



# Toolkit Development

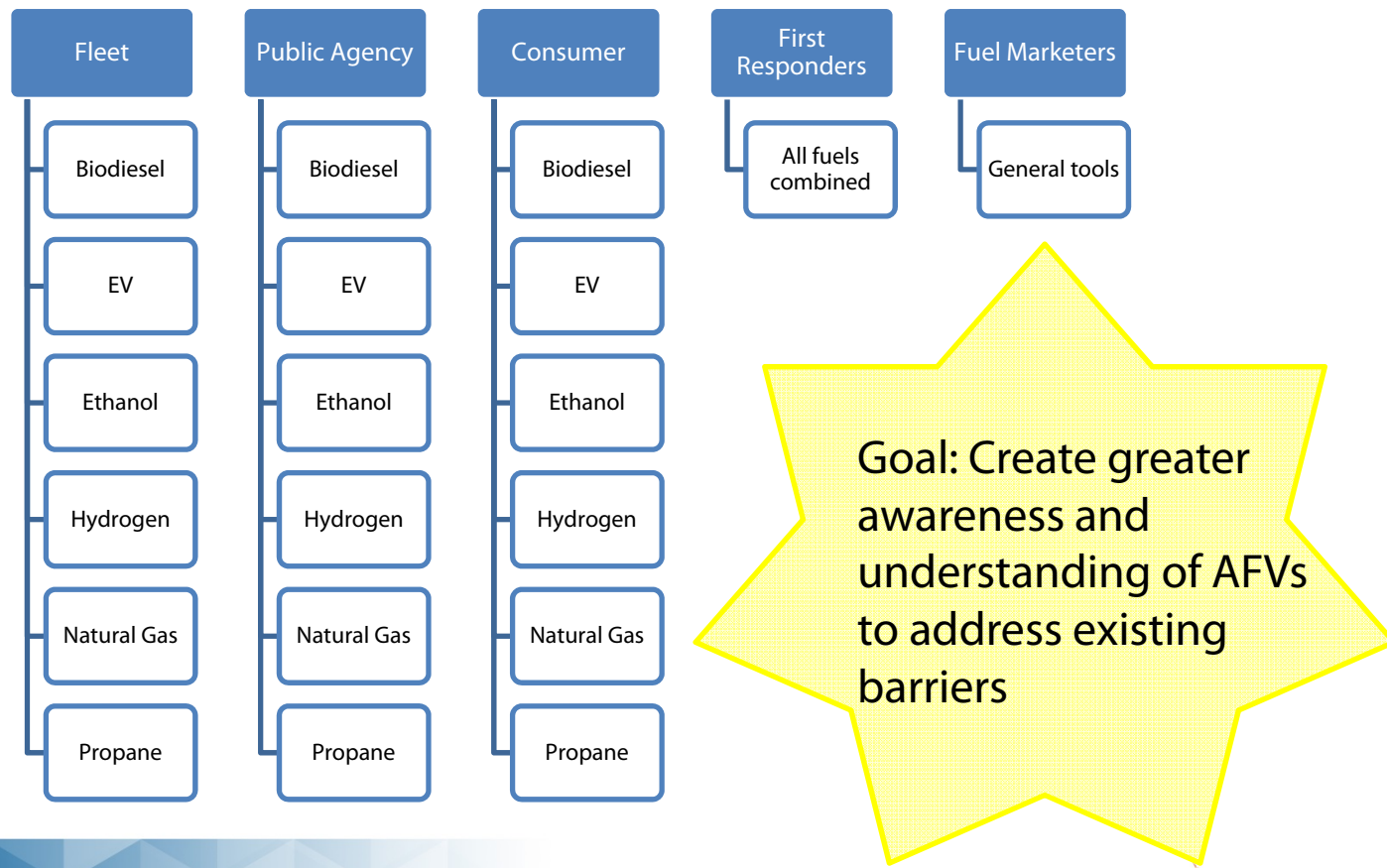


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# What is a toolkit?

