



National Renewable Energy Laboratory
Innovation for Our Energy Future

The Contribution of NGVs to Energy Security and NGV-related Activities at the National Renewable Energy Laboratory



**Utah Public Service
Commission**

**Yoshio Coy
Sr. Engineer**

October 8, 2009

Discussion Topics

1. NREL's NGV-Related Activities
2. Clean Cities Overview – NREL's Role
3. Energy Security Benefits of NGVs
4. Brief Overview of DOE Clean Cities Grant Awards

1. NREL's NGV-Related Activities

- Website -- Alternative Fuel and Advanced Vehicle Data Center (Tools and Resources)
- Clean Cities Tiger Teams
- Technical Response Service
- AFV Implementation Technical Assistance

AFDC Overview

Web site - <http://www.afdc.energy.gov/afdc/>



The screenshot shows the homepage of the Alternative Fuels & Advanced Vehicles Data Center (AFDC). The header features the U.S. Department of Energy logo and the text "Energy Efficiency & Renewable Energy". Below this is a green banner with the title "Alternative Fuels & Advanced Vehicles Data Center". A navigation bar includes links for "About the AFDC", "Fuels", "Vehicles", "Fleets", "Incentives & Laws", "Data, Analysis & Trends", and "Information Resources". The main content area is divided into several sections: a left sidebar with a map and text about the AFDC's mission; a central area with "Alternative Fuel Portals" (Biodiesel, Electricity, Ethanol, Hydrogen, Natural Gas, Propane), "Select Vehicle Information" (Conversions, Emissions, Fuel Economy, HEVs, Plug-in Hybrids, Idle Reduction), and "Quick Links to AFDC Tools" (Light-Duty Vehicle Search, Heavy-Duty Vehicle Search, Alternative Fueling Station Locator, Incentives & Laws, Publications Search, State Information); and a right sidebar with a search bar, "Site Map", "EERE Information Center", "NEWS" (Proposed Rulemaking Announced for CAFE Standards and Greenhouse Gas Emissions), "EVENTS" (Fueling Your Alternative Fuel Vehicle Fleet), and "FEATURES" (Clean Cities 2009 Petroleum Reduction Projects, TransAtlas, Natural Gas Industry Briefings, Petroleum Reduction Planning Tool, Clean Cities, Financial Opportunities).

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

Alternative Fuels & Advanced Vehicles Data Center

About the AFDC | Fuels | Vehicles | Fleets | Incentives & Laws | Data, Analysis & Trends | Information Resources

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.

[Printable Version](#)

Alternative Fuel Portals

- [Biodiesel](#)
- [Electricity](#)
- [Ethanol](#)
- [Hydrogen](#)
- [Natural Gas](#)
- [Propane](#)

More Fuels Information

Select Vehicle Information

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

More Vehicle Information

Quick Links to AFDC Tools

- [Light-Duty Vehicle Search](#)
- [Heavy-Duty Vehicle Search](#)
- [Alternative Fueling Station Locator](#)
- [Incentives & Laws](#)
- [Publications Search](#)
- [State Information](#)

Search
Search Help | More Search Options

Site Map
EERE Information Center

NEWS

Proposed Rulemaking Announced for CAFE Standards and Greenhouse Gas Emissions
September 16, 2009
[More News](#)

Learn About Our [RSS Feed](#)

[Subscribe to EERE News Updates](#)

EVENTS

Fueling Your Alternative Fuel Vehicle Fleet: Partnering EPACT Mandated and Stakeholder Fleets to Deploy More Alt Fuels
09/17/2009 - 09/17/2009
[More Events](#)

FEATURES

[Clean Cities 2009 Petroleum Reduction Projects](#)

[TransAtlas](#)

[Natural Gas Industry Briefings](#)

[Petroleum Reduction Planning Tool](#)

[Clean Cities](#)

[Financial Opportunities](#)

Tools & Resources

Fueling Station Locator



[Help >](#)

[Basic Station Search](#)

[Map a Route](#)

[Stations by State](#)

First: Select one or more fuels.

- ☐ Biodiesel (B20 and above)
- ☒ Compressed Natural Gas (CNG)
- ☐ Electric
- ☐ Ethanol (E85)
- ☐ Hydrogen
- ☒ Liquefied Natural Gas (LNG)
- ☐ Liquefied Petroleum Gas (Propane)

Second: Enter a complete address or zip

90831

Show stations within a 25 mile radius.

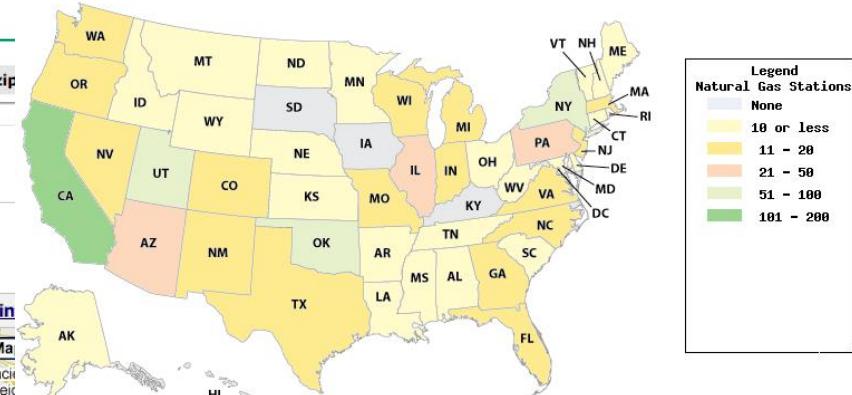
[Advanced Options](#)

[Get Results](#)

Natural Gas Fueling Station Locations

To find sites that currently offer compressed natural gas (CNG), select a state on the map below. The database will generate a detailed list of stations verified to offer CNG. If you are interested in liquefied natural gas (LNG) stations, go to the [Alternative Fueling Station Locator](#). This locator will also enable you to map CNG and LNG stations near a specific address or city location.

