

# **Getting the Word Out: *Diesel Exhaust Fluid (DEF) Locator, Mapping Tools, and Outreach Activities***

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Diesel Exhaust Fluid Forum

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Presented at the Diesel Exhaust Fluid Forum sponsored by Integer held November 11-12, 2008 in San Diego, CA

# Why are DEF Outreach Efforts Needed?

- Light-duty diesels are ready to enter the marketplace
- Some light- and heavy-duty vehicles will require diesel exhaust fluid (DEF), and consumers need to be trained on how to use it
- Consumers are interested in fuel economy and want to know about selective catalytic reduction (SCR) technologies and why these vehicles need DEF
- DEF is new and no one knows where to find it

# What Is Being Done?

- The U.S. Department of Energy (DOE) and National Renewable Energy Laboratory (NREL) are working with the Alliance of Automobile Manufacturers to help get the word out about DEF and SCR technologies
  - Expanded information on the Alternative Fuels and Advanced Vehicles Data Center (AFDC), [www.afdc.energy.gov](http://www.afdc.energy.gov)
    - DEF Locator
    - GIS Mapping Tool
    - Diesel content online to assist with education
  - Additional DEF activities
    - [www.factsaboutscr.com](http://www.factsaboutscr.com)
    - Press releases
- Light- and heavy-duty original equipment manufacturers (OEMs) are invested in outreach efforts to assist with vehicle sales and consumer satisfaction

# What Is the AFDC?

- Technology-focused Web site
- Comprehensive alternative fuels and advanced vehicle information
- Tools for the general public, fleets, educators, and consumers
  - Alternative Fueling Station Locator
  - Vehicle Search (alternative fuel and advanced)
  - Cost/Emissions Calculators
  - Laws and Incentives
  - Publications Database
  - Truck Stop Electrification Site Locator
- Sponsored by Clean Cities, part of DOE's Vehicle Technologies Program

# AFDC: [www.afdc.energy.gov](http://www.afdc.energy.gov)



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## Alternative Fuels & Advanced Vehicles Data Center

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Celebrates Alternative Fuel Vehicle  
Success ▶  
October 06, 2008

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Southern California Clean Vehicle  
Technology Expo ▶  
10/13/2008 - 10/15/2008

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 **Handbook for Handling,  
Storing, and Dispensing  
E85** ▶ (PDF 5.4 MB)  
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**Clean Cities** ▶

The Alternative Fuels and Advanced Vehicles Data Center (AFDC, formerly known as the Alternative Fuels Data Center) provides a wide range of information and resources to enable the use of alternative fuels (as defined by the [Energy Policy Act of 1992](#)), in addition to other petroleum reduction options such as advanced vehicles, fuel blends, idle reduction, and fuel economy.

This site is sponsored by the U.S. Department of Energy's [Clean Cities](#) initiative.



### Data, Analysis, and Trends

Our [Data, Analysis, and Trends](#) section provides industry trends and facts based on data analysis.

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### Alternative Fuel Portals

- [Biodiesel](#)
- [Electricity](#)
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- [Hydrogen](#)
- [Natural Gas](#)
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[More Fuels Information](#) ▶



### Select Vehicle Information

- [Conversions](#)
- [Emissions](#)
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- [HEVs](#)
- [Plug-in Hybrids](#)
- [Idle Reduction](#)

[More Vehicle Information](#) ▶



### Quick Links to AFDC Tools

- [Vehicle Make & Model Search](#)
- [Alternative Fueling Station Locator](#)
- [Incentives & Laws](#)
- [Publications Search](#)
- [State Information](#)

# Why Diesel Information on AFDC?


- Fuel-efficiency improvements to light-duty diesels lead to reduced dependence on foreign oil
- Education and training is needed
- Consumers are used to using the AFDC for alternative fuels and advanced vehicle information
- Adding DEF information to the AFDC is a cooperative effort between:
  - DOE
  - NREL
  - Alliance of Automobile Manufacturers