- Wants to inform select audiences about alternative fuel vehicles and infrastructure



# Why are we doing this?

	Not at all familiar	Slightly familiar	Somewhat familiar	Moderately familiar	Extremely familiar
Biodiesel	0 0.0%	3 50.0%	1 16.7%	2 33.3%	0 0.0%
Electricity	0 0.0%	1 16.7%	2 33.3%	2 33.3%	1 16.7%
Ethanol (E85)	2 33.3%	2 33.3%	0 0.0%	1 16.7%	1 16.7%
Hydrogen	2 33.3%	2 33.3%	1 16.7%	1 16.7%	0 0.0%
Natural Gas (LNG/CNG)	1 14.3%	2 28.6%	1 14.3%	2 28.6%	1 14.3%
Propane (LPG)	2 28.6%	1 14.3%	3 42.9%	1 14.3%	0 0.0%

## Non-Adopting Fleets' Opinions

# Why are we doing this?

	Not at all familiar	Slightly familiar	Somewhat familiar	Moderately familiar	Extremely familiar
Biodiesel	1 7.7%	1 7.7%	3 23.1%	4 30.8%	4 30.8%
Electricity	1 7.7%	0 0.0%	0 0.0%	3 23.1%	9 69.2%
Ethanol (E85)	1 7.7%	3 23.1%	5 38.5%	2 15.4%	2 15.4%
Hydrogen	3 23.1%	3 23.1%	5 38.5%	2 15.4%	0 0.0%
Natural Gas (LNG/CNG)	1 7.7%	1 7.7%	4 30.8%	3 23.1%	4 30.8%
Propane (LPG)	2 15.4%	2 15.4%	3 23.1%	4 30.8%	2 15.4%

## Public Agencies

# Example Toolkit – Fleet component

NATURAL GAS



## Natural Gas

FACTS ABOUT NATURAL GAS

### 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<sub>4</sub>).

CNG is natural gas that has been compressed and stored as a gas in high pressure tanks up to 4500 pounds per square inch (psi). LNG is natural gas that is cooled to a temperature below -260°F.

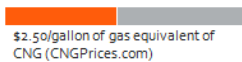
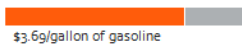
Nearly 87% of U.S. natural gas is domestically produced and it boasts 20-40% less carbon monoxide and 80% particulate matter than gasoline. According to the natural gas vehicle coalition, there are about 112,000 natural gas vehicles on U.S. roads.

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

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

*How much does it cost to fuel my vehicle?*

It costs approximately \$2.11 per gasoline gallon equivalent.



- On a well-to-wheels basis, natural gas vehicles (NGVs) produce 22% less greenhouse gas than comparable diesel vehicles and 29% less than gasoline vehicles.
- Nearly four in five transit buses in the 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

NATURAL GAS

### What types of vehicles can use natural gas?

Several types of vehicles can use natural gas, as it is a very versatile fuel.

- Vanpool – shuttle
- Refuse hauler
- Sweeper
- Forklift
- Low-speed vehicle
- MD/HD trucks
- Transit Bus
- Light-duty vehicle

#### 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**, 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 Natural Gas: [www.afdc.energy.gov/fuels/natural\\_gas.htm](http://www.afdc.energy.gov/fuels/natural_gas.htm)
- AFDC Renewable Natural Gas: [www.afdc.energy.gov/fuels/emerging\\_biogas.html](http://www.afdc.energy.gov/fuels/emerging_biogas.html)
- Natural Gas Vehicles for America: [www.ngvamerica.org/](http://www.ngvamerica.org/)
- CNG Now!: [www.cngnow.com/](http://www.cngnow.com/)
- California Natural Gas Vehicle Coalition: [www.cngvc.org/](http://www.cngvc.org/)
- Department of Energy: [energy.gov/natural-gas](http://energy.gov/natural-gas)
- American Gas Association: [www.aga.org](http://www.aga.org)

## Basic information about the fuel



# Example Toolkit

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## Are Natural Gas Vehicles for your Fleet?