[Learn about our data collection methodologies.](#)



Results 1 to 10 of 52

A City of Long Beach
Liquefied Natural Gas (LNG)
2600 Temple Ave
Long Beach CA 90806
Phone: 562-570-5402
Distance: 1.5 Miles
Access: Private - government only

B Long Beach Gas and Oil - Clean Energy
Compressed Natural Gas
2400 E Spring St
Long Beach CA 90806
Phone: 562-493-2804
Distance: 2.1 Miles
Access: Public - credit card at all times

C Downtown Long Beach - Clean Energy
Compressed Natural Gas
400 W Broadway
Long Beach CA 90822
Phone: 562-493-2804

1 2 3 4 5 6 >>

Map data ©2009 TeleAtlas - Terms of Use

Some locations can't be precisely located by the mapping application, so we recommend you call stations to verify location, hours of operation, and access.

[Learn about our data collection methodologies.](#)

Tools & Resources

Fueling Station Locator

<http://www.afdc.energy.gov/afdc/locator/m/stations>

Alternative Fuels & Advanced Vehicles Data Center

Mobile Alternative Fueling Station Locator

Fuel Type

Biodiesel (B20 and above)

Location

Enter a city, postal code, or address

80204

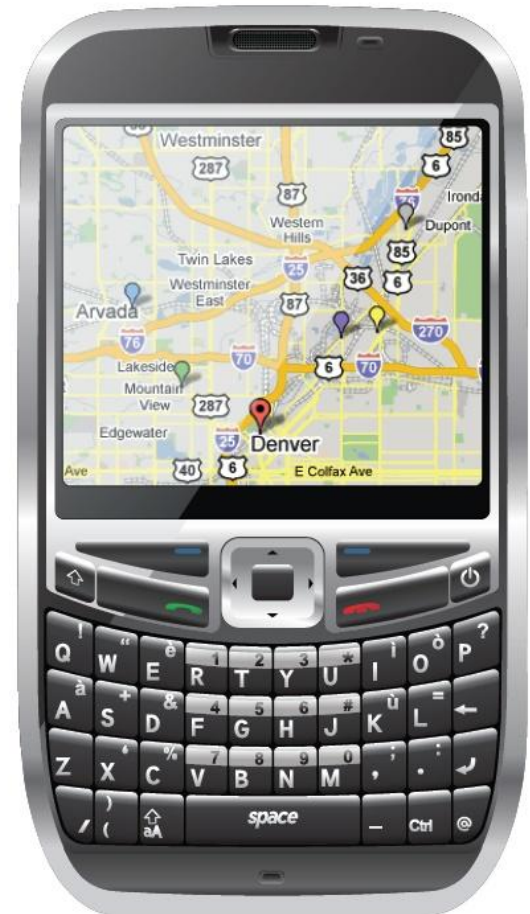
☒ Include private stations

Not all stations are open to the public. Choose this option to also search private fueling stations.

Search

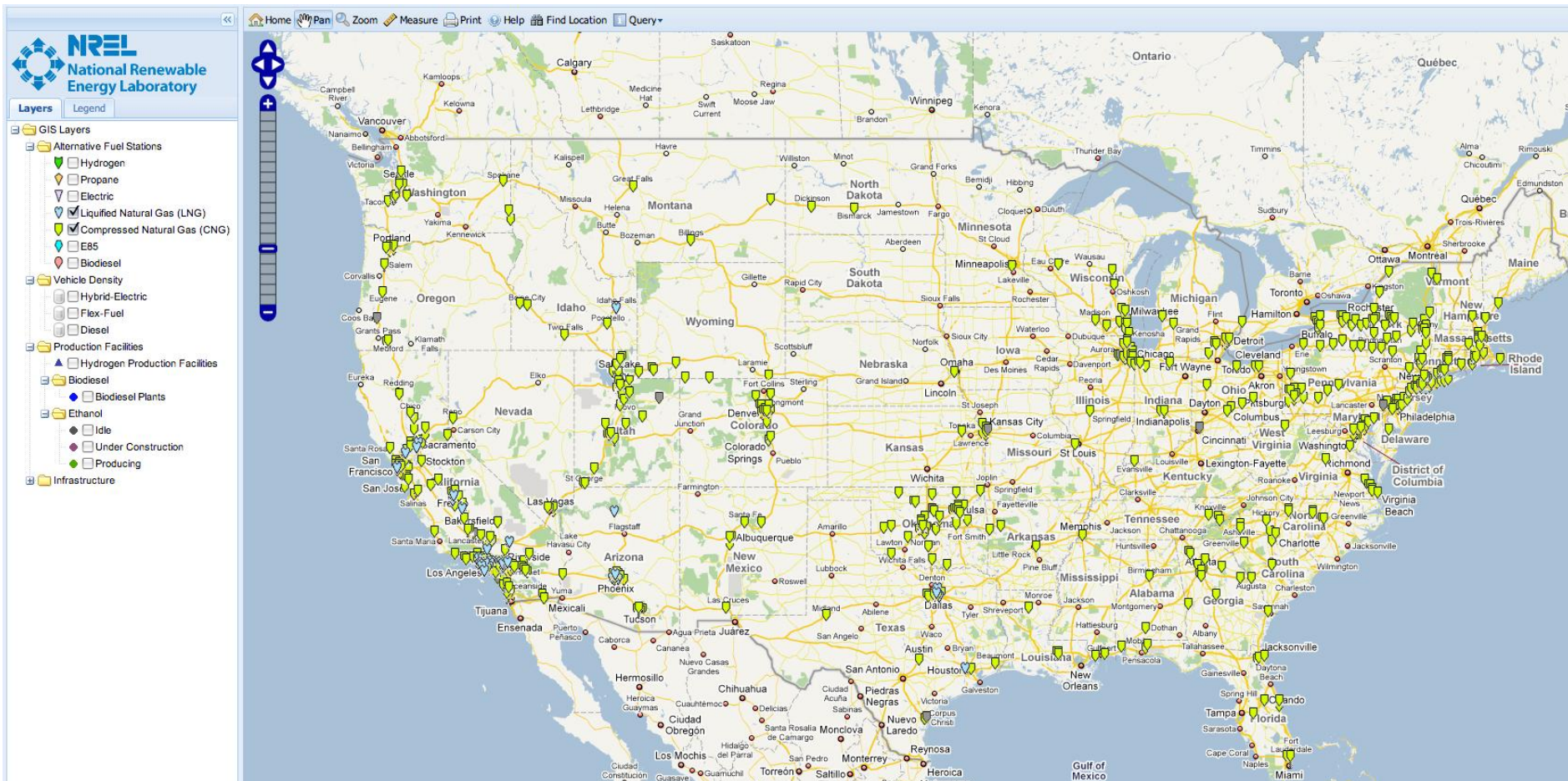
Caution: The AFDC recommends that users verify that stations are open, available to the public, and have the fuel prior to making a trip to that location. Some stations in our database have addresses that could not be located by the Station Locator application. This may result in the station appearing in the center of the zip code area instead of the actual location.