# Diesel Information on the AFDC

- Content is located in the Diesel Vehicles section and includes links to relevant information
- All vehicle classes are covered (light-, medium-, and heavy-duty)
- Topics covered on the site include:
  - Light-duty vehicle availability
  - Emissions
  - Selective catalytic reduction
  - DEF
  - NO<sub>x</sub> traps




# Diesel Vehicles Section



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## Alternative & Advanced Vehicles



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Emissions

Selective Catalytic Reduction

NO<sub>x</sub> Adsorbers


**Conversions**

**Resale**

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**Fuel Economy**

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### Diesel Vehicles

Advanced diesel vehicles using EPA-mandated [ultra-low sulfur diesel](#) (ULSD) fuel are among the most fuel-efficient vehicles available today. Collaborative R&D between DOE, industry and the national laboratories has resulted in improved engine efficiency and very low emissions. Collaboration with the U.S. Environmental Protection Agency, industry, and national laboratories under the DOE Diesel Emission Control Sulfur Effects (DECSE) program provided the supporting data needed to mandate 15 ppm sulfur in diesel fuel as the appropriate level to maintain effectiveness of diesel engine emission control technologies. Most diesel vehicles also can run on [biodiesel](#) blends without engine modification.

Progress in DOE- and industry-funded diesel engine R&D is highlighted annually in the [Advanced Combustion Engines Progress Report](#) and in the [DOE Diesel Engine-Efficiency and Emissions Research \(DEER\) Conference](#), now in its 14<sup>th</sup> year.

This page serves as a table of contents for the Diesel Vehicles section. To learn more, choose from the links below.

**Diesel Vehicle Classes ▶**  
Learn about light-, medium-, and heavy-duty diesel vehicles.


**Light-Duty Diesel Vehicle Availability ▶**  
Find out which light-duty diesel vehicles are available in the United States.


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**Truck Stop Electrification Site Locator**


**Alternative Fueling Station Locator**




# Light-Duty Diesel Vehicle Availability



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### Alternative & Advanced Vehicles



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### Light-Duty Diesel Vehicle Availability

According to [J.D. Power Automotive Forecasting](#), demand for light-duty diesel vehicles might approximately double in the next 10 years. More auto manufacturers will be producing light-duty diesels, and these vehicles will be more fuel efficient and environmentally friendly than ever.

To learn about currently available light-duty diesel vehicles, use the [FuelEconomy.gov's diesel vehicle search engine](#) or visit the Diesel Technology Forum's [Diesels for Sale in the U.S.](#) (this page lists some larger diesel vehicles as well.)



# FuelEconomy.Gov

[www.fueleconomy.gov](http://www.fueleconomy.gov)



[Find and Compare Cars](#) | 
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2009 Diesel Vehicles					
Sorted by MPG (city), Click on column headings to resort					
Select up to 4 models to compare					
	<a href="#">Compare!</a>	<b>New EPA MPG</b>	<b>Annual Fuel Cost</b>	<b>Carbon Footprint</b>	<b>Air Pollution Score</b>
		city	hwy	(tons/yr of CO <sub>2</sub> )	All states except CA and NE states
Model		city	hwy	Cost	
<input type="checkbox"/> Volkswagen Jetta	4 cyl, 2 L, Manual 6-spd, Diesel	30	41	\$2029	6.2
<a href="#">compare</a>		city	hwy		NA
<input type="checkbox"/> Volkswagen Jetta SportWagon	4 cyl, 2 L, Manual 6-spd, Diesel	30	41	\$2029	6.2
<a href="#">compare</a>		city	hwy		NA
<input type="checkbox"/> Volkswagen Jetta	4 cyl, 2 L, Automatic (S6), Diesel	29	40	\$2091	6.4
<a href="#">compare</a>		city	hwy		NA
<input type="checkbox"/> Volkswagen Jetta SportWagon	4 cyl, 2 L, Automatic (S6), Diesel	29	40	\$2091	6.4
<a href="#">compare</a>		city	hwy		NA
<input type="checkbox"/> Mercedes-Benz E320 Bluetec	6 cyl, 3 L, Automatic 7-spd, Diesel	23	32	\$2657	8.1
<a href="#">compare</a>		city	hwy		NA

