a couple of hours to "refuel" a PEV instead of a matter of minutes for a conventional vehicle. With this in mind, EVCS should be placed in locations where the user can do something else (i.e., shop, go to a movie, etc.) while waiting for their vehicle to charge. The chart below (*Charging Recommendations and Dwell Times*) provides an example of optimal locations for charging stations based on the type of EVCS.
- Where is the demand? – Identify roads with high vehicle travel and consider installing public EVCS in locations (see above) along those busy streets. In addition, target sites that are frequented by the community to avoid stranded assets. It may be reasonable to plan for future demand. The State of California has a goal to provide enough infrastructure to support 1.5 million zero-emission vehicles on the roads by 2025.[1]

Consider This

EVCS installations can be integrated with other onsite clean energy upgrades, such as solar installations and energy storage. Solar power may offset the EVCS load while charging a PEV, while energy storage can efficiently integrate it in a facilities overall energy management program.

Companies such as Envision Solar have products on the market that pairs solar panels with an EVCS and energy storage in a single modular unit.



[1] http://opr.ca.gov/docs/Governor's_Office_ZEV_Action_Plan_(02-13).pdf

Charging Recommendations and Dwell Times

EVCS	User Profile	Typical Venues
Level 1	Parked for 6-8 hours	Airports (long term) Hotels Parking garages Workplaces
Level 2	Parked for 2-4 hours	Shopping centers Airports (short term) Street/Meters Parking garages Medical facilities Gyms Public spaces
DC Fast Charge	Quick stop for 5-30 minutes	Shopping centers Quick-serve restaurants Airports (short term) Highways & commuting roads

Local Case Study: County of San Diego

The County of San Diego (County) wanted to provide charging stations for its employees and the public at ten of their County facilities; however, there was no funding to pursue such a project. What they did have was available parking spaces, the business opportunity, and government support. What remained was a vendor to install, own, and operate the equipment.

The County was not confident that they would find a vendor willing to agree to such a deal. Around the same time, the California Energy Commission released a funding opportunity for PEV charging station installations (PON-13-606). The County applied for and was successfully awarded $500,000 for EVCS infrastructure installations. While the grant required 25% match from the County, it was met with the property value of the parking spaces (on which the charging stations would be installed) for five years.

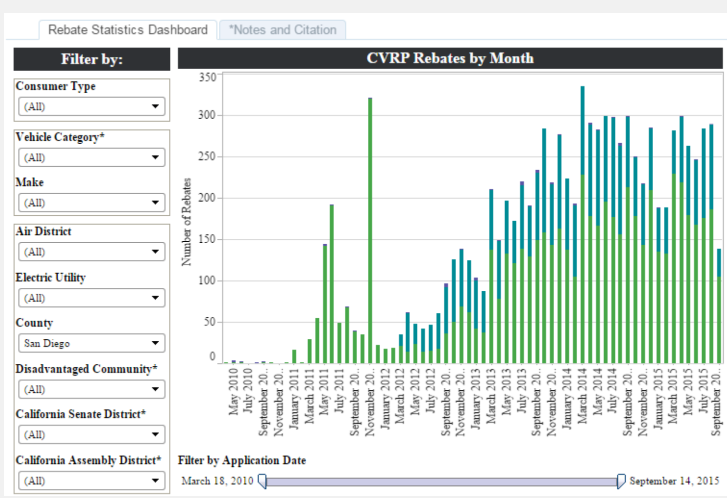
Having the grant funding allowed the County to release an RFP for a vendor to install, own, and operate PEV charging stations at the ten County sites and the $500,000 supported the installation costs. ChargePoint won the County's bid and has already completed the first installation at the County Administration Center. All electricity accounts for the installations are maintained by ChargePoint.

Level 2 charging use costs $0.30/kWh and DC fast charging use costs $0.50/kWh.

How Many PEVs are in my region?

The Clean Vehicle Rebate Project has an interactive map that allows users to see how many rebates were distributed by county, zip code, air district, utility, and more. While this does not portray the exact number of PEVs on the roads, the number of rebates distributed is a good proxy for the actual number.

https://cleanvehiclerebate.org/eng/rebate-statistics



What are the costs of installing a charging station?

The cost of installing a charging station varies based on the type of charging station and the location in which it will be installed. Though the cost of basic charging equipment is relatively low, the costs get higher with additional electrical panel upgrades, wiring, and trenching.

Estimated Cost of Installing EV Charging Station[2]

	Level 2	DC Fast Charging
Hardware	$450-$3,000	$12,000-$35,000
Electrician Labor	$100-$1,500	$1,600-$3,000
Electrician Materials	$50-$300	$300-$600
Other materials	$50-$150	$100-$400

Specific Cost Considerations [3]

Conduit	$1.50-$2.50/ft
Trenching	$25-$100/ft
Concrete Patch	$14-$15/sq. ft
Asphalt Patch	$10-$11/sq. ft

Other cost considerations include bollards and extended warranties. It is advised to discuss these potential costs with your charging station vendor before installation begins. Charging station installations can certainly rise in cost, especially if your agency is planning to provide multiple charging stations for the community. Incentives are one way to reduce the overall cost in such projects.

Incentives

The California Energy Commission's **Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP)**[4] is a competitive grant program that provides up to $100 million annually towards advanced technology projects. In Fiscal Year 2015-2016, there is an anticipated $27 million available for PEV charging infrastructure projects.

Several cities in the San Diego region have taken advantage of ARFVTP funding to install charging stations within their jurisdictions, such as the County of San Diego (above).

Federal Congestion Mitigation and Air Quality (CMAQ) Improvement Program funds may also be used towards the establishment of publicly owned or leased EVCS. Many cities within the State of Colorado have successfully used this funding in tandem with grants provided by the Colorado Energy Office, to increase the public charging stations in the state from 79 to 116 (as of 2013).[5]

The California Capital Access Program now offers an **Electric Vehicle Charging Station Financing Program** for small businesses. While public agencies cannot take advantage of this program, it is useful for local businesses should they wish to take advantage of competitive loans for EVCS.

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[2] Information gathered from CALSTART "Best Practices for Workplace Charging" (2012: http://www.calstart.org/Libraries/Publications/Best_Practices_for_Workplace_Charging.sflb.ashx) and Rocky Mountain Institutes "Pulling Back the Veil on EV Charging" (2014: http://blog.rmi.org/blog_2014_04_29_pulling_back_the_veil_on_ev_charging_station_costs)
[3] Ibid.
[4] http://www.energy.ca.gov/contracts/transportation.html
[5] http://cleanairfleets.org/newsroom/charge_ahead_colorado_program_brings_41_electric_vehicle_charging_stations_

Permitting a charging station

Typically, only an electrical permit is required for the installation of a residential EVCS. However, for EVCS in non-residential settings, zoning, or building permits may be necessary, depending on the installation scenario and local regulations.

Best Practices for Permitting[6]

Links to resources are bulleted below:

- Allow online permitting: such as the City of San Diego's online permit system
- Develop a standard fee for all single family home EVCS installations across jurisdictions
- Use the City of Oceanside's *Residential Electric Vehicle Charger Guidelines* as a guidance document for streamlining permitting, installation, and inspection processes for residential EVCS installations[7]
- Enable one-day permitting for quick turnaround times
- Develop a uniform permit for EVCS installations: an example permit is found on the AFDC's website http://www.afdc.energy.gov/pdfs/EV_charging_template.pdf
- Define EVCS as appliances and make it subject to the same permitting requirements

Permitting assistance for the San Diego region can be accessed on the Plug-in San Diego website: http://www.energycenter.org/pluginsd. Further assistance with general codes for EVCS can be found in the Transportation and Climate Initiative's document *EV Ready Codes for the Built Environment*.[8]

Codes and Standards

When installing a fueling station, it is important to adhere to the necessary codes and standards. This guidance document provides a thorough list of codes and standards when developing electric vehicle infrastructure: http://www.afdc.energy.gov/pdfs/48605.pdf.

Electric vehicle charging stations are governed by codes similar to other electrical devices, notably, the National Electrical Code (NEC) 625.[9]

Fueling Station Aspect	Pertinent Codes and Standards
Vehicle and Charger Interface	Society of Automotive Engineers (SAE) J-1772, J-2841, J-2293, J-2847, J-2836
Vehicle Charging Stations	NFPA 70 NEC article 625
Charging Station Components	UL FFTG, UL FFWA

[6] http://www.transportationandclimate.org/sites/www.transportationandclimate.org/files/EVSE_Planning_and_Policy_Tool_Guide.pdf (2012)
[7] http://www.ci.oceanside.ca.us/civicax/filebank/blobdload.aspx?blobid=30053
[8] http://www.transportationandclimate.org/sites/www.transportationandclimate.org/files/EV-Ready_Codes_for_the_Built_Environment_0.pdf (2012)
[9] http://www.psrc.org/assets/3729/A_NEC_625_2008.pdf?processed=true

CalGreen Code

Title 24, the *California Building Code of Regulations* (*California Building Standards Code*), includes the *California Green Building Standards Code*, section 11 of Title 24 – the CALGreen code. The California Building Standards Code is updated every three years and it delineates building code requirements for implementation and enforcement by all cities, counties, and other permitting agencies in California.

Cities, counties, and permitting agencies may adopt voluntary CALGreen standards or develop their own. In many code scenarios, permitting agencies may adopt voluntary "tiers"—additional requirements that may help jurisdictions exceed mandatory CALGreen codes.

The 2013 CalGreen Intervening Cycle Update, which occurs between each three-year update to include supplements and amendments to the code as necessary, included mandatory code language for PEV charging and became effective July 1, 2015. All public agencies must adhere to the mandatory CalGreen code and can adopt them in a single ordinance. Local governments can integrate Tier 1 and Tier 2 measures as they see fit or develop their own additional requirements above and beyond the mandatory code.[10]

This update includes the following changes:[11]

Multi-Family Residential	
Mandatory	Make at least 3 percent of total parking spaces ready for PEVs (through electrical capacity, building plans, etc.). - Developments under 17 dwelling units exempt
	Construction documents should show where electric vehicle charging station (EVCS) are to be located; at least one EVCS needs to be located in a common area for use by all residents.
Voluntary	(Tier 1 & Tier 2) Make at least 5 percent of total parking spaces ready for PEVs (through electrical capacity, building plans, etc.). - Developments under 17 dwelling units exempt
Single Family Residential	
Mandatory	Install raceway and electrical panel capacity to support 40 amp capacity electrical circuit.
Voluntary	(Tier 1 & Tier 2) Install complete 208/240-volt branch circuit at minimum 40 amps.
Non-residential	
Mandatory	Install electrical panel capacity to support 40 amp capacity electrical circuit.
	If there are more than 50 parking spaces, at least 1 or more must be ready for PEVs, see table below.
Voluntary	(Tier 1) At least 4 percent of parking spaces must be ready for PEVs.
	(Tier 2) At least 6 percent of parking spaces must be ready for PEVs.