If you're having difficulty, please contact the technical response team at [800-254-6735](tel:800-254-6735). They will be able to assist you.



Tools & Resources

TransAtlas



Tools & Resources

Fleet Experiences

Fleet Experiences

Learning from other fleet experiences can be helpful when implementing alternative fuel and advanced technology vehicles in your fleet. This compilation of fleet experiences tells how other fleets are using alternative fuel vehicles, dealing with infrastructure issues, obtaining funding, and more.

Read about fleet experiences by selecting the links in the table below. Choose a link beneath any topic to find experiences related to your area of interest. For a glimpse of how specific fleets utilize alternative fuels and advanced vehicles, visit the [Fleet Applications](#) page.



Raley's Liquefied Natural Gas Trucks

Vehicle Category

- [Light-Duty Vehicles](#)
- [Medium/Heavy-Duty Vehicles](#)
- [Low Speed Vehicles](#)
- [Off-Road Vehicles](#)

Fuel/Technology Type

- [Biodiesel](#)
- [Electric](#)
- [Ethanol](#)
- [Hybrid Electric](#)
- [Hydrogen](#)
- [Natural Gas](#)
- [Propane](#)

Fleet Applications

- [Airports](#)
- [Delivery Vehicles](#)
- [Long-Haul Trucks](#)
- [Parks](#)
- [Police/Traffic Enforcement](#)
- [Refuse Haulers](#)
- [School Buses](#)
- [Shuttle Buses](#)
- [Taxis](#)
- [Transit Buses](#)

We want to hear from you. If you have successfully implemented AFVs into your fleet or have overcome technical or political obstacles to do so, we want to hear your story. If you need assistance, let us know that too, and we'll try to help.

Please help me implement
AFVs in my fleet! ▶

Tools & Resources

Vehicle Search

Heavy-Duty Vehicle and Engine Search

Search our database to find and compare specific vehicles, engines, or hybrid propulsion systems. You can also generate printable reports.

Vehicles Engines Hybrid Propulsion Systems

Manufacturer

All

Fuel Type

CNG

Application

✓ All
Bus
Other
Refuse
School Bus
Shuttle
Specialty
Street Sweeper
Transit Bus
Trolley
Truck

Compare

- ☐ [Autocar LLC - Xpeditor](#)
- ☐ [Blue Bird Corp. - All American Rear Engine School Bus](#)
- ☐ [Blue Bird Corp. - Blue Bird Vision](#)
- ☐ [Crane Carrier Company - LDT2](#)
- ☐ [Crane Carrier Company - LE2](#)
- ☐ [Crane Carrier Company - LET2](#)
- ☐ [Crane Carrier Company - LWT2](#)
- ☐ [Daimler Commercial Buses NA - Orion VII CNG LF](#)
- ☐ [ElDorado National - Axess](#)
- ☐ [ElDorado National - E-Z Rider II BRT](#)
- ☐ [ElDorado National - Escort RE-A](#)
- ☐ [ElDorado National - Transmark RE](#)
- ☐ [ElDorado National - XHF](#)
- ☐ [Elgin Sweeper Company - Broom Bear](#)
- ☐ [Elgin Sweeper Company - Crosswind](#)
- ☐ [Freightliner - Business Class M2 112](#)
- ☐ [Freightliner Custom Chassis Corp. - MT-45 CNG Chassis](#)
- ☐ [Freightliner Custom Chassis Corp. - MT-55 CNG Chassis](#)
- ☐ [Mack Trucks Inc. - Mack TerraPro Low Entry](#)

Light-Duty Vehicle Search

Search our light-duty alternative fuel vehicle database to find and compare alternative fuel vehicles. You can also generate printable reports to aid in decision-making.

Cars and Trucks Low Speed

Fuel Type

Natural Gas (1)

Manufacturer

All

Class

All

Year

☒ 2009 (1)

☐ 2008 (1)

☐ 2007 (1)

☐ 2006 (4)

☐ 2005 (1)

[More Years](#)

Compare

☐ [Honda Civic GX \(2009\)](#)

Select

All | None

[Side-by-Side Comparison](#)

[Printable Version](#)

[Learn about our data collection methodologies.](#)

[AFDC Home](#) | [EERE Home](#) | [U.S. Department of Energy](#)
[Webmaster](#) | [Web Site Policies](#) | [Security & Privacy](#) | [AFDC Disclaimer](#) | [USA.gov](#)
Content Last Updated: 07/10/2009

Tools & Resources

Incentives & Laws

State & Federal Incentives & Laws

[Printable Version](#)

[Search Help](#) > [More Search Options](#) >

[Site Map](#)
[EERE Information Center](#)

Our database captures state and federal laws and incentives related to alternative fuels and vehicles, air quality, fuel efficiency, and other transportation-related topics. State-level information is updated annually after each state's legislative session ends. To access state information, select a state from the map below. Federal information is updated after enacted legislation is signed into law. Select the Federal Incentives and Laws link below for the latest federal-level information.