[Learn More About EPA's New MPG Tests!](#)


- Personalize....**
- [Use your gas prices and Annual Miles](#)
  - [Switch Units: Gallons/100 Miles Liters/100 km](#)
  - [Show Air Pollution Scores for CA and Northeast States](#)

# Diesel Selective Catalytic Reduction



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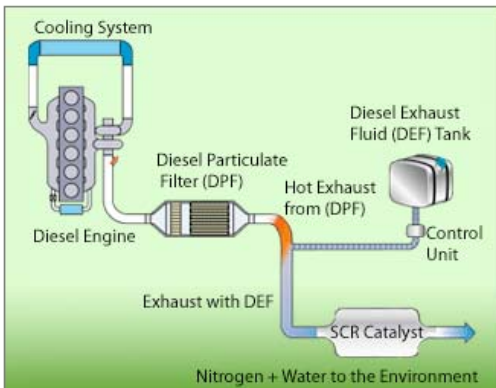
**Fuel Economy**

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### Diesel Selective Catalytic Reduction

Selective catalytic reduction (SCR) is an advanced emission-control technology that can help light-, medium-, and heavy-duty diesel vehicles meet stringent [regulations](#) on nitrogen oxides (NO<sub>x</sub>) emissions. In an SCR system, a liquid reducing agent composed of urea and water—known as [Diesel Exhaust Fluid](#) (DEF)—is combined with engine exhaust in the presence of a catalyst to convert smog-forming NO<sub>x</sub> into harmless nitrogen and water vapor. See the diagram below.

#### Schematic of a Selective Catalytic Reduction (SCR) System



The diagram shows a Diesel Engine connected to a Diesel Particulate Filter (DPF). A Cooling System is attached to the DPF. Hot Exhaust from the DPF goes to a Diesel Exhaust Fluid (DEF) Tank. A Control Unit is connected to the DEF Tank. The Exhaust with DEF then passes through an SCR Catalyst, resulting in Nitrogen + Water to the Environment.

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# Diesel Exhaust Fluid



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### Diesel Exhaust Fluid

Diesel Exhaust Fluid (DEF)—sometimes known simply by the name of its active component, urea—is a key component of [selective catalytic reduction](#) (SCR) systems, which help diesel vehicles meet stringent [emission regulations](#). DEF is a liquid reducing agent that reacts with engine exhaust in the presence of a catalyst to convert smog-forming nitrogen oxides (NO<sub>x</sub>) into harmless nitrogen and water vapor.

#### Composition

Current DEF formulations are a nontoxic, colorless, and odorless mixture of the chemical urea and purified water. The use of alternative reducing agents—such as diesel fuel—is also being explored.

Urea is a nitrogen-containing compound that transforms into ammonia when heated. It occurs naturally or is synthesized from natural gas and is used in various industries, including as a fertilizer in agriculture. A urea-based DEF is used widely in Europe under the brand name [AdBlue](#).


#### Use in Diesel Vehicles

Diesel Exhaust Fluid is carried onboard a vehicle in a tank separate from the fuel tank. The vehicle's DEF tank must be refilled periodically. Experience in Europe indicates that average DEF consumption is about 5% of diesel fuel consumption. Refilling the DEF tank occurs at approximately the interval of recommended oil changes for light-duty vehicles. The interval varies based on application for medium- and heavy-duty vehicles.