[10] Tiers indicate voluntary measures. Tier 1 indicates one level above the mandatory requirements, and Tier 2 indicates two levels above the mandatory requirements

[11] State of California. Revision Record for the State of California: Supplement 2013 Title 24, Part 11, California Green Building Code. 1 July 2015. https://www.iccsafe.org/cs/codes/Errata/State/CA/5570S133.pdf.

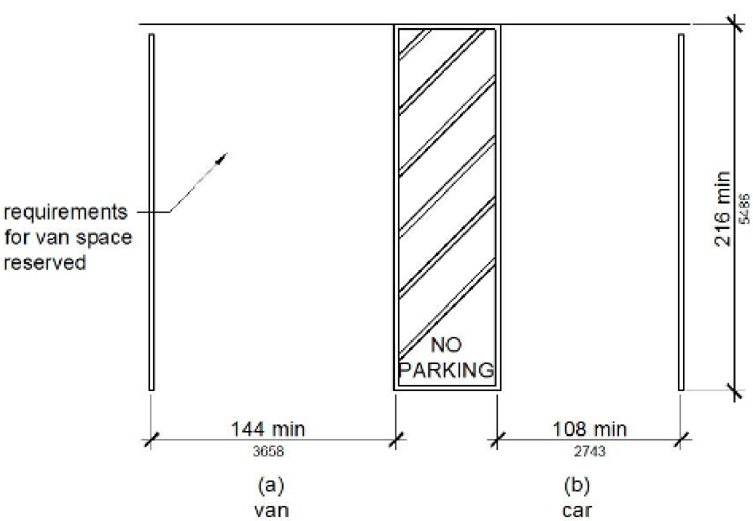
Accessibility

As of August 2015, accessibility of EVCS is not in the California Building Code. Currently, the Division of the State Architect (DSA) and the Governor's Office of Planning and Research(OPR) have draft guidelines and best practices for universal charging access. These guidelines expand upon DSA "Interim Disabled Access Guidelines for Electric Vehicle Charging Stations 97-03" and will likely become regulations within *California Building Code Chapter 11B Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.*[12]

Minimum Number of Accessible EVCS for On-Site or On-Street Locations

Total Number of EVCS Provided at a Site	Minimum Number of Required Physically Accessible EVCS
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 and over	4, plus 2 for each 100, or fraction thereof, over 100

On-Site EVCS Spaces Dimensions



For further guidance and recommended practices, read the *Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices* document by OPR.[13] You also canreview the City of San Diego's Technical Policy 11B-1, which has largely been adapted from the State guidelines and standards.

[12] http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf
[13] Ibid.

Managing usage and payments

When offering public charging, a few common issues should be considered: whether to require a fee for charging and how to regulate who parks in charging spots and for how long.

PEV Parking Policies, Ordinances, and Resolutions

It is a common practice for a local government to pass a policy, law, or resolution that regulates how public charging stations are used. Such resolutions often establish electric vehicle parking fees and regulation for PEV charging. Examples are below:

- City of Laguna Beach, Resolution 13.005:[14] Sets PEV charging/parking rate as free for the first four hours of parking, and $5 per hour fee for each additional hour.
- City of Lodi, Ordinance 1881:[15] Amends Lodi Municipal Code Chapter 10.44 to include electric vehicle charging stalls into its code on "Stopping, Standing and Parking".
- County of Alameda, Resolution 2013-89:[16] Allows County-owned charging stations available to the public for no fee.

Fee versus Free Charging

Charging for Fee	Charging for Free
Benefits: • Prevents free-riding (i.e., cars staying plugged in too long, too often) • Allows charging station host to cover cost of electricity usage • Allows "efficient" use of charging stations	Benefits: • Promotes PEV charging for a relatively new market • Attractive for PEV drivers to use the equipment • No cost associated with collecting fees for charging
Considerations: • Penalizing extended charging times by increasing fee after *x* amount of hours • High costs may discourage charging station use • Costs may incur when collecting money (e.g., credit card transaction fees)	Considerations: • Cannot cover the cost of electricity • PEVs may stay plugged in for too long, preventing those who need a charge from charging

[14] http://lagunabeachcity.granicus.com/MetaViewer.php?view_id=3&clip_id=299&meta_id=23343
[15] http://publicdocs.lodi.gov/Docs/ORDINANCES/2013/ord1881.pdf
[16] http://www.acgov.org/sustain/documents/EV_Charging_Station_Policy.pdf

Ownership Models

1. Public Agency/Property Manager owns equipment:

Benefits	Considerations
• Host dictates whether to offer charging for free or for a fee • Host determines the fee for charging (if applicable) • Host keeps all revenue from the charging station, perhaps recovering cost of electricity (if charging for a fee) • Host can determine who uses the station	• Host must buy their own equipment • Host must pay the construction costs • Host must manage payment • Host must properly maintain the equipment

2. Electric Vehicle Service Provider (EVSP) owns equipment:

Benefits	Considerations
• No (or limited) equipment or installation cost to host • EVSP manages and maintains the station • EVSP shares revenue from charging station with host	• Host usually remains customer of record on utility bill and must pay electricity costs upfront before EVSP pays host back • PEV drivers need to have membership fees to use stations

Relevant policies and laws

There are several reasons to want to install a public charging station. One reason is that installing an alternative fuel station and promoting the alternative fuel helps California achieve its climate mitigation goals.

Strategy Origin	Year	Objectives	Goals and Milestones
Federal Clean Air Act	1970	Air Quality	80 percent reduction of NOx by 2023
Federal Energy Policy and Conservation Act	1975	Petroleum Reduction	Set into place the Corporate Average Fuel Economy to improve fuel economy.
Federal Energy Policy Act	1992	Petroleum Reduction	Defined alternative fuels and required certain fleets to increase alternative fuel vehicle acquisitions
AB 1493 (Pavley regulations)	2002	GHG Reduction	17 percent reduction in climate change emissions from light-duty fleet by 2020 and 25 percent overall reduction by 2030
Petroleum Reduction and Alternative Fuel Goals (*Reducing California's Petroleum Dependence*)[17]	2003	Petroleum Reduction	This document was developed In response to AB 2076 (Shelley). It set goals to reduce petroleum fuel use to 15 percent below 2003 levels by 2020, and recommended the State adopt a goal of 20 percent nonpetroleum fuel use in the year 2020
AB 1007 (*State Alternative Fuels Plan*)	2005	GHG Reduction	Develop and adopt a plan that sets increased alternative fuel use goals for years 2012, 2017, and 2022
Energy Policy Act of 2005; Energy Independence and Security Act of 2007	2005	Renewable Fuel Standard	36 billion gallons of renewable fuel used in the US by 2022
Executive Order S-3-05	2005	GHG Reduction	By 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels
AB 32 (Global Warming Solutions Act)	2006	GHG Reduction	Reduce GHG emissions to 1990 levels by 2020
Low Carbon Fuel Standard	2007	GHG Reduction	10 percent reduction in carbon intensity of transportation fuels in California by 2020
Executive Order B-16-2012	2012	ZEV Mandate	Accommodate 1 million zero-emission vehicles by 2020 and 1.5 million by 2025
Governor Brown Inaugural Address 2015	2015	Petroleum Reduction	Reduce petroleum use in cars and trucks by up to 50 percent within the next 15 years (2030)

[17] Reducing California's Petroleum Dependence, an Energy Commission and ARB, joint agency report, August 2003, publication #P600-03-005F.

E85 / Flex-Fuel

FACTS ABOUT ETHANOL

What is E85?

Ethanol is a renewable fuel made from various plant materials ("biomass") including corn, sugar cane, barley, and wheat.

There are several blends of ethanol: E10 (10% ethanol, 90% gasoline), which is universal in California gasoline, E15 (15% ethanol), and E85 85% ethanol). E85 can be used in flex-fuel vehicles.

How many public stations are in the San Diego region?

As of July 2015, there are seven public E85 stations in the San Diego region. By 2016, three additional stations are expected to be open to the public.

How much does it cost to fuel my vehicle?

The chart below shows the average prices of gasoline and E85 over the past 24 months.

24-month average*	
Gasoline	$3.35
E85	$3.09
Savings	$0.26

*June 2013-June 2015

- The use of 13.3 billion gallons of ethanol in 2012 reduced greenhouse gas (GHG) emissions from vehicles by 33.4 million metric tons – that's like removing 5.2 million vehicles from the road
- One bushel of corn equals approximately 2.8 gallons of ethanol
- Flex-fuel vehicles can use any blend between 0-85%
- Flex-fuel vehicles account for one out of three vehicles in the entire federal fleet
- Advanced cellulosic ethanol could reduce life cycle GHG emissions by up to 86%

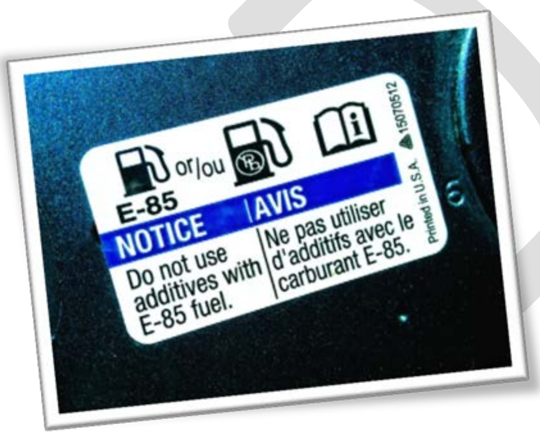
What types of vehicles can use ethanol?

- Passenger vehicles
- Pick-up trucks
- Police vehicles
- Vans
- Medium-duty trucks

Flex-fuel vehicles can use regular gasoline and E85 interchangeably.

Did you know…

There are over 80 model year 2015 flex-fuel vehicles available in the U.S. You may already have flex-fuel capable vehicles in your fleet.



Where can I learn more?