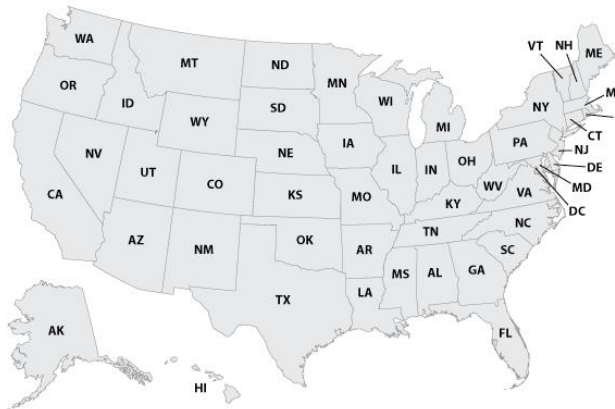
Read a brief summary of the provisions of the [Energy Improvement and Extension Act of 2008](#) that was part of the Emergency Economic Stabilization Act. These provisions pertain to alternative fuels and vehicles.

The [Energy Independence and Security Act of 2007](#) (P.L. 110-140) was signed into law on December 19, 2007. This broad-reaching policy contains many provisions to increase energy efficiency and the availability of renewable energy. For the complete text, download The Energy Independence and Security Act of 2007 ([PDF 895 KB](#)). [Download Adobe Reader](#)

Selected summaries from federal legislation related to alternative fuels and advanced transportation technologies are also available, view [select summaries](#).



- [Federal Incentives and Laws](#)
- [Recent Federal Actions](#)



- [List All States - Alternative Fuel Vehicle Incentives and Laws](#)
- [List All States - Expired Alternative Fuel Vehicle Incentives and Laws](#)
- For additional incentives related to renewable energy, go to the [Database of State Incentives for Renewable Energy](#).

[Learn about our data collection methodologies.](#)

If you have questions or would like to add an incentive to the database, e-mail the [Technical Response Service](#).

NREL's NGV Activities – AFV

Implementation Technical Support

1. Vehicle and fueling infrastructure Codes and Standards (C&S) development and maintenance (ANSI, CSA, SAE, NFPA, ISO, NCWM, ICC, UL)
2. Natural Gas Vehicle Technology Forum (NGVTF) – Identifies technology targets and facilitates government-industry research, development, demonstration, and deployment programs
3. Natural Gas Transit and School Bus Users Forum (TUG) -- provides information and technical assistance to transit agencies and school bus fleets operating or considering natural gas buses
4. Technical Information Dissemination
 - Clean Cities stakeholders/Coordinators
 - Industry organizations,
 - Authorities Having Jurisdiction (AHJs)
 - Fire service/first responders



NREL's NGV Activities -- Tiger Teams

Technical Problem Solving (Vehicle Operations): Issues can be related to vehicle performance or drivability, safety, maintenance, driver acceptance, lack of training, implementation of alternative fuel vehicles at specific sites, etc.

Technical Problem Solving (Infrastructure Operations): Issues with fueling station design/site, interaction with alternative fuel providers and fire safety code officials, fueling station performance and maintenance requirements, user/operator training, etc.

Evaluation of Potential Opportunities: Clean Cities coalitions working to develop complex AFV projects (transit, airport, etc.) may request technical assistance if expertise is not available from local or regional resources or stakeholders.

NREL's NGV Activities -- TRS

Technical Response Service Hotline

Helping stakeholders make the case for a switch to alternative fuels and/or advanced vehicles

- **Research and Respond to Inquiries**
 - Products/technologies
 - State/Federal regulations
 - Conversions – process and requirements
 - Emissions – comparisons between different fuel types
 - Incentives and Funding – identifying sources and tax credit information
 - Fueling station locations
- **Email: technicalresponse@icfi.com**
- **Voicemail: 800-254-6735**