## DEF Locator and GIS Mapping Tool


- The DEF Locator will allow users to map DEF locations, get driving directions to a DEF retailer, map a route, and search using “advanced options”
- The GIS Mapping Tool provides a high-level view of DEF locations, including planned and existing locations

# Diesel Exhaust Fluid Locator (Still in development)



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### Diesel Exhaust Fluid Locator

The [Diesel Exhaust Fluid Locator](#) helps users locate facilities that sell Diesel Exhaust Fluid (DEF, sometimes called urea). DEF is a liquid reducing agent used in [selective catalytic reduction](#) (SCR) systems to reduce [emissions](#) of nitrogen oxides (NO<sub>x</sub>) from diesel vehicles.

To learn more about DEF, visit the [Diesel Exhaust Fluid](#) page. Visit the [Light-Duty Diesel Availability](#) page to see which light-duty vehicles require DEF.



The DEF Locator includes details for each DEF provider, including address, phone number, public/private status, type of location, hours of operation, dispensing capability, vehicle access, DEF recycling capability, and more. The data are provided by the [Alliance of Automobile Manufacturers](#) and are updated monthly. Detailed information is available on the DEF Locator Instructions page.

If DEF providers have addresses that cannot be located by the mapping application, the providers might be mapped in incorrect locations. You should call a provider before visiting to verify its location, hours of operation, and type of access.

The DEF Locator is dynamically generated. If you are using a specialized screen reader and having difficulty understanding the content, contact the [AFDC Webmaster](#), who can assist you with a verbal or written description.

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# Diesel Exhaust Fluid Locator (Still in development)



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[Find DEF Locations](#)

[Map a Route](#)

[Advanced Options](#)

Enter an Address, City, State, or Zip Code

Show stations within  mile radius

Data for this tool are provided by the Alliance of Automobile Manufacturers.



**Additional Information Related to Diesel Exhaust Fluid**  
[Diesel Vehicles](#)  
[Diesel Selective Catalytic Reduction](#)  
[Diesel Exhaust Fluid](#)

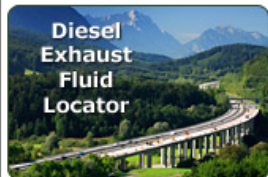
**Additional Mapping Resources**  
[Alternative Fueling Station Locator](#)  
[Truckstop Electrification Site Locator](#)  
[Geographic Data, Analysis, and Trends](#)  
[Biomass Resources](#)







# Diesel Exhaust Fluid Locator (Still in development)



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Enter your route using Address, City, State, or Zip Code

Starting Location  
San Diego, Ca



Ending Location  
San Francisco, Ca


Show stations within  miles of my route

Data for this tool are provided by the Alliance of Automobile Manufacturers.



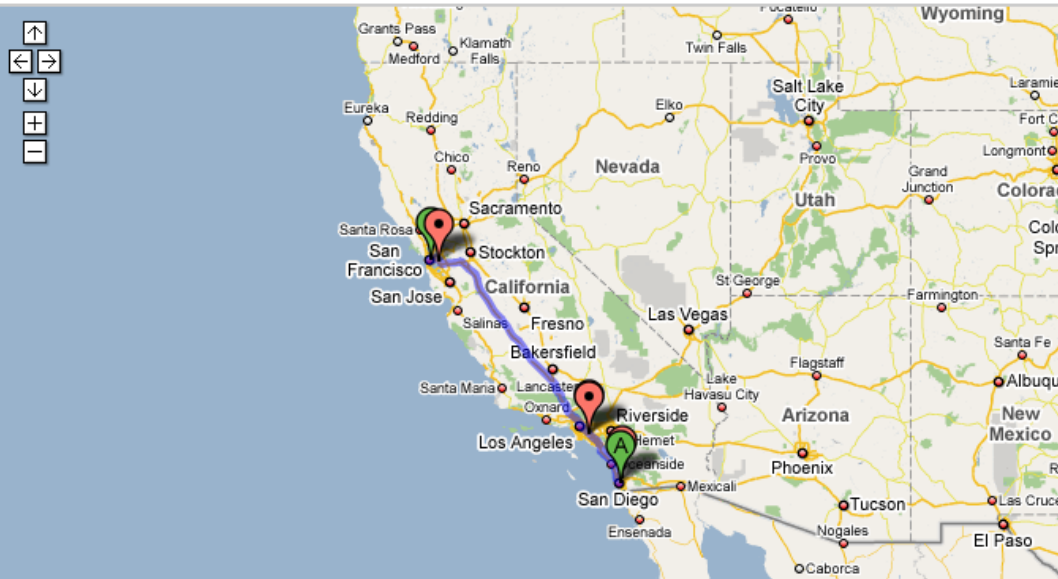
**Note:** Printing this page will provide information about each location where exhaust fluid is available along your route.