- Alternative Fuel Data Center - www.afdc.energy.gov/fuels/ethanol.html
- Choose Ethanol - www.chooseethanol.com/
- American Coalition for Ethanol – www.ethanol.org
- Ethanol Across America – www.ethanolacrossamerica.net

Deciding whether to install fueling stations

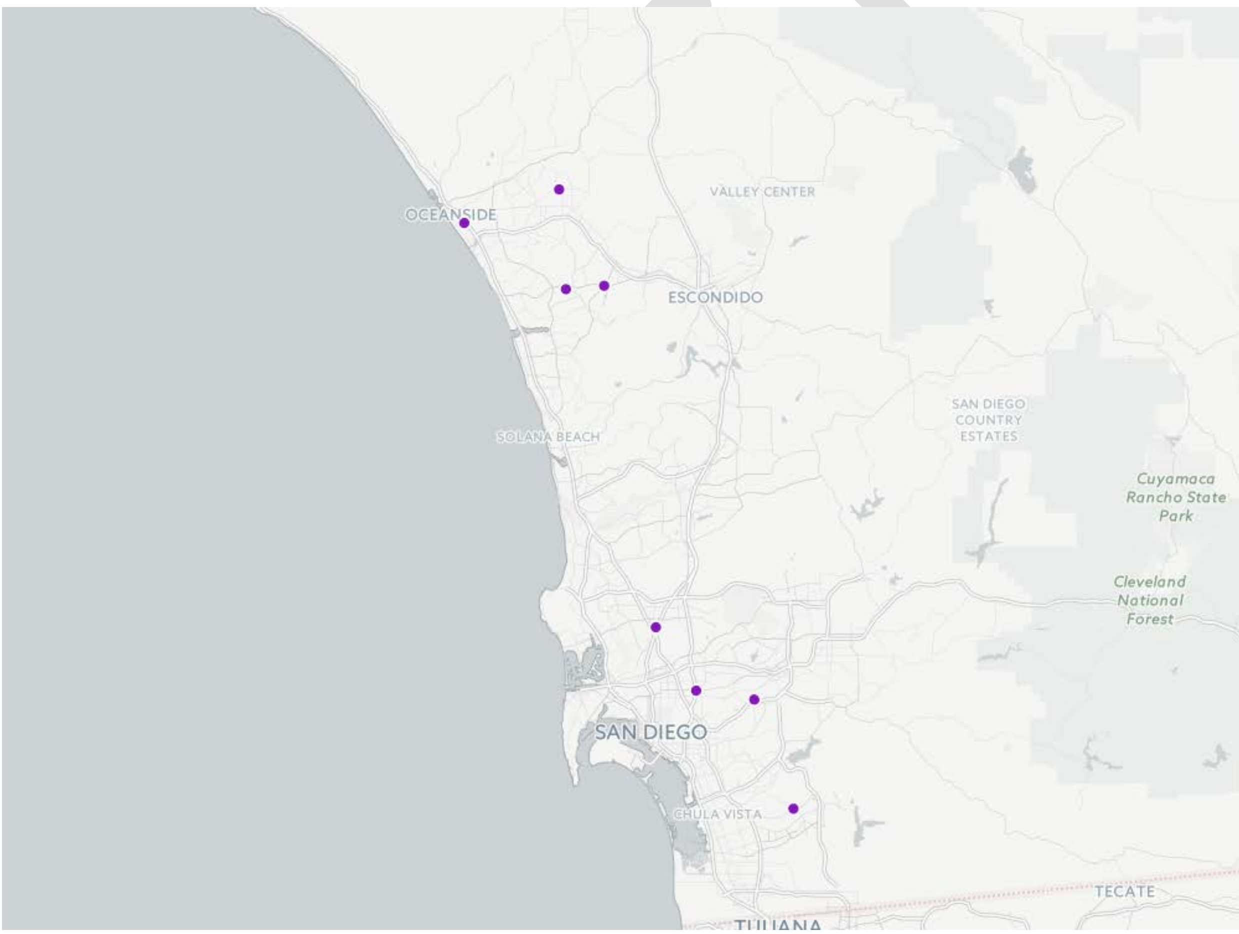
The following tools and resources are available to help guide you through the decision-making process when considering installing E85 fueling stations or adopting the fuel into your fleet.

Case Studies

Idaho County Employs FFVs and Idle Reduction: This video shows how a county in Idaho has committed to using ethanol in its fleet. Due to ethanol use and new idle reduction policies, the county saved over $105,000 in fuel in one year. Watch the video here: http://www.afdc.energy.gov/case/663.

City of Hoover Fleet Boasts 200-Plus Flex-Fuel Vehicles: The City of Hoover's FFV fleet has traveled over 20 million miles between 2004 and 2013, using over 1.5 million gallons of E85. Read more at: http://www.afdc.energy.gov/case/1423.

Map of Public E85 Fueling Stations in San Diego Region



(Map updated as of August 2015)
http://www.afdc.energy.gov/fuels/e85_locations.html

Permitting E85 fueling stations

The siting of an E85 station and the actual electrical and mechanical work all require permits. Along with permits, fueling stations also need to follow specific fire codes and developers need to work closely with fire marshal or fire department to ensure the safety of the station and its users.

E85 Equipment

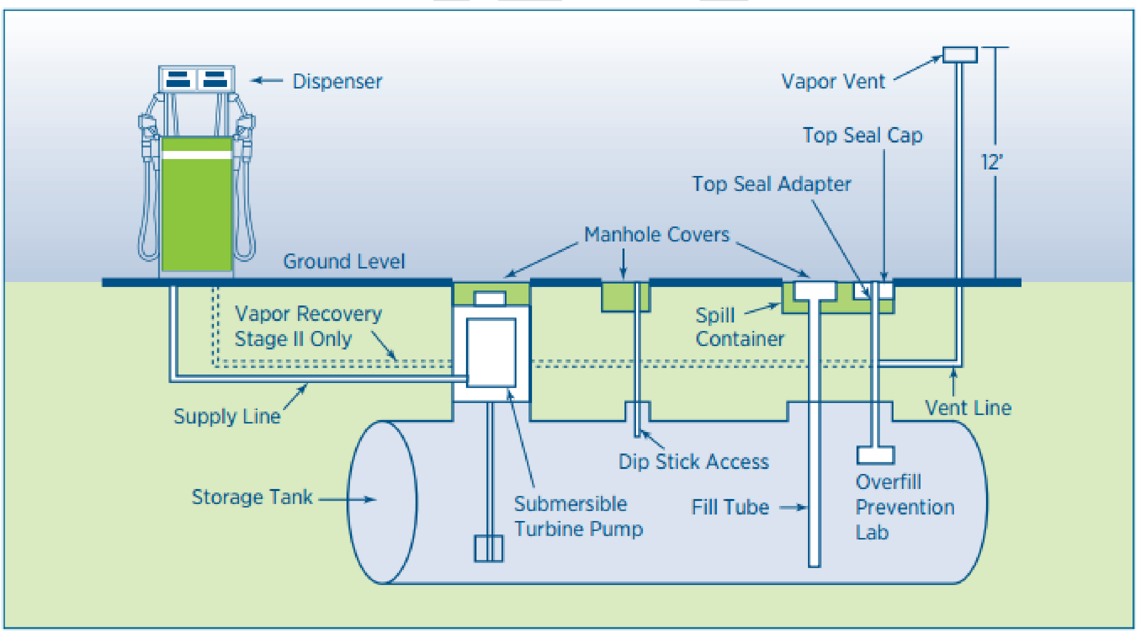
E85 that is to be stored in an underground storage tank must follow underground storage tank (UST) regulations. As of October 13, 2015 operators must inform the California State Water Resources Control Board of the compatibility of the UST system to hold regulated substances containing greater than 10% ethanol.

Compatibility must be demonstrated by:[1]

- Certification or listing of UST system equipment or components by nationally recognized, independent testing laboratory
- Written equipment or component manufacturer approval

> Read more about the proper handling, storing, and dispensing of E85: http://www.afdc.energy.gov/uploads/publication/ethanol_handbook.pdf.
>
> Read more about E15 and Infrastructure: http://www.afdc.energy.gov/uploads/publication/e15_infrastructure.pdf.

Above-ground tanks must also have the equipment manufacturer provide statements of compatibility with all ethanol blends. Additionally, all dispenser equipment is recommended to be UL-listed.



Typical Fuel Dispenser and Underground Storage Tank. Illustration by NREL: http://www.afdc.energy.gov/uploads/publication/ethanol_handbook.pdf

[1] http://epa.gov/oust/ustsystm/compat.html

Regulations

Fueling station operators will need to comply with the following regulations:

- Federal Spill Prevention, Control and Countermeasures
- State "spill" requirements
- Hazardous waste regulations
- State and local fire codes
- Petroleum product delivery laws
- Local regulations
    - SD Air Pollution Control District (SDAPCD) – requires a vapor recovery permit for E85 stations[2]
    - City of San Diego Fire Marshal – requires Hazardous Materials Permit[3]
    - County of San Diego Department of Environmental Health – Hazardous Materials Division – requires underground storage tank permit[4]
    - Many other cities include a San Diego Regional Hazardous Materials Questionnaire, which require review and approval from the County of San Diego Department of Environmental Health – Hazardous Materials Division and SDAPCD. This questionnaire can be found here: http://www.calepa.ca.gov/CUPA/Documents/2008/HMquestionSD.pdf

The EPA has page of resources for how to safely convert petroleum underground storage tanks into USTs that can store biofuels such as ethanol. http://epa.gov/swerust1/altfuels/ethcnvrt.htm

[2] http://www.sdapcd.org/permits/AppsTOC.html.
[3] http://www.sandiego.gov/fire/services/permits/hazmat.shtml
[4] http://www.sandiegocounty.gov/content/sdc/deh/hazmat/hmd_permits.html

Codes and Standards

When installing a fueling station, it is important to adhere to the necessary codes and standards. This guidance document provides a thorough list of codes and standards when developing ethanol infrastructure: http://www.afdc.energy.gov/pdfs/48603.pdf.

The general standards for the dispensing and storage of biodiesel and ethanol fall under the National Fire Protection Association (NFPA) 30 Flammable and Combustible Liquids Code. It covers fire and explosion prevention, storage of liquid in containers, storage systems, and processing facilities. More specific codes and standards for other aspects of biofuel stations are found in the following table. Many of these codes and standards also apply to conventional gasoline fueling stations.

Fueling Station Aspect	Pertinent Codes and Standards
Containers	NFPA 30 American Society for Testing and Materials (ASTM) Standards for Containers American National Standards Institute (ANSI)/ Underwriters Laboratory (UL) Standards for Containers US Department of Transportation (DOT) 10CFR49
Dispensing Operations	NFPA 30 NFPA 30A NFPA 385 NFPA 10
Storage of Liquids	UL 2245, 2080, 2085 NFPA 91, 30A Steel Tank Institute (STI) Corrosion Control Standards

Relevant policies and laws

There are several reasons to install a public fueling station for your jurisdiction. One reason is that installing an alternative fueling station and promoting the alternative fuel helps California achieve its climate mitigation goals.