2. Clean Cities Overview



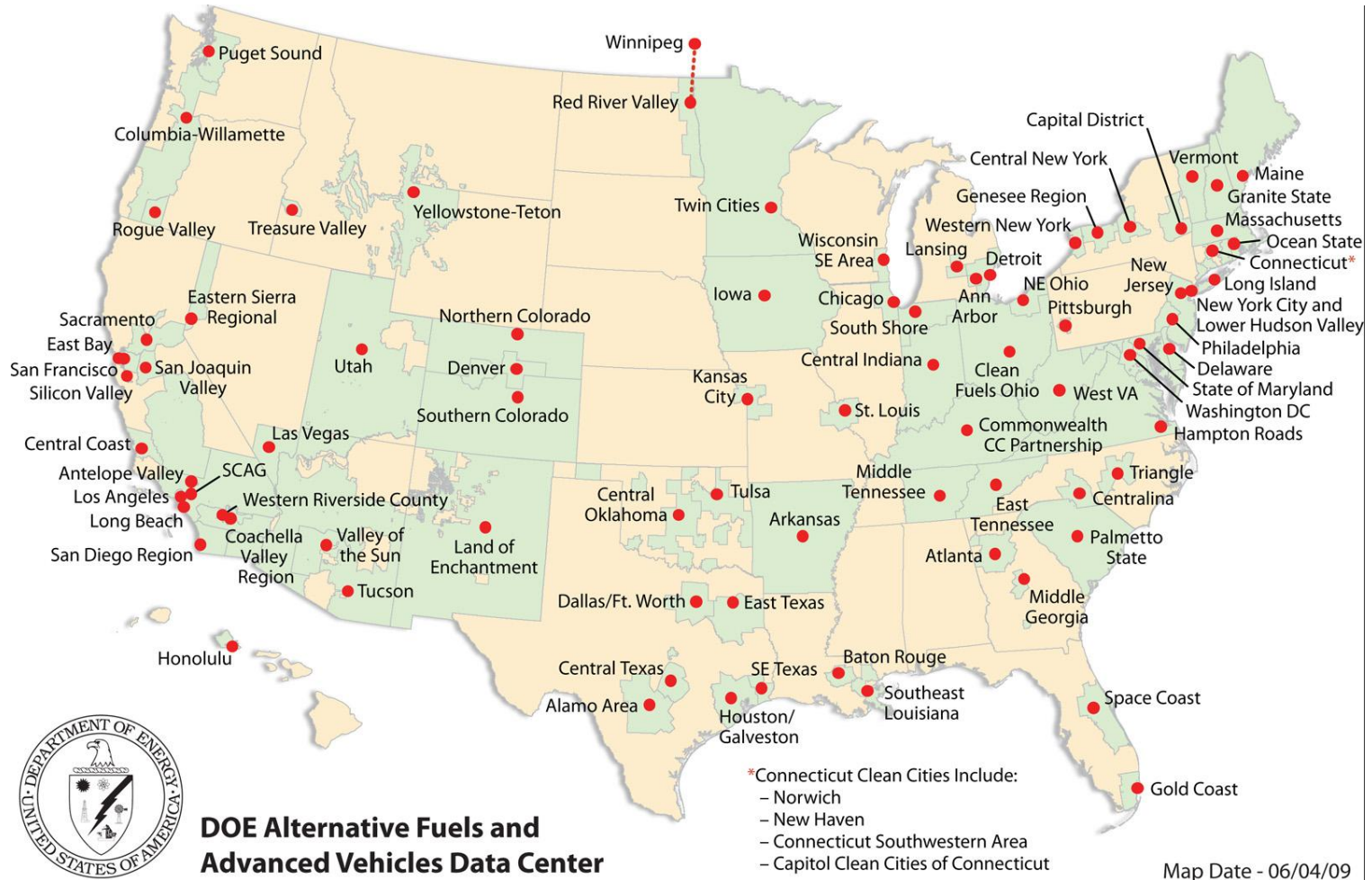
15TH ANNIVERSARY

15 Years of Petroleum Reduction

- ***Voluntary, locally-based government/industry partnership***
- Established in 1993 in response to the Energy Policy Act (EPAct) of 1992
- Focus on **Deployment** (next steps after R&D is completed)
- Companion program to the EPAct mandates requiring certain fleets to acquire AFVs (Federal, State, and Fuel provider fleets)
- Mission: Reduce petroleum consumption in the transportation sector
- More than 2 billion gallons of petroleum displaced!
- <http://www1.eere.energy.gov/cleancities/>

Clean Cities Overview

- Almost 90 coalitions
- More than 6,500 stakeholders



Clean Cities National Lab Support

National Energy Technology Lab (NETL – Project Management and Regional coordination of key Clean Cities activities)

National Renewable Energy Lab (NREL – Colorado)

Clean Cities Core program technical support , AFDC, technical communications, publications, Clean Cities Web sites, Hotline Response Service

Oak Ridge National Lab (ORNL -Tennessee)

Federal Fuel Economy Guide, FuelEconomy.Gov websites, National Fuel Economy consumer education and outreach efforts

Brookhaven National Lab (BNL –New York)

BioMethane and Land fill gas recovery

Argonne National Lab (ANL –Illinois)

Emissions Modeling (GREET and AIRCRED) and Idle Reduction analysis

3. NGV Contributions to Fuel Displacement

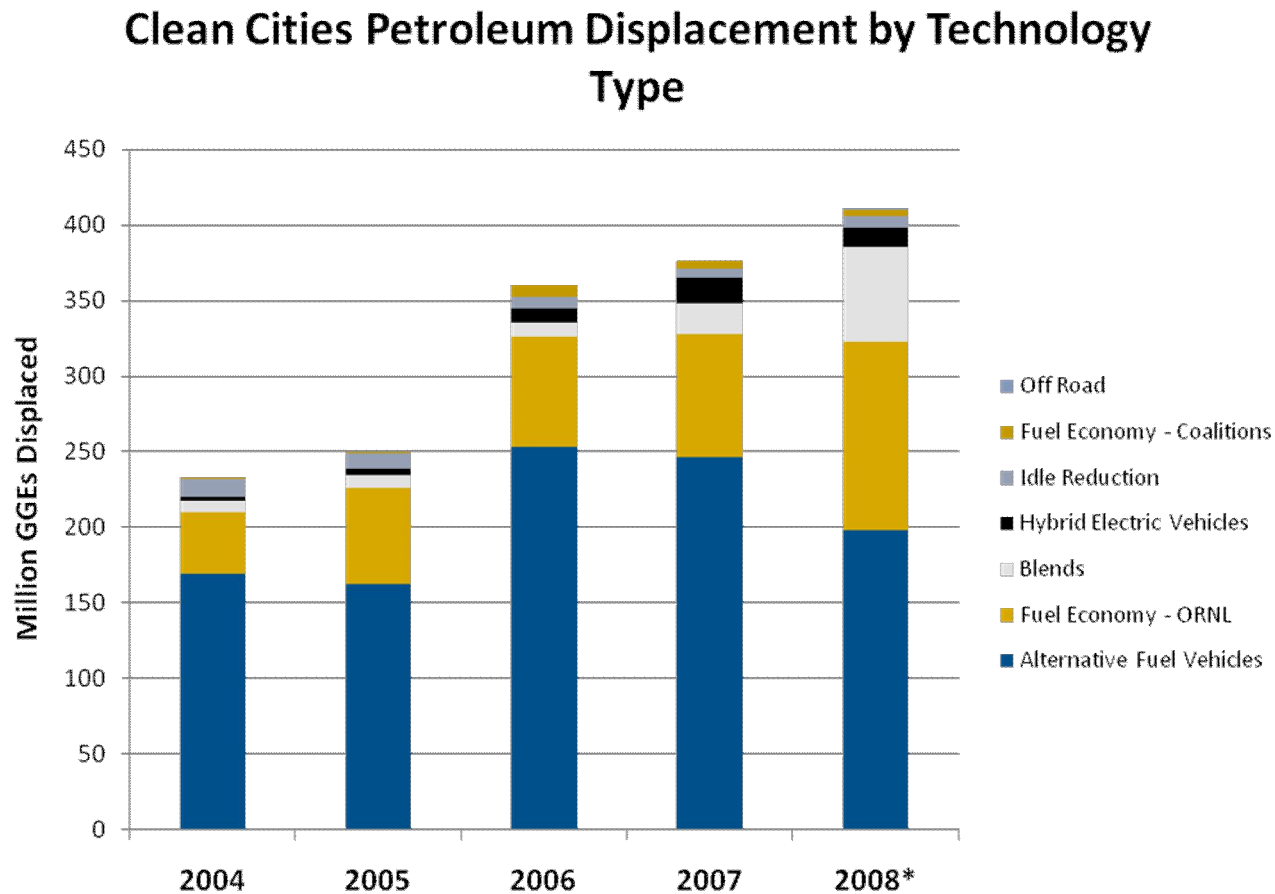
Petroleum Displacement of Each Portfolio Element