Results 1 to 4 of 4

 San Diego, CA

501 mi (about 7 hours 40 mins)

1. Head **north** on **1st Ave** toward **W Ash St** 0.4 mi
2. Turn **left** to merge onto **I-5 N** 429 mi
3. Continue on **I-580 W** (signs for **I-580/Tracy/San Francisco**) 62.1 mi
4. Take exit **19A** on the **left** for **I-80 W** toward **San Francisco** 0.6 mi
5. Keep **right** at the fork to continue toward **I-80 W** and merge onto **I-80 W** 7.6 mi



# Diesel Exhaust Fluid Locator (Still in development)



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**Search by Address, State, or Route**

Address
  State
  Route

Enter an address and a search radius

Show stations within  mile radius

**Advanced Search Criteria (Optional)**

Site Type:

All Locations
  OEM Dealerships
  Gas Station
  Oil Changing Facilities
  Other Retail

Site Access:

All Locations
  Public
  Private
  Access Card Required

Dispensing Capacity:

All Types
  Bottle
  Leak-proof Bottle
  High Flow Pump

Diesel Fuel Availability:

Show All Sites
  Diesel Available
  No Diesel Available

Vehicles Serviced:

All Types
  Light-Duty
  Heavy Duty
  Fleets

Service Available:

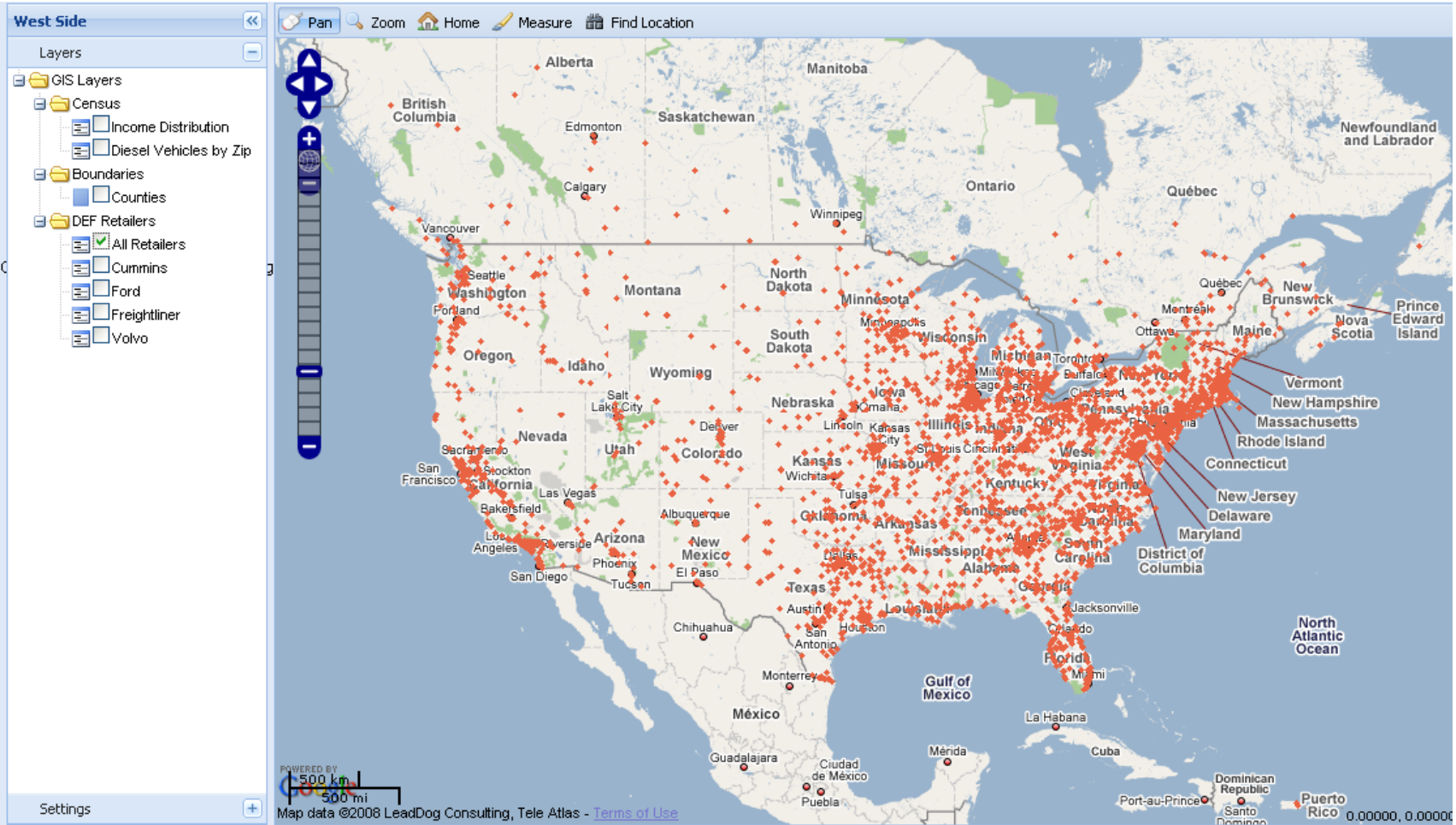
Show All Sites
  "Do it for Me"
  "Do it Yourself"

Data for this tool are provided by the Alliance of Automobile Manufacturers.