Strategy Origin	Year	Objectives	Goals and Milestones
Federal Clean Air Act	1970	Air Quality	80 percent reduction of NOx by 2023
Federal Energy Policy and Conservation Act	1975	Petroleum Reduction	Set into place the Corporate Average Fuel Economy to improve fuel economy.
Federal Energy Policy Act	1992	Petroleum Reduction	Defined alternative fuels and required certain fleets to increase alternative fuel vehicle acquisitions
AB 1493 (Pavley regulations)	2002	GHG Reduction	17 percent reduction in climate change emissions from light-duty fleet by 2020 and 25 percent overall reduction by 2030
Petroleum Reduction and Alternative Fuel Goals (*Reducing California's Petroleum Dependence)*[5]	2003	Petroleum Reduction	This document was developed In response to AB 2076 (Shelley). It set goals to reduce petroleum fuel use to 15 percent below 2003 levels by 2020, and recommended the State adopt a goal of 20 percent nonpetroleum fuel use in the year 2020
AB 1007 (*State Alternative Fuels Plan*)	2005	GHG Reduction	Develop and adopt a plan that sets increased alternative fuel use goals for years 2012, 2017, and 2022
Energy Policy Act of 2005; Energy Independence and Security Act of 2007	2005	Renewable Fuel Standard	36 billion gallons of renewable fuel used in the US by 2022
Executive Order S-3-05	2005	GHG Reduction	By 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels
AB 32 (Global Warming Solutions Act)	2006	GHG Reduction	Reduce GHG emissions to 1990 levels by 2020
Executive Order S-06-06 (*Bioenergy Action Plan*)	2006	In-State Biofuels Production	Produce in California 20 percent of biofuels used in state by 2010, 40 percent by 2020, and 75 percent by 2050
Low Carbon Fuel Standard	2007	GHG Reduction	10 percent reduction in carbon intensity of transportation fuels in California by 2020
Governor Brown Inaugural Address 2015	2015	Petroleum Reduction	Reduce petroleum use in cars and trucks by up to 50 percent within the next 15 years (2030)

[5] Reducing California's Petroleum Dependence, an Energy Commission and ARB, joint agency report, August 2003, publication #P600-03-005F.

Hydrogen Fuel Cells

What is hydrogen?

Hydrogen is found in organic matter and in water (H_2o). The majority of hydrogen for transportation is produced by extracting it from natural gas. Hydrogen can also be extracted from water; however, this is a more energy intensive method

Hydrogen fuel cell electric vehicle (FCEV) is a vehicle that is powered by hydrogen. Hydrogen is pumped into pressurized cylinders in the vehicle. The fuel cell converts the hydrogen into electrical energy to drive the motor.

Fuel cell vehicles are zero-emission vehicles that emit water vapor and warm air as exhaust.

How many public hydrogen stations are in the San Diego region?

The region's first public hydrogen station is scheduled to be installed by early 2016. More are expected by 2020.

How much does it cost to fuel my vehicle?

According to the Department of Energy, a full tank of compressed hydrogen should cost around $50 (and provide a range of approximately 300 miles). The DOE also estimates that the future costs will fall to $30 to fill a tank of hydrogen.

The target price for hydrogen is $4.00/gallon of gasoline equivalent.

Auto manufacturers such as Toyota and Hyundai provide vehicle buyers free hydrogen for three years.

FACTS ABOUT HYDROGEN

- Much of the hydrogen in the US is produced in three states: California, Louisiana, and Texas (Energy Information Administration, EIA)
- Approximately 10-11 million metric tons of hydrogen are produced in the US each year; enough to power 20-30 million cars or 5-8 million homes (EIA)
- Hydrogen fuel can be made from many sources, including wind, solar, biogas and biomass in addition to natural gas
- A fuel cell is required to last 5,000 hours or 150,000 miles before needing to be replaced

Courtesy of CA Fuel Cell Partnership

What types of vehicles use hydrogen?

Hydrogen fuel cells are a fairly new technology, but there are still plenty of vehicles that can use this type of fuel.

- Passenger vehicles
- Shuttle buses
- Transit buses
- Forklifts

A sampling of the available vehicles can be found on the California Fuel Cell Partnership (CaFCP) website: http://www.cafcp.org/carsandbuses/makesandmodels.

Did you know…

- More than 80 hydrogen-powered buses operate globally, include 15 in California.
- Fuel Cell vehicles take less than five minutes to refuel.
- FCEVs are zero-emission and run on compressed hydrogen fed into a fuel cell "stack" that produces electricity to power the vehicle.
- Learn about the Fuel Cell Electric Bus Roadmap for California here: http://www.cafcp.org/sites/files/FCEB-RoadMap-Infographic.pdf.

Where can I learn more about hydrogen?

- Alternative Fuel Data Center: www.afdc.energy.gov/fuels/hydrogen.html
- California Fuel Cell Partnership: www.fuelcellpartnership.org/
- DOE Fuel Cells Technology Office: energy.gov/eere/fuelcells/fuel-cell-technologies-office
- FuelCells.org: www.fuelcells.org/
- Fuel Cell & Hydrogen Energy Association: www.fchea.org/
- International Association for Hydrogen Energy: www.iahe.org
- Hydrogen Analysis Resource Center: hydrogen.pnl.gov/
- Fuel Cell Today: fuelcelltoday.com/

Deciding whether to install fueling stations

The California Fuel Cell Partnership (CAFCP) has published *The California Roadmap* (2012)[1] and *Hydrogen Progress, Priorities and Opportunities* (2014)[2], a document that reassesses the CaFCP's *California Road Map*, to bring more fuel cell vehicles on California's roads. The goal is to build hydrogen stations near existing gas stations within six minutes of where FCEV drivers live and work. Hydrogen stations should be built in destination spots as well.

Jurisdictions looking to install hydrogen fueling stations may reference *The California Roadmap*, *Hydrogen Progress, Priorities and Opportunities* or visit http://cafcp.org/carsandbuses/caroadmap to better align their plans with the CaFCP's overarching blueprint.

Case Studies

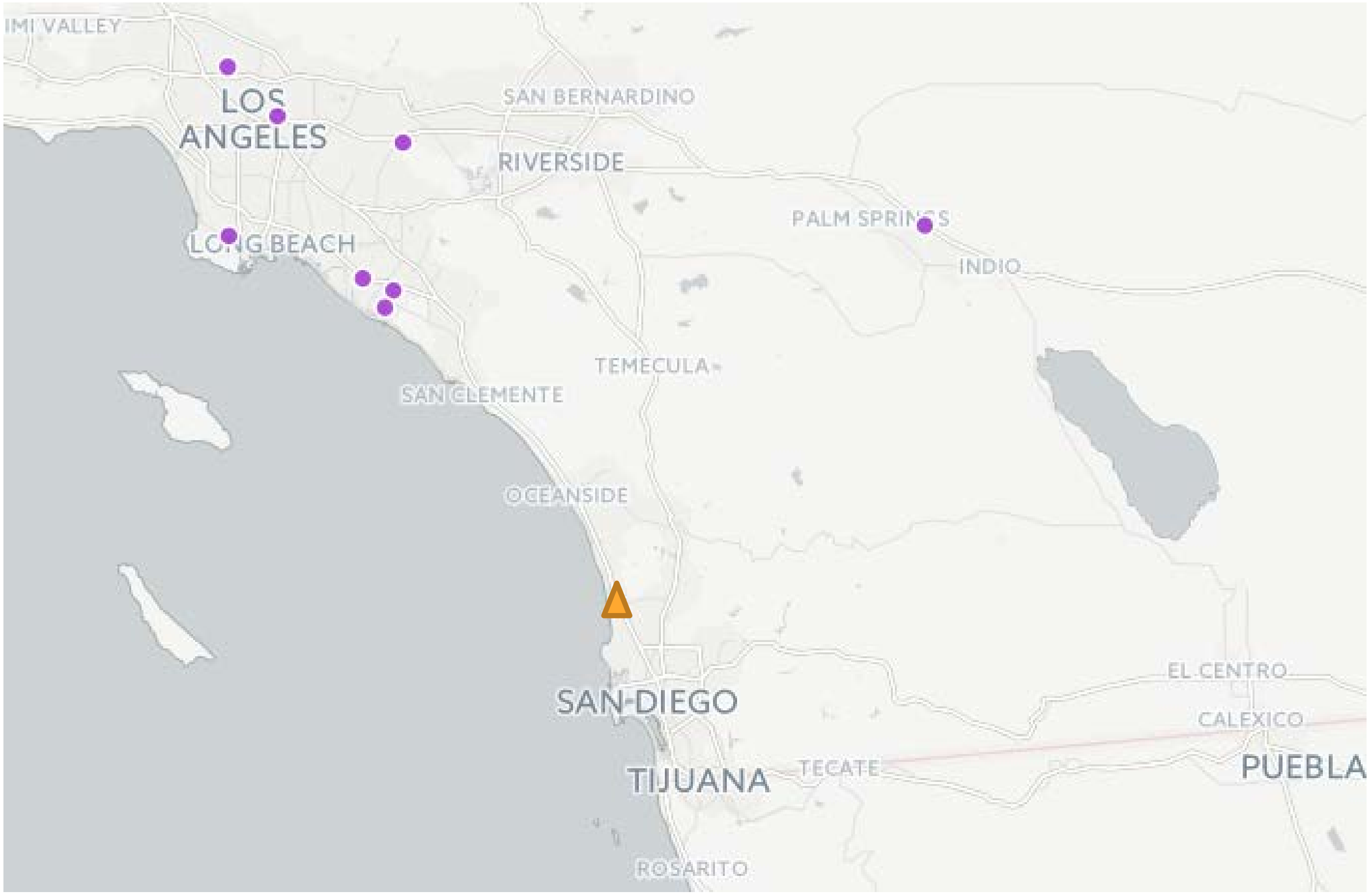
SCAQMD Opens a Hydrogen Fueling Station: The South Coast Air Quality Management District (SCAQMD) opened one of the largest capacity hydrogen fueling stations in California in the City of Diamond Bar. Learn how it came to be: http://www.aqmd.gov/home/library/public-information/2015-news-archives/hydrogen-station-opening.

City of Oakland Alameda-Contra Costa Transit District (AC Transit) Hydrogen Station: Since 2006, the City of Oakland has hosted a hydrogen station at the Chevron AC Transit station to fuel their fuel cell buses and vehicles as part of the U.S. Department of Energy's Infrastructure Demonstration and Validation Project. Read more about the project here: http://www.hydrogen.energy.gov/permitting/fueling_case_studies_california.cfm.

More case studies can be found on the California Fuel Cell Partnership's H2 Readiness Guide.[3]

[1] http://cafcp.org/sites/files/20120814_Roadmapv(Overview).pdf
[2] http://cafcp.org/sites/files/Roadmap-Progress-Report2014-FINAL.pdf
[3] http://cafcp.org/sites/files/H2-Best-Practices_Final-Single-Page.pdf, page 17.

Map of Existing and Future Public Hydrogen Fueling Stations in the San Diego Region



*circles indicate existing fueling stations; triangles indicate planned stations
(Map updated as of August 2015)
http://www.afdc.energy.gov/fuels/hydrogen_locations.html

What are the costs of installing a hydrogen fueling station?