You may not be sure whether or not a natural gas vehicle is the right decision for you. The following tools and resources are available to help guide you through your decision-making process.

Learn from examples of fleets that are using NGVs in their daily operations

### Case Studies

**Refuse Fleets Using CNG:** Fleets of heavy-duty refuse trucks have seen success with switching to CNG. In this case study by the Department of Energy, three refuse fleets are highlighted: Republic Services, a national waste and recycling services company; Groot Industries, Inc. a small residential pick-up and disposal company in Illinois; and the City of Milwaukee's Department of Public Works (DPW). Read more at [http://www.afdc.energy.gov/uploads/publication/casestudy\\_cng\\_refuse\\_feb2014.pdf](http://www.afdc.energy.gov/uploads/publication/casestudy_cng_refuse_feb2014.pdf).

**Transit Buses Using CNG:** Of Culver City's fleet of 650 vehicles and equipment include 46 CNG transit buses, refuse trucks, heavy-duty public works trucks, park vehicles, and other staff vehicles. Read more at <http://www.socalgas.com/documents/innovation/natural-gas-vehicles/NGV-CulverCity-CNG-Bus.pdf>.

Several San Diego fleets also use natural gas vehicles:



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### Local Case Study: Carbon Reductions through Renewable Natural Gas at San Diego International Airport Provided by Clean Energy

Clean Energy has been providing CNG to SD Airport customers for about 10 years, but in October 2013, we began providing renewable natural gas to our 2 San Diego Airport Stations. CE's brand of RNG is called "Redeem", and it is captured from different renewable sources such as landfills and wastewater treatment plants. The decomposition of organic matter produces bio-methane, an otherwise harmful gas when released into the atmosphere, which is captured and treated before being injected into the grid as pipeline-quality methane. The renewable natural gas flows to Clean Energy stations through the natural gas pipeline, and dispensed as transportation fuel to those who fuel at CE stations.

In an effort to reduce greenhouse gases, San Diego International Airport encourages the use of alternative fuels for all transportation modes that serve the airport. Natural Gas vehicles give airport fleets the largest carbon reduction possible for vehicles such as cutaway shuttles, buses, and vans. NGV vehicles are available in most platforms and are used by rental car shuttle, parking shuttle and Vehicle for hire shuttle customers, making Natural gas the most common alternative fuel used at the airport.

Ultra Low Sulfur Diesel vehicles and Gasoline Vehicles produce a Well-to-Wheel carbon intensity of 94.71 and 95.86 gCO<sub>2</sub>/Megajoule, respectively. When the airport vehicles started fueling on pipeline natural gas (before introduction of Redeem), the average well to wheel carbon intensity was 67.70 gCO<sub>2</sub>/MJ. These numbers are from taken from the California Air Resources Board GREET standard which was most recently updated in 2010.<sup>3</sup>

Now that CE is flowing Redeem to these stations, vehicles fueling at CE stations are contributing only 27.8 gCO<sub>2</sub>/MJ. This puts NGV's in a similar carbon reduction category as PEV's which contribute 35 gCO<sub>2</sub>/MJ after the EV engine efficiency is included in the calculation.

Over the past 12 months, Clean Energy's combined airport fueling has reduced Carbon Emissions by 4,965 metric tons when compared to gasoline or diesel. This is the equivalent of taking over 1,000 cars off the road.

Customers and Regional Transportation Authorities are encouraged to use the emissions calculator that we have on the Clean Energy website. It's relatively easy to use and gives a general snapshot of the positive environmental impact one can make by operating NGV's in place of Gasoline and Diesel vehicles. It's important to note that the emissions calculator provides a reduction based on an estimated average CI value, and actual reductions may vary as the overall CI of Redeem changes as new RNG sources are added to our supply portfolio.