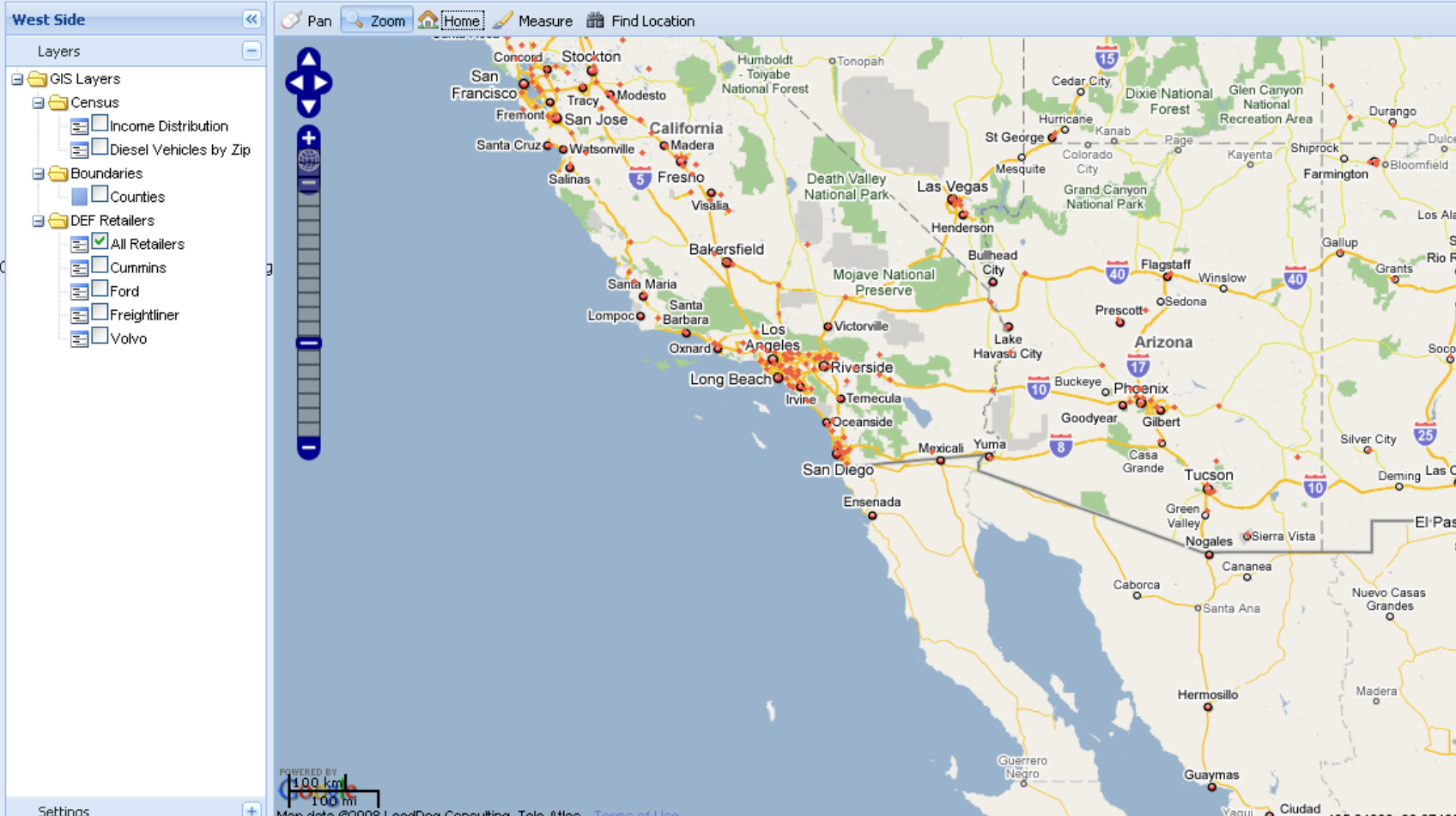
# DEF GIS Map (Still in development)

## All Retailers



# DEF GIS Map (Still in development)

## All Retailers Zoom Function



The screenshot displays the DEF GIS Map interface, which includes a map of the Western United States and a layers panel on the left. The map shows major cities, highways, and national parks. The layers panel is titled "West Side" and contains the following sections:

- GIS Layers**
  - Census
    - Income Distribution
    - Diesel Vehicles by Zip
  - Boundaries
    - Counties
  - DEF Retailers
    - All Retailers
    - Cummins
    - Ford
    - Freightliner
    - Volvo

The interface also features a navigation toolbar with a compass, zoom in (+) and zoom out (-) buttons, a home button, and a search bar. A scale bar at the bottom left indicates 100 km and 100 miles. The map data is attributed to ©2008 LeadDog Consulting, Tele Atlas, and Terms of Use.



## Status Report

- General-educational portions of the Diesel Vehicles section are now live on the AFDC
- Some OEMs anticipate the public release of light-duty diesel vehicles utilizing DEF in early 2009
- The Diesel Exhaust Fluid Locator and the GIS Mapping Tool are due to go live in January 2009

## DEF Web Site URLs

➤ [www.afdc.energy.gov](http://www.afdc.energy.gov)

- Note: Once the mapping tools go live, a short URL ([www.fueltools.gov](http://www.fueltools.gov)) will take users directly to the DEF Locator and other locator tools on AFDC

➤ [www.factsaboutscr.com](http://www.factsaboutscr.com)