The cost of installing a charging station varies based on the type of fueling station and location in which it will be installed. Hydrogen stations are currently cost-shared by the State of California through the Alternative and Renewable Fuel and Vehicle Technology Program.[4]

A "hydrogen station" is typically added to an existing fueling station (gasoline or compressed natural gas, CNG). Hydrogen fueling equipment includes a dispenser, storage tubes and a compressor. Like CNG, hydrogen is a compressed gas that is stored above ground in cylinders. Hydrogen can be delivered to the station as a compressed gas or as a liquid, which is then warmed up to form a gas and then compressed. Hydrogen can also be made on site from natural gas or water. If the station makes hydrogen on site, the footprint can be significant to accommodate for the production equipment.

This document from NREL provides cost estimates for a station installation: http://www.nrel.gov/docs/fy13osti/56412.pdf.

[4] http://www.energy.ca.gov/contracts/transportation.html

How to fund a fueling station?

The California Energy Commission's (CEC) Alternative and Renewable Fuel Vehicle and Technology program (ARVFTP) provides grant opportunities for eligible participants to apply and get up to 70% of the capital cost of their hydrogen station funding covered. To date, the ARFVTP has funded 48 hydrogen fueling stations. In the 2015-2016 fiscal year, the CEC anticipates $20 million will be allocated to hydrogen infrastructure projects.

The copy of their last competitive grant for hydrogen fueling stations is: http://www.energy.ca.gov/contracts/PON-12-606/. Public-private partnerships have been successful when pursuing these grant opportunities.

Permitting a hydrogen fueling station

The siting of a hydrogen fueling station and the actual electrical and mechanical work all require permits. Along with permits, fueling stations also need to follow specific fire codes and developers need to work closely with fire marshal or fire department to ensure the safety of the station and its users.

The Permitting Process

The following table shows the potential permits required when constructing and operating a hydrogen fueling station.

Permit	Agency	Permit/Permit Scope
Air emission impacts	Air District	Air Quality Permit or No impact declaration
California Accidental Release Prevention Program (Cal-ARP)	Local administering agency and US EPA	Approved submission or finding of non-applicability/ requires an evaluation of the impact of the release of a regulated materials from the site and a plan in the event of a release (see below)
California Environmental Quality Act (CEQA)	Self-enforcing, but local authority having jurisdiction (AHJ) has first opportunity to enforce	CEQA approval or finding of no significant impact/environmental agency having jurisdiction (see below)
Construction	Building Department	Permit to Construct General/Address safety construction issues
Demolition	Building Department	Construction Permit/Demolish structures required for dispenser construction
Drainage and site grading	Engineering Department	Permit to Construct Drainage/Modification to sewer drainage
Electrical	Building Department	Electrical permit/modification to electrical service
Fire safety	Fire Department Plans Review Office	Fire Safety Permit/General fire code compliance
Food services	Health Department	Food sales
Water quality	Water Quality Management Agency	Liquid discharges to the environment
Zoning	Local zoning board	Zoning approval/allows construction and operation at defined location

This chart is from *Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations* by C. Rivkin, C. Blake, R. Burgess, W. Buttner, and M. Post. http://www.nrel.gov/docs/fy13osti/56223.pdf.

California Environmental Quality Act (CEQA) [5]

- Installing a hydrogen station generally is a project under CEQA.
- Local governments have filed categorical exemptions or prepared a negative declaration under CEQA. Commonly filed exemptions for hydrogen stations are:
    - o 15301 (Class 1) for Existing Facilities
    - o 15303 (Class 3) for Small Structures

California Accidental Release Program (Cal-ARP)[6]

- Hydrogen stations are exempt from Cal-ARP if <10,000 pounds of hydrogen is stored or processed on site.[7]
- If more than 10,000 pounds of hydrogen, facility owner must prepare a document that includes the following:
    - o Regulated substances held onsite at the stationary source,
    - o Offsite consequences of an accidental release of a regulated substance,
    - o The accident history at the stationary source,
    - o The emergency response program for the stationary source,
    - o Coordination with local emergency responders,
    - o Hazard review or process hazard analysis,
    - o Operating procedures at the stationary source,
    - o Training of the stationary source's personnel,
    - o Maintenance and mechanical integrity of the stationary source's physical plant, and
    - o Incident investigation.

[5] California Fuel Cell Partnership. *H2 Readiness Guide*. http://cafcp.org/sites/files/H2-Best-Practices_Final-Single-Page.pdf
[6] Ibid.
[7] www.caloes.ca.gov/HazardousMaterials/Pages/CalARP-Proposed-Regulations-2013.aspx.

Steps for Permitting[8]

The following steps outline the administrative process for reviewing and approving projects. These are just general steps and the actual process may vary.

1. Pre-submittal review and feedback (optional)
2. Review and feedback to applicant
3. Formal submission of application
4. Public meeting (as needed)
5. Make adjustments in permit application based on public input (as needed)
6. Review of modified application and feedback to application
7. Resubmittal of modified application
8. Issuance of permit
9. Project construction
10. Site inspection to determine that project built as shown in final design plans
11. Periodic inspections to determine ongoing compliance

Construction and Setbacks

Below is an example of a hydrogen station layout showing the setbacks, which may vary. More details about the relevant codes and standards regarding setbacks and construction can be found on the AFDC website: http://www.afdc.energy.gov/fuels/hydrogen_infrastructure.html.

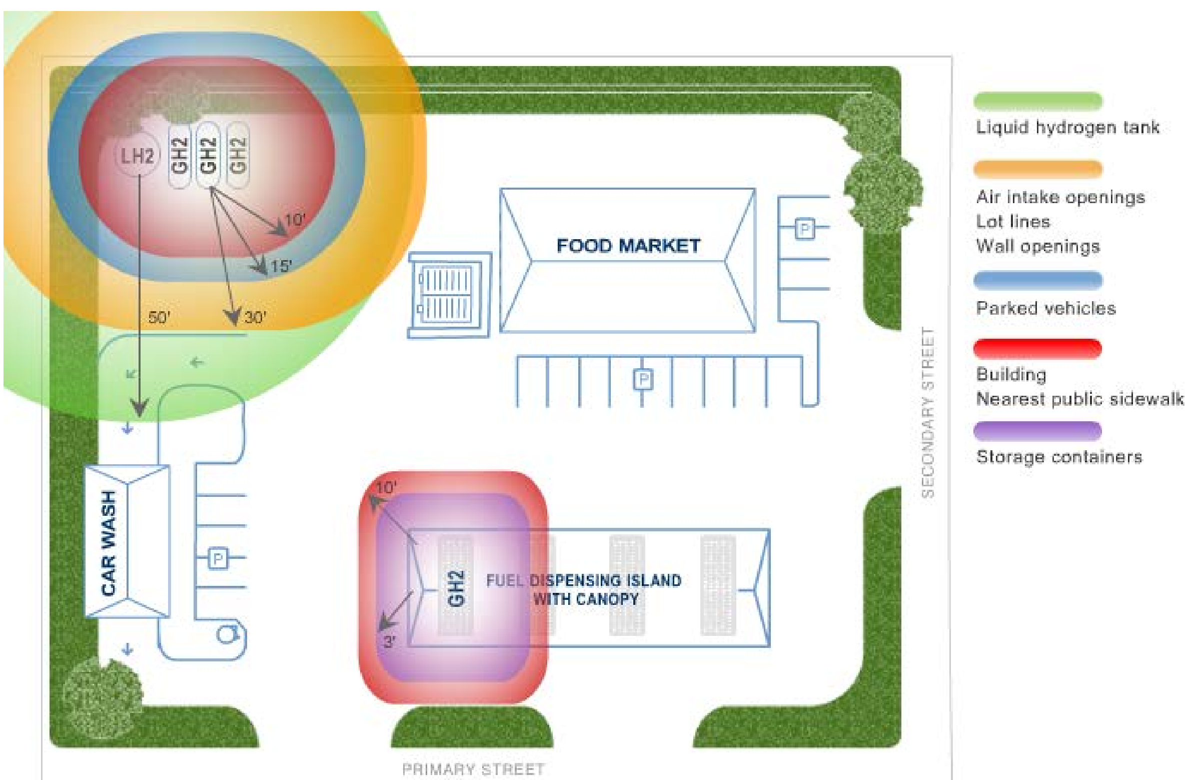


Photo via Alternative Fuel Data Center

[8] C. Rivkin, C. Blake, R. Burgess, W. Buttner, and M.Post. November 2012. *Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations*. National Renewable Energy Laboratory. http://www.nrel.gov/docs/fy13osti/56223.pdf.

Codes and Standards

When installing a fueling station, it is important to adhere to the necessary codes and standards. This guidance document provides a thorough list of codes and standards when developing hydrogen infrastructure: http://www.nrel.gov/docs/fy13osti/56223.pdf.

Codes, standards, and regulations for the generation, installation, storage, piping, use, and handling of hydrogen fall under the National Fire Prevention Association standards (NFPA2).[9]

Provisions apply to the production, storage, transfer, and use of hydrogen in all occupancies and on all premises. NFPA 2 includes fundamental requirements for hydrogen in both gaseous and liquid phases and contains additional use-specific categories, such as vehicle fueling facilities, systems for fuel cell power and generation, applications involving combustion processes and special atmospheres, and operations in the lab. More specific codes and standards for other aspects of biofuel stations are found in the following table. Many of these codes and standards also apply to conventional gasoline fueling stations.

The Department of Energy has a guidebook for permitting hydrogen fuel dispensing facilities.[10] This guidebook is extremely thorough and provides information regarding what the basic installation of a hydrogen station looks like, the safety requirements that a facility should meet, system requirements, and a case study as well.

Hydrogen Certificate for Code Officials

For a more in-depth understanding of the codes and permitting that are involved for hydrogen fueling station development, the U.S. Department of Energy offers an online Introduction to Hydrogen for Code Officials, which contains learning modules and a certificate of completion.

Access it online: http://www.hydrogen.energy.gov/training/code_official_training/

Fueling Station Aspect	Pertinent Codes and Standards
Containers	NFPA 1, 2, 70 (NEC)
Dispensing Operations	NFPA 2 SAE J2601 Fueling Protocol ASME B31.12 Hydrogen Piping and Pipelines
Storage of Hydrogen	UL 2075 SAE J2579 Vehicle Fuel Systems

[9] http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=2
[10] http://www.pnnl.gov/fuelcells/docs/permit-guides/module2_final.pdf

Natural Gas

FACTS ABOUT NATURAL GAS

- On a well-to-wheels basis, natural gas vehicles (NGVs) produce 22% less greenhouse gas (GHG) than comparable diesel vehicles and 29% less than gasoline vehicles
- Nearly one in five transit buses in San Diego County run on CNG
- CNG passenger vehicles are eligible for California's HOV lane access decal, which allows single-occupant vehicles to drive in the HOV lanes

What is natural gas?

Natural gas used as a transportation fuel is used as compressed natural gas (CNG) or liquefied natural gas (LNG). Natural gas is a mixture of hydrocarbons, predominantly methane (CH_4).

CNG is natural gas that has been compressed and stored as a gas in high pressure tanks up to 3,600 pounds per square inch (psi). LNG is natural gas that is cooled to a temperature below -260˚F.