The Emissions Calculator can be found here: <http://www.cleanenergyfuels.com/emissions-calculator/>



REET standard: [http://www.arb.ca.gov/fuels/lcfs/121409lcfs\\_lutables.pdf](http://www.arb.ca.gov/fuels/lcfs/121409lcfs_lutables.pdf)

## Case Studies

# Example Toolkit

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## Financing your Natural Gas Vehicle and Equipment

You've decided that it makes sense to consider adopting NGVs into your fleet. However, it is still unclear what it will cost and how much infrastructure will cost. These tools are intended to help you better understand the financial benefits of adopting NGVs and the costs associated with their procurement.

### Vehicle and Infrastructure Cash-Flow Evaluation Model (VICE)

The VICE tool is developed by the Department of Energy's Clean Cities Program. It estimates the environmental and economic costs of adopting NGVs into your fleet. It takes into consideration fuel costs, fuel types, and vehicle purchase price. Before getting started with this tool, having the following data available will strengthen the estimates returned:

- 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, truck, para. Shuttle, delivery truck, gasoline pick-up truck, or gasoline taxi) Keep in mind the following:
  - Incremental cost of vehicle
  - Average 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/](http://www.afdc.energy.gov/vice_model/).

### Savings in Fuel Costs

There are tools available to estimate your fuel savings when switching to a NGV. The basic information to have on-hand when using these tools are:

- Average number of miles driven per year
- Average MPG of the fleet vehicle
- Number of vehicles to be switched to NGVs

The **Alternative Fuel Data Center's Vehicle Cost Calculator** shows the total cost of ownership and emissions for a large variety of makes and models of most vehicles, including alternative fuel vehicles. You can also create your own custom vehicle if you cannot find the model you want. The tool is: <http://www.afdc.energy.gov/calculator/>.

**CNG Now!** has a CNG calculator that determines your fuel savings at the pump when switching from gasoline vehicles to CNG. The tool is <http://www.cngnow.com/vehicles/calculator/pages/information.aspx>.

### Incentives

There are various incentives available. **\*\*More information to be added about incentives here\*\***

Incentive Name	Incentive Website
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PLACEHOLDER FOR INCENTIVES

## Fueling Stations

These are ownership models of a fueling station for your fleet's uses:\*

### Using Fueling Stations

The following options are available:

1. **On-site private fueling:** The fleet/end-user has a fueling station constructed on the fleet's operating site, and the fuel is available only to the fleet. This typically requires a long-term fueling agreement with the natural gas provider/installer.
2. **Off-site private fueling:** Fueling station is located away from the fleet/end-user's operating site. The fleet/end-user is given exclusive access to these stations with some sort of code/card system. These stations are owned by third parties.
3. **On-site fueling for fleets with public access:** The fleet/end-user has a fueling station constructed on the fleet's operating site, and the fuel is available to not only the fleet, but to the public as well.
4. **Off-site public fueling:** A third party builds a CNG fueling station in an area that is convenient for a variety of fleets and private consumers to access. It is open to anyone who needs to fill a vehicle with natural gas. This is a popular option among fleets because it is a convenient and familiar fueling experience without the fuel commitment needed with on-site private fueling option.



it Magazine, November 2014.

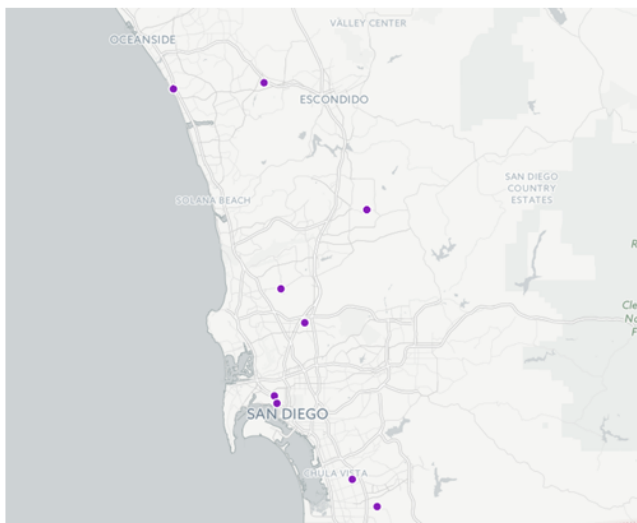
## Financial Incentives and Fueling Stations