| Technology | Million GGEs | Percent of Coalitions' Total | Change from Last Year* |
|----------------------------|--------------|------------------------------|------------------------|
| AFV | 198 | 69% | -2% |
| Blends | 63 | 22% | 31% |
| Hybrid Electric Vehicles | 12 | 4% | -26% |
| Idle Reduction | 8 | 3% | 28% |
| Fuel Economy/VMT Reduction | 4 | 1% | -25% |
| Off Road | 1 | 0% | na |
| Coalitions Total | 287 | 100% | 3% |
| ORNL Fuel Economy | 125 | | 55% |
| Grand Total | 412 | | 14% |

*To enable a direct comparison, changes from last year were calculated from 2007 displacement numbers adjusted to remove E10 and transfer B20 from AFV section to blends.

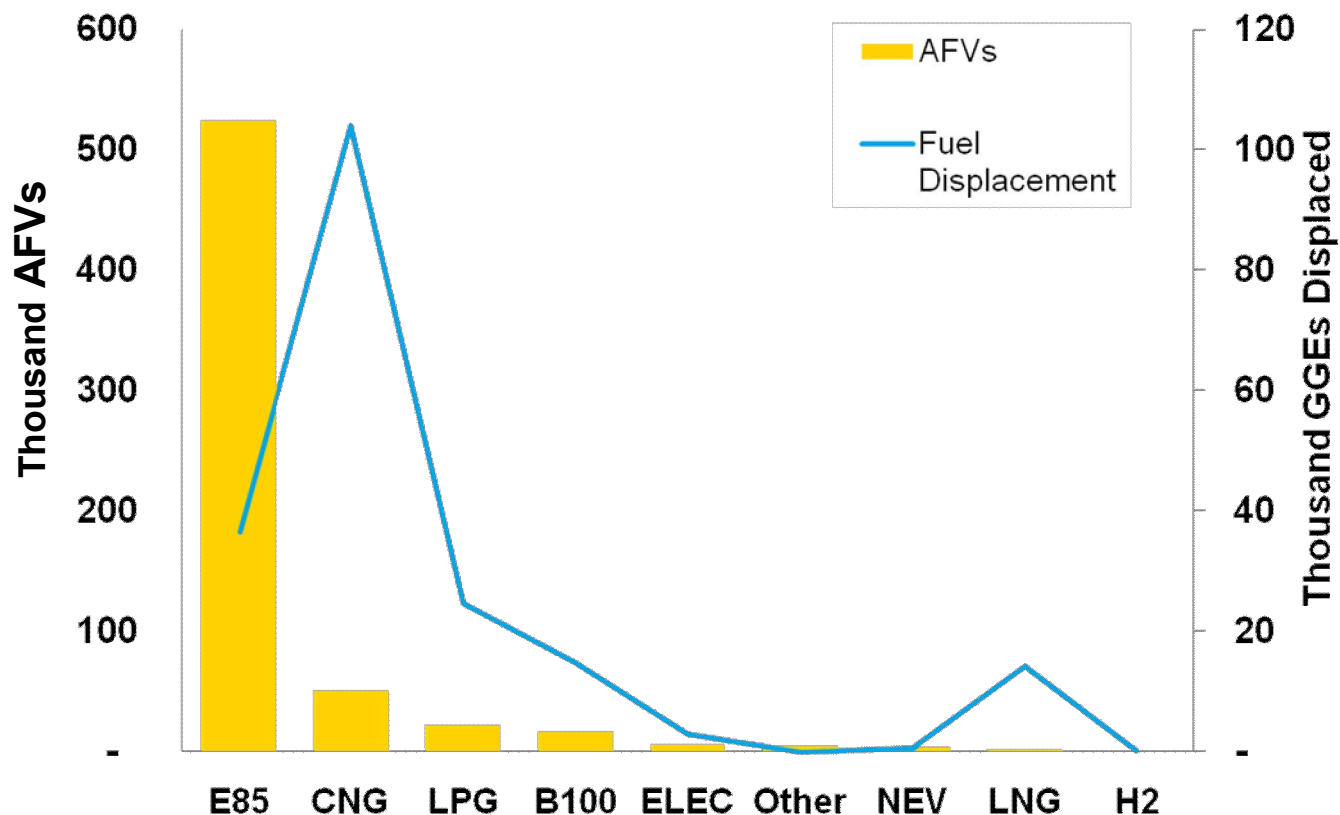
Source: Clean Cities Annual Metrics Report 2008, August 2009