Nearly 87% of U.S. natural gas is domestically produced and boasts 20-40% less carbon monoxide and 80% particulate matter than gasoline. According to the Natural Gas Vehicle Coalition, there are about 112,000 natural gas vehicles on U.S. roads.

How many public natural gas stations are in the San Diego region?

There are approximately eight public CNG stations in the San Diego region, with two more in development.

How much does it cost to fuel my vehicle?

CNG is generally less expensive than gasoline. Further, the price per gallon equivalent of CNG does not experience volatile fluctuations like gasoline or diesel.

24-month average*	
Gasoline	$3.35
CNG	$2.13
Savings	$1.22

*June 2013-June 2015

What types of vehicles can use natural gas?

Several types of vehicles can use natural gas. It is a versatile fuel.

- Vans
- Pick-up trucks
- Refuse haulers
- Low-speed vehicles
- Med- and heavy-duty trucks
- Transit Buses
- Light-duty vehicles

Types of natural gas vehicles

- **Dedicated**: These vehicles are designed to run only on natural gas.
- **Bi-fuel**: These vehicles have two separate fueling systems that enable them to run on either natural gas or gasoline.
- **Dual-fuel**: These vehicles are traditionally limited to heavy-duty applications, have fuel systems that run on natural gas and use diesel fuel for ignition assistance.

Renewable Natural Gas (RNG), also called biomethane, or sustainable natural gas, is produced from biogas (i.e., swamp gas, landfill gas, or digester gas). When processed to a higher purity standard, RNG can be used as an alternative fuel in NGVs.

Where can I learn more about natural gas?

- Alternative Fuel Data Center: www.afdc.energy.gov/fuels/natural_gas.html
- AFDC Renewable Natural Gas: www.afdc.energy.gov/fuels/emerging_biogas.html
- Natural Gas Vehicles for America: www.ngvamerica.org/
- CNG Now!: www.cngnow.com/
- California Natural Gas Vehicle Coalition: www.cngvc.org/
- Department of Energy: energy.gov/natural-gas
- American Gas Association: www.aga.org

Deciding whether to install fueling stations

The following tools and resources are available to help guide you through the decision-making process when considering installing natural gas fueling stations or adopting them into your fleet.

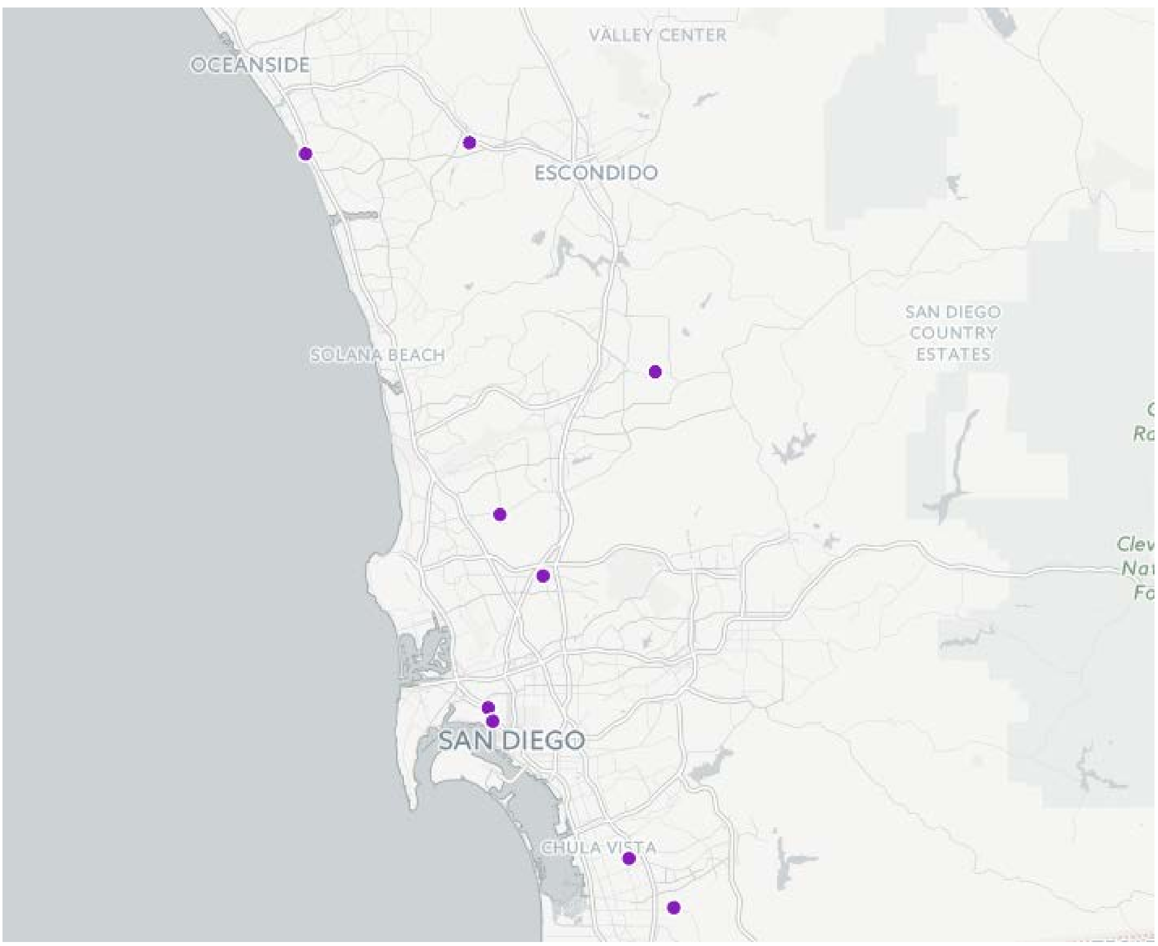
Case Studies

City of Dublin: The City of Dublin, Ohio opened a natural gas fueling station thanks to a grant from the U.S. Department of Energy and Clean Fuels Ohio for a CNG project. This project also made possible the acquisition of 44 CNG City vehicles. Read more about the process on the City of Dublin's website: http://dublinohiousa.gov/city-of-dublin-compressed-natural-gas-cng-fueling-station/.

Pennsylvania's public-private CNG fueling plan: Pennsylvania officials have planned to build a statewide network of CNG stations to not only encourage the transition of the State's transit fleet to CNG, but to promote more public access to CNG stations. Read more about the plan, contract, and process here: http://ngvtoday.org/2014/10/22/tens-of-millions-in-play-in-pennsylvania-public-private-cng-fueling-plan/.

The following map shows the location of public CNG fueling stations in the San Diego Region.

Map of Public CNG Fueling Stations in San Diego Region



(Map updated as of August 2015)
http://www.afdc.energy.gov/fuels/natural_gas_locations.html

Installing natural gas fueling stations

You have decided that it makes sense for the jurisdiction should install public refueling stations. These tools are intended to help you better understand the costs of installing CNG stations.

Vehicle and Infrastructure Cash-Flow Evaluation Model (VICE)

This tool allows fleet managers to assess the financial soundness of converting their fleet vehicles to CNG. It takes into consideration ownership models, project type, vehicles, and infrastructure costs. Before getting started with the tool, fleet managers should have answers to the following questions:

- Are you thinking of procuring only vehicles or both vehicles and fueling infrastructure?
- Will you be investing in NGVs and fueling infrastructure at the same time?
- Is your fleet tax exempt?
- What types of vehicles are you considering to replace? (transit bus, school bus, trash truck, paratransit shuttle, delivery truck, gasoline pick-up truck, or gasoline taxi) Keep in mind the following:
  - Incremental cost of vehicle
  - Average vehicle miles traveled (VMT)
  - Average vehicle life
  - Fuel economy
- Any infrastructure tax credit or incentives available? (see below for more on incentives)
- Number of NGVs you want to acquire and your timeline for acquisition.

The tool, an excel spreadsheet, can be found here: http://www.afdc.energy.gov/vice_model/.

Requests for Proposals

A public agency may wish to make CNG stations available to the public. Public agencies often will contract these services to a third-party vendor, resulting in a private-partnership. Requests for proposals (RFPs) are often required to execute these partnerships. These are some examples of RFPs:

- Oregon Department of Transportation wanted to use CMAQ funding to increase the number of CNG stations in the state: http://www.oregon.gov/ODOT/TD/AT/docs/CMAQ/CNG%20CMAQ%20RFP.pdf.
- Pennsylvania Department of Transportation sought a third-party vendor to install up to 37 CNG stations in the state through a public-private partnership (see above): http://www.dot.state.pa.us/public/Bureaus/Press/P3/RFQ_Addendum_4-Clean_Copy.pdf.

Incentives

The California Energy Commission's **Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP)**[1] is a competitive grant program that provides up to $100 million annually towards advanced technology projects. In Fiscal Year 2015-2016, there is an anticipated $1.5 million available for natural gas infrastructure projects.

Federal programs such as Federal Transit Authority Grants and the Congestion Mitigation and Air Quality Improvement Program may be used to fund infrastructure or vehicle acquisition projects. More details are found here: https://www.ngvamerica.org/government-policy/federal-incentives/federal-ngv-grant-programs/.

[1] http://www.energy.ca.gov/contracts/transportation.html

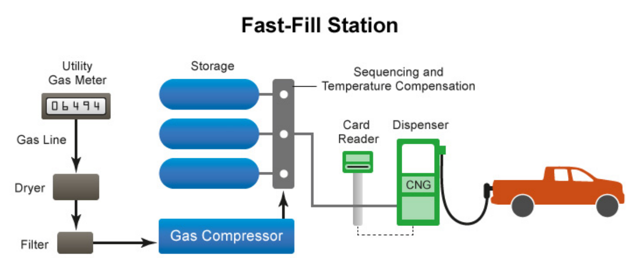
Permitting natural gas fueling stations

The design and construction of a natural gas fueling station require permits. Along with permits, fueling stations also need to follow specific fire codes and developers need to work closely with fire marshals or the local fire department to ensure the safety of the structure.

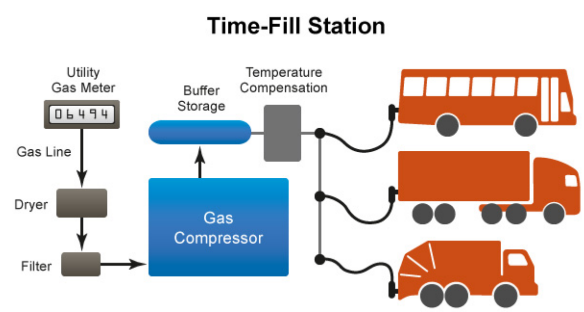
Permitting and Construction Process[2]

- At least 9-10 months before construction is scheduled to begin, the developer needs to schedule a meeting with the permitting agency's planning and building departments to discuss:
  - Zoning classifications
  - Setbacks required from the property line
  - Environmental review (CEQA)
  - Fees
- Local jurisdiction receives permitting package from applicant
  - Civil drawings and specifications
  - Mechanical drawings and specifications
  - Electrical drawings and specifications
  - Electrical distribution system, panel schedules, grounding and load calculations
  - Construction schedule is set

Different Types of Stations[3]



Fast-fill station: A fast-fill station receives fuel from a local utility line at low pressure and then an on-site compressor converts the gas to a high pressure. After being compressed, the fuel is stored so that it is available for a quick fill-up. These stations are most suitable for retail situations in which many light-duty vehicles may arrive throughout the day and need to fill up quickly.