# Example Toolkit

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Map of CNG Fueling Stations in San Diego Region



[http://www.afdc.energy.gov/fuels/natural\\_gas\\_locations.html](http://www.afdc.energy.gov/fuels/natural_gas_locations.html)

### What are the costs of installing a fueling station?

The VICE model (above section) covers fueling station costs and considerations. To read more about the costs involved in installing a fueling station, the Department of Energy has a comprehensive guide, *Costs Associated with Compressed Natural Gas Vehicle Fueling Infrastructure* ([http://www.afdc.energy.gov/uploads/publication/cng\\_infrastructure\\_costs.pdf](http://www.afdc.energy.gov/uploads/publication/cng_infrastructure_costs.pdf)), which detail cost ranges for infrastructure, cost considerations (such as permitting), with recommendations from the natural gas industry.

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Estimated CNG Station Cost<sup>1</sup>

Station Size	Cost Range
Basic Time-Fill (5-10 gge/day)	\$5,500-\$10,000
Starter Station (20-40 gge/day)	\$35,000-\$75,000
Small Station (100-200 gge/day)	\$250,000-\$600,000
Medium Station (500-800 gge/day)	\$550,000-\$900,000
Large Station (1,500-2,000 gge/day)	\$1.2-\$1.8 million

### 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 National Fire Protection Association (NFPA) 52 Gaseous Fuel Systems Code. 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	Society of Automotive Engineers (SAE) J1616 RP, J2406 RP
Storage Containers	NFPA 52

<sup>1</sup> Adapted from AFDC's *Costs Associated with Compressed Natural Gas Vehicle Fueling Infrastructure*, Sept 2014, [http://www.afdc.energy.gov/uploads/publication/cng\\_infrastructure\\_costs.pdf](http://www.afdc.energy.gov/uploads/publication/cng_infrastructure_costs.pdf).

More about fueling stations



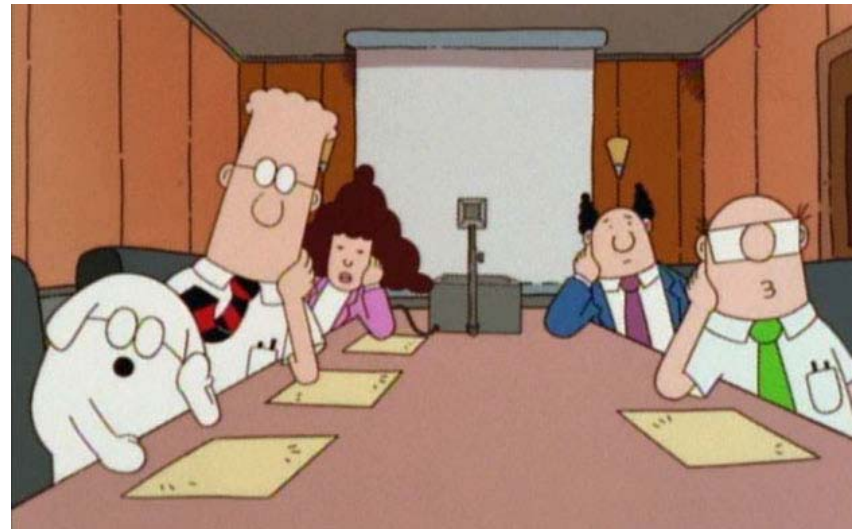
# Outreach Plan

- Use existing forums to increase awareness of toolkits (e.g., Clean Cities events, SANDAG working groups)
  - From which 1-on-1 meetings may stem
- For personalized meetings, first target local governments and fleets that have already implemented AFVs first. Then move on to those that have not.



# Feedback

- What strategies should we use to get more input on these toolkits?
- What other topics are missing from the toolkit?
- Are there any regional case studies that should be included in the toolkit?
- Other feedback?





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