Clean Cities -- Petroleum Displacement by Type



Clean Cities -- AFVs and Fuel Displacement

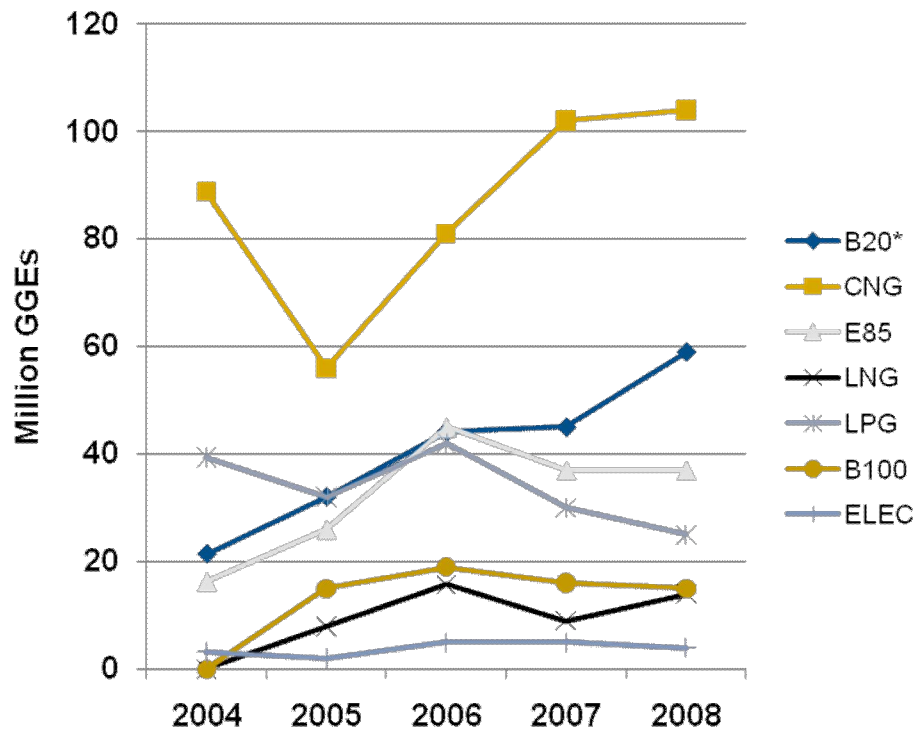
Number of AFVs and Fuel Displacement by Fuel Type



Source: Clean Cities Annual Metrics Report 2008, August 2009

Clean Cities – AFVs and Fuel Displacement

Clean Cities Petroleum
Displacement by AFV Type



Per EIA (2007) Consumption:

Diesel: 44.5B Gal

Gasoline: 140.6B Gal

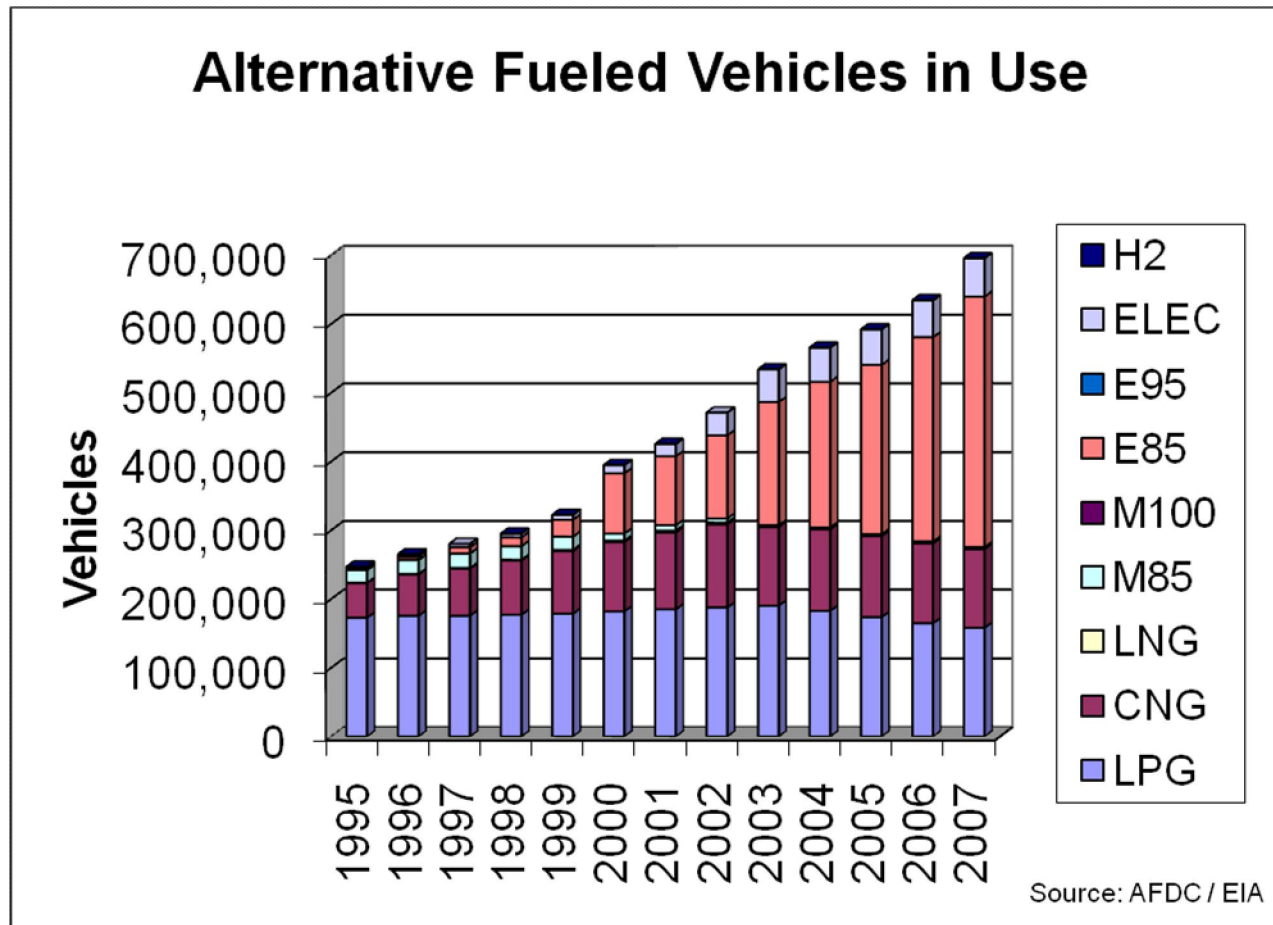
Total: 185B Gal

CNG: 178M Gal

CNG accounts for approximately
.1%

2007 Bush Target

AFVs in Use (EIA Data)



114,391 CNG Vehicles in 2007

178,565,000 CNG GGE Consumed 2007

~1,500 GGE per CNG Vehicle

NGVs IN THE WORLD



2009



World Total



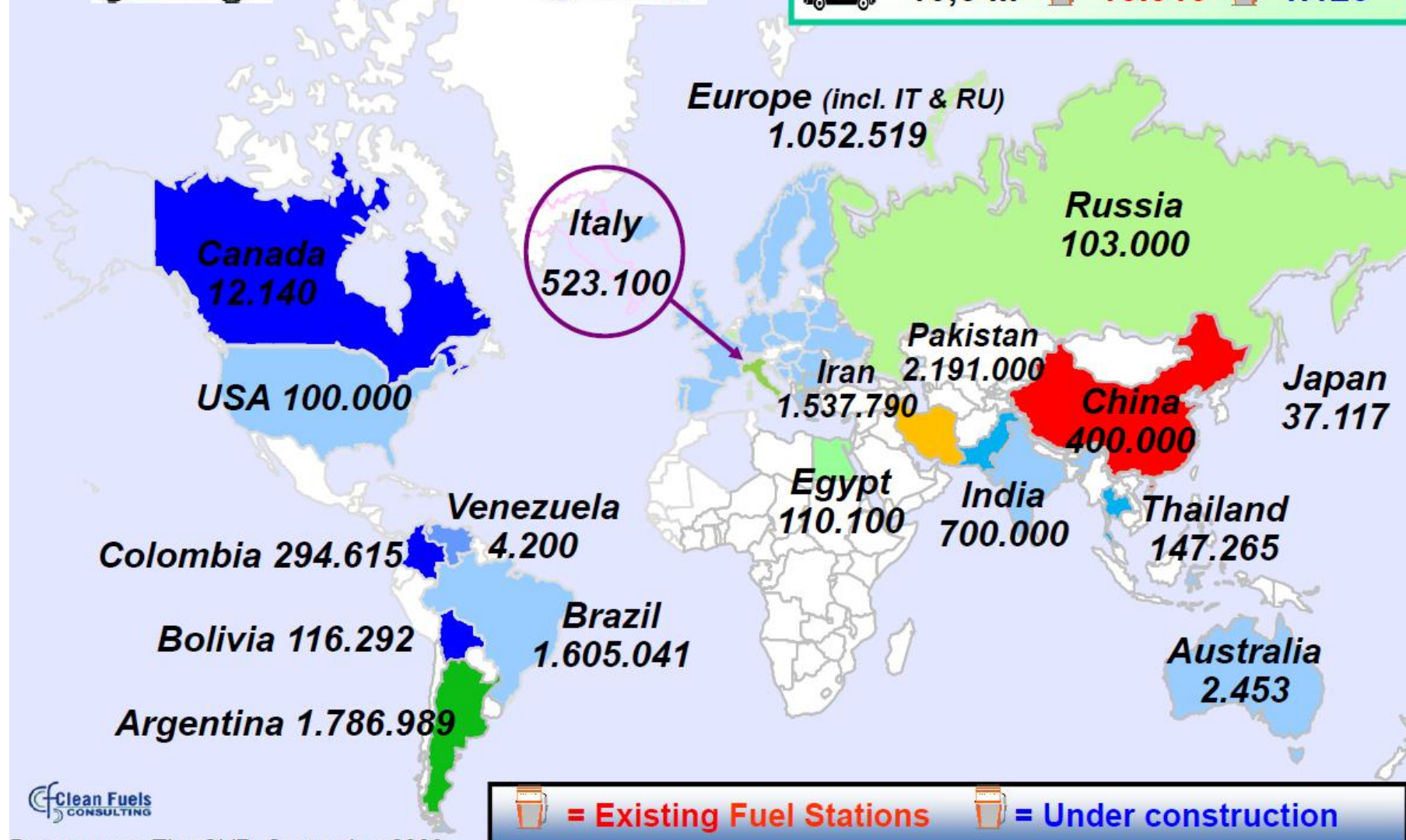
~ 10,5 M



15.919













1.125



Data source: The GVR, September 2009

THE TOP TEN COUNTRIES WORLDWIDE

| | Country | NGVs* | Fuel Stations* | % CNG Price less than Petrol |
|--|------------|----------|----------------|------------------------------|
|  | Pakistan | 2,19 mil | 2.941 | 47% |
|  | Argentina | 1,79 mil | 1.826 | 54,8% |
|  | Brazil | 1,6 mil | 1.746 | 41,8% |
|  | Iran | 1,54 mil | 926 | 62% |
|  | India | 700.000 | 500 | 68,4% |
|  | Italy | 523.100 | 700 | 54% |
|  | China | 400.000 | 1.336 | 46,4% |
|  | Colombia | 294.615 | 458 | 47,2% |
|  | Bangladesh | 180.000 | 425 | 67,3% |
|  | Thailand | 147.265 | 331 | 71,4% |

 Clean Fuels
CONSULTING