Time-fill station: A time-fill station receives fuel from a local utility line at low pressure and then an on-site compressor converts the gas to a high pressure. However, the compressed fuel is not stored. Vehicles fill up directly from the compressor. Usually there is a tank with compressed fuel as well, but that is meant to keep the compressor from turning on and off throughout the day. These stations are suitable for vehicles with large tanks that refuel at a central location every night.

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[2] Adapted from Clean Fuel Connection, *Permitting CNG and LNG Stations: Best Practices Guide for Host Sites and Local Permitting Authorities*. http://www.advancedtransportationcenter.org/wp-content/uploads/2014/10/CNG_Best_Practices-Enid_Joffe_2014.pdf.
[3] Images of fast-fill and time-fill stations from Clean Cities Alternative Fuel Data Center: http://www.afdc.energy.gov/fuels/natural_gas_cng_stations.html.

Ownership Models for Stations[4]

- Outright purchase
- Financing through local distribution utility – the utility makes the capital investment and then the customer pays back the utility through monthly bills
- Capital equipment lease – financing equipment for the station
- Third-party ownership – third-party owns and operates the station for a fixed monthly fee
- Compression services rental – third-party owns and services the equipment but the customer operates the station

Typical CNG Station Components[5]

- Compressor
- Dispenser with point of sale or fuel management system
- Dryer (removes moisture from gas)
- Storage
- Priority panel (controls the storage)
- Program logic controller (controls the compressor parameters)
- Sequencing panel (controls flow from storage)

Permitting Natural Gas Fueling Stations

Read more online at the Bay Area Air Quality Management District's document *Permitting CNG and LNG Stations: Best Practices Guide for Host Sites and Local Permitting Authorities*. http://tinyurl.com/obb3553.

The Clean Fuel Connection also has developed a Best Practices document for local permitting authorities on CNG station installations: http://www.advancedtransportationcenter.org/wp-content/uploads/2014/10/CNG_Best_Practices-Enid_Joffe_2014.pdf.

The City of San Diego Fire Department has a specific permit for the installation of CNG fueling infrastructure: http://www.sandiego.gov/fire/pdf/hazapp.pdf.

The City of San Diego's Fee schedule is found here: http://www.sandiego.gov/fire/pdf/feeschedule.pdf.

[4] Ibid.
[5] Ibid.

Codes and Standards

When installing a fueling station, it is important to adhere to the necessary codes and standards. This guidance document provides a thorough list of codes and standards when developing natural gas infrastructure: http://www.afdc.energy.gov/pdfs/48611.pdf.

The general standards for natural gas fall under NFPA 52 Gaseous Fuel Systems Code.[6] This code addresses the design, installation, compression, storage, and dispensing system of CNG and LNG. It seeks to mitigate the risk of fire and explosion hazards. More specific codes and standards are in the table below.

Dispensing and Storage	Pertinent Codes and Standards
Dispensing Component Standards	NFPA 52 Canadian Standards Association (CSA) NGV 2, 1, 3.1, 4
Dispensing Operations	NFPA 52
Dispensing Vehicle Interface	SAE J1616 RP, J2406 RP
Storage Containers	NFPA 52

[6] http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=52

Relevant policies and laws

There are several reasons to install a public fueling station for your jurisdiction. One reason is installing an alternative fueling station and promoting the alternative fuel helps California achieve its climate mitigation goals.

Strategy Origin	Year	Objectives	Goals and Milestones
Federal Clean Air Act	1970	Air Quality	80 percent reduction of NOx by 2023
Federal Energy Policy and Conservation Act	1975	Petroleum Reduction	Set into place the Corporate Average Fuel Economy to improve fuel economy.
Federal Energy Policy Act	1992	Petroleum Reduction	Defined alternative fuels and required certain fleets to increase alternative fuel vehicle acquisitions
AB 1493 (Pavley regulations)	2002	GHG Reduction	17 percent reduction in climate change emissions from light-duty fleet by 2020 and 25 percent overall reduction by 2030
Petroleum Reduction and Alternative Fuel Goals (*Reducing California's Petroleum Dependence)*[7]	2003	Petroleum Reduction	This document was developed In response to AB 2076 (Shelley). It set goals to reduce petroleum fuel use to 15 percent below 2003 levels by 2020, and recommended the State adopt a goal of 20 percent nonpetroleum fuel use in the year 2020
AB 1007 (*State Alternative Fuels Plan*)	2005	GHG Reduction	Develop and adopt a plan that sets increased alternative fuel use goals for years 2012, 2017, and 2022
Energy Policy Act of 2005; Energy Independence and Security Act of 2007	2005	Renewable Fuel Standard	36 billion gallons of renewable fuel used in the US by 2022
Executive Order S-3-05	2005	GHG Reduction	By 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; by 2050, reduce GHG emissions to 80 percent below 1990 levels
AB 32 (Global Warming Solutions Act)	2006	GHG Reduction	Reduce GHG emissions to 1990 levels by 2020
Executive Order S-06-06 (*Bioenergy Action Plan*)	2006	In-State Biofuels Production	Produce in California 20 percent of biofuels used in state by 2010, 40 percent by 2020, and 75 percent by 2050
Low Carbon Fuel Standard	2007	GHG Reduction	10 percent reduction in carbon intensity of transportation fuels in California by 2020
Governor Brown Inaugural Address 2015	2015	Petroleum Reduction	Reduce petroleum use in cars and trucks by up to 50 percent within the next 15 years (2030)

[7] Reducing California's Petroleum Dependence, an Energy Commission and ARB, joint agency report, August 2003, publication #P600-03-005F.

In addition to the above, The Fleet Rule for Public Agencies and Utilities (Rule) was set forth by the California Air Resources Board. The Rule mandates that public agencies and utility vehicles reduce diesel particulate matter emissions from their affected vehicles through Best Available Control Technology or by procuring alternative fuel vehicles, such as CNG.[8]

[8] http://www.arb.ca.gov/msprog/publicfleets/publicfleets.htm

Propane Autogas

FACTS ABOUT PROPANE AUTOGAS

- There are over 80,000 bus, taxi, and deliver services that use propane autogas in their fleets
- Propane autogas is the third most common transportation fuel in the world
- Propane autogas accounts for 2% of the nation's energy use
- There are more propane autogas fueling stations available in the U.S. than any other alternative fuel station (aside from electric charging stations) as of July 2015

What is propane autogas?

Propane autogas is also known as liquefied petroleum gas (LPG).

While gaining popularity as an alternative fuel in the United States, propane autogas is the third most common transportation fuel in the world.

Nearly all U.S. propane autogas is produced domestically and over half of it is a by-product from natural gas purification.

Propane autogas is a clean burning fossil fuel with lower greenhouse gas emissions than gasoline.

How many public propane autogas stations are in the San Diego region?

There are 15 public propane autogas stations in the San Diego region as of July 2015.

How much does it cost to fuel my vehicle?

Propane autogas is generally less expensive than gasoline.

24-month average*	
Gasoline	$3.35
LPG	$2.86
Savings	$0.49

*June 2013-June 2015

What kind of vehicles use propane autogas?

- Forklifts
- Low-Speed Vehicles
- Buses
- School Buses
- Lawn equipment
- Trucks
- Shuttles
- Delivery services

Where can I learn more?

- Alternative Fuel Data Center: www.afdc.energy.gov/fuels/propane.html
- National Propane Association: www.npga.org
- Propane Education and Research Council: www.propanecouncil.org
- Autogas USA: www.autogasusa.org
- Propane: www.propane.com

Deciding whether to install fueling stations

The following tools and resources are available to help guide you through the decision-making process when considering installing propane autogas fueling stations or adopting them into your fleet.

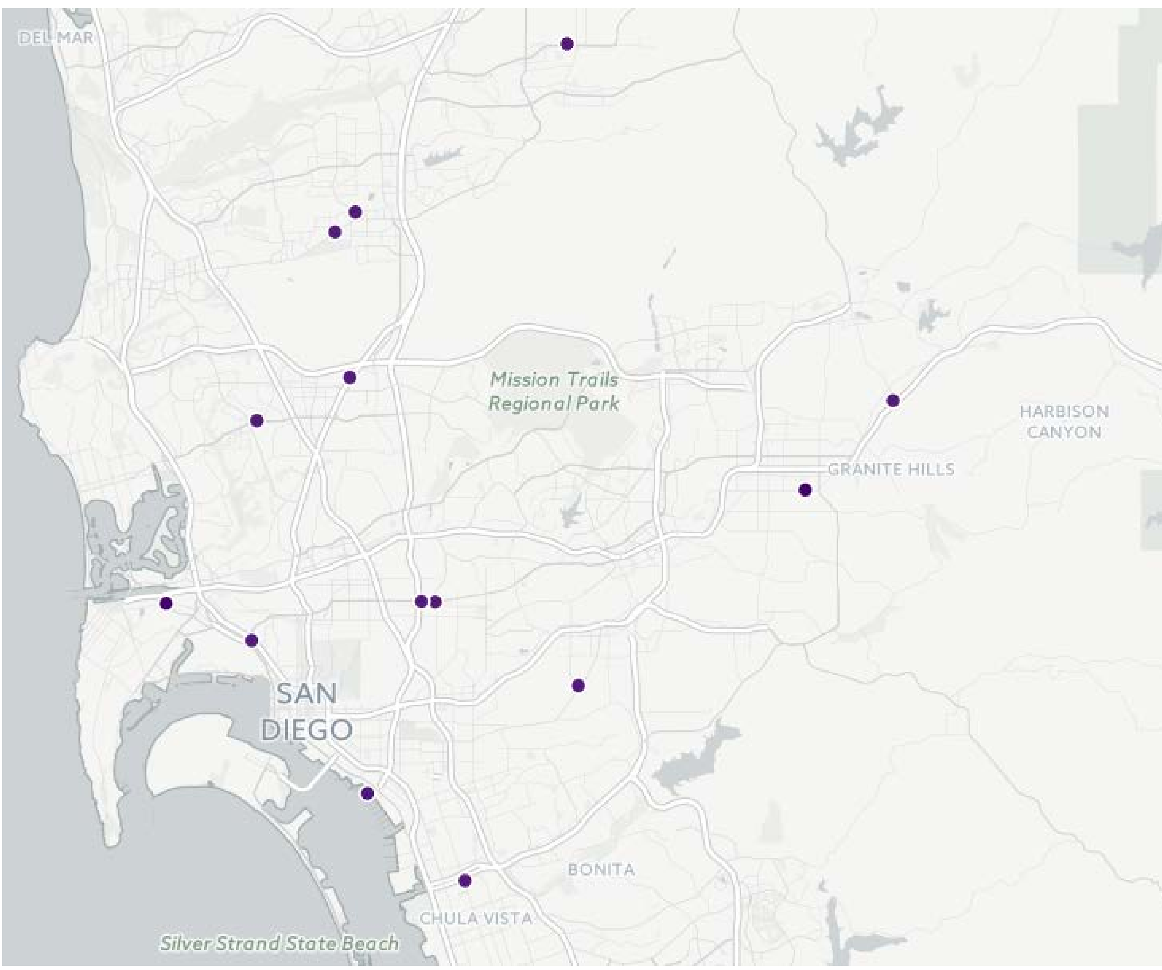
Case Studies

Propane Autogas School Bus Fleets: Bus fleets using propane autogas have saved school districts nearly 50% on a cost per mile basis for fuel and maintenance. The Alternative Fuel Data Center developed this case study, which highlights four school bus fleets in Texas and one in Virginia. Read more at: http://www.afdc.energy.gov/uploads/publication/case-study-propane-school-bus-fleets.pdf.

Propane Autogas is a Reliable Fleet Fuel: This Alternative Fuel Data Center case study notes how successful propane autogas has been as a fleet fuel in fleets across the country. This discusses how several fleets across the country have found success with propane autogas. Read more at http://www.afdc.energy.gov/case/2043.

Chula Vista Elementary School District: The Chula Vista Elementary School District has 10 propane autogas buses out of its fleet of 118. These propane autogas buses were made possible thanks to a state funding opportunity. Each year, these propane autogas vehicles drive an average of 15,000 miles per year.

Map of Public LPG Fueling Stations in the San Diego Region



(Map updated as of August 2015)
http://www.afdc.energy.gov/fuels/propane_locations.html

Installing propane fueling stations

Propane autogas production, storage, and bulk distribution are found across the United States. The following information may be helpful when building a station.

Ownership Models

1. Owning a larger station: Fleets can choose to own a large propane autogas station in order to benefit from special fuel pricing. These stations typically accept a full truck of autogas from the supplier (about 10,000 gallons).
2. Leasing equipment: Fleets new to propane autogas or with a fleet size of 25-50 vehicles may choose to lease the tank, pump, and dispensing equipment from a fuel supplier in return for a fuel supply contract. Infrastructure to support the equipment is paid for by the lessee (i.e., electricity, permits, etc.).

What are the costs of installing a fueling station?

The Department of Energy has a comprehensive guide , *Costs Associated with Propane Vehicle Fueling Infrastructure* (http://www.afdc.energy.gov/uploads/publication/propane_costs.pdf), which details the range of infrastructure costs, and other cost considerations (such as permitting), with recommendations from the propane autogas industry.

Estimated Propane Autogas Station Cost[1]

Station Size	Cost Range
Small Station 500-1,200-gal storage tank 1 single-hose dispenser	Purchase new: $25,000-$50,000
Medium Station 2,000-gal storage tank 2 dual-hose dispensers	Purchase new: $50,000-$75,000
Large Station 15,000-18,000-gal storage tank 2-4 dual-hose dispensers	Purchase new: $150,000-$300,000 Leasing: $15,000-$50,000 per year

[1] Summarized from AFDC's *Costs Associated with Propane Vehicle Fueling Infrastructure*. August 2014. http://www.afdc.energy.gov/uploads/publication/propane_costs.pdf.

Permitting propane autogas fueling stations

Propane autogas fueling stations and dispensers can be placed alongside gasoline, diesel, or other alternative fuels. The refueling infrastructure is very similar to gasoline and diesel refueling equipment.

Types of Stations Available (Typical)

Small station:

- 500-2,000 gallon tank
- Services about 25-50 vehicles
- 1-2 filling stations

Large station:

- 18,000-30,000 gallon tank
- Services over 50 vehicles
- 2-4 filling stations

Common characteristics of propane autogas stations:

- Propane autogas tanks are above ground, held horizontally or vertically
- New nozzles allow for smooth connection and disconnection
- Tanks should be approximately 10-25 feet from a building
- Propane autogas tank pressure is about 100-200 psi
- Filling time is quicker than that of gasoline

Permitting Tips

- Engage local Fire Marshal for a permit and County of San Diego's Hazardous Materials Division (HMD) for permits (http://www.sandiegocounty.gov/content/sdc/deh/hazmat/hmd_permits.html)
- Smaller, skid-mounted systems may be easier to permit
- Tanks that are over 2,000 gallons require a fire safety analysis with the local Fire Marshal
- Tanks that are over 4,000 gallons require an extra inspection from Department of Occupational Safety and Health (DOSH) pre-construction in addition to the post-construction inspection

Permits for a Propane Autogas Station (typical)

Pre-construction

- Planning and Zoning – make sure you are building in the right place
- Building – submit plans
- Electrical – permit
- Fire Marshal – ensures the station is compliant with the local fire code
- Hazmat – Hazmat permit is required for regulating facilities that handle or store hazardous material, store at least 1,320 gallons of aboveground petroleum, or own and operate underground storage tanks. It is issued through the County of San Diego Department of Environmental Health.

Post-construction

- Department of Occupational Safety and Health (DOSH) [Pressure Vessel division]

Codes and Standards

When installing a propane autogas fueling station, it is important to adhere to the necessary codes and standards. The Alternative Fuel Data Center offers a thorough list of codes and standards for developing propane autogas infrastructure: http://www.afdc.energy.gov/pdfs/48612.pdf.

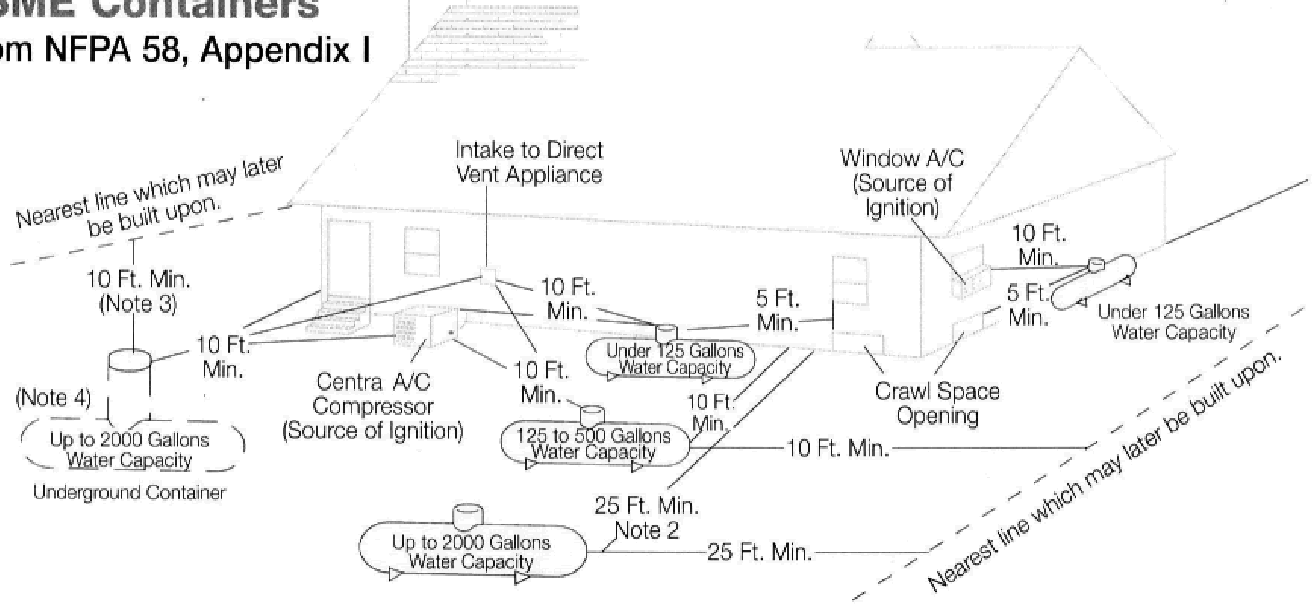
The NFPA 58, Liquefied Petroleum Gas Code,[2] addresses the construction, installation, and operation of propane autogas fueling stations and equipment. It seeks to provide safe methods for propane autogas storage, transportation, and use in order to mitigate fires and explosions. More specific codes and standards are included in the table below.

Fueling Station Aspect	Pertinent Codes and Standards
Vehicle Fuel Dispense and Dispensing Systems	NFPA 58 UL 567
Storage Containers	NFPA 58 ASME Boiler and Pressure Vessel Code American Petroleum Institute (API)-ASME Code for Unfired Pressure Vessels for Petroleum Liquids and Gases

[2] http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=58

Location of ASME Containers
From NFPA 58, Appendix I

Federal, state, and local ordinances and regulations should be observed at all times.



Notes:

1) Regardless of its size, any ASME tank filled on-site must be located so that the filling connection and fixed liquid level gauge are at least 10 feet from external source of ignition (i.e. open flame, window A/C, compressor, etc.), intake to direct vented gas appliance, or intake to a mechanical ventilation system.

2) May be reduced to 10 feet minimum for a single container of 1200 gallons water capacity or less if it is located at least 25 feet from any other LP-Gas container of more than 125 gallons water capacity.

3) Minimum distances from underground containers shall be measured from the relief valve and filling or level gauge vent connection at the container, except that no part of an underground container shall be less than 10 feet from a building or line of adjoining property which may be built upon.

4) Where the container may be subject to abrasive action or physical damage due to vehicular traffic or other causes it must be either a) placed not less than 2 feet below grade or b) otherwise protected against such physical damage.

http://www.propane101.com

Relevant propane autogas policies and laws

There are several reasons to install a public fueling station in your jurisdiction. One reason is that installing an alternative fueling station and promoting alternative fuels can help California achieve its greenhouse gas emissions reduction goals.

Strategy Origin	Year	Objectives	Goals and Milestones
Federal Clean Air Act	1970	Air Quality	80 percent reduction of NOx by 2023
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[3] Reducing California's Petroleum Dependence, an Energy Commission and ARB, joint agency report, August 2003, publication #P600-03-005F.

In addition to the list of relevant propane policies and laws, the California Air Resources Board established the Fleet Rule for Public Agencies and Utilities (Rule).[4] The Rule mandates that public agencies and utility vehicles reduce diesel particulate matter emissions from their affected vehicles through Best Available Control Technology or by procuring alternative fuel vehicles. Propane autogas vehicles are an economical and efficient replacement for light- and medium-duty diesel and gasoline vehicles.

[4] http://www.arb.ca.gov/msprog/publicfleets/publicfleets.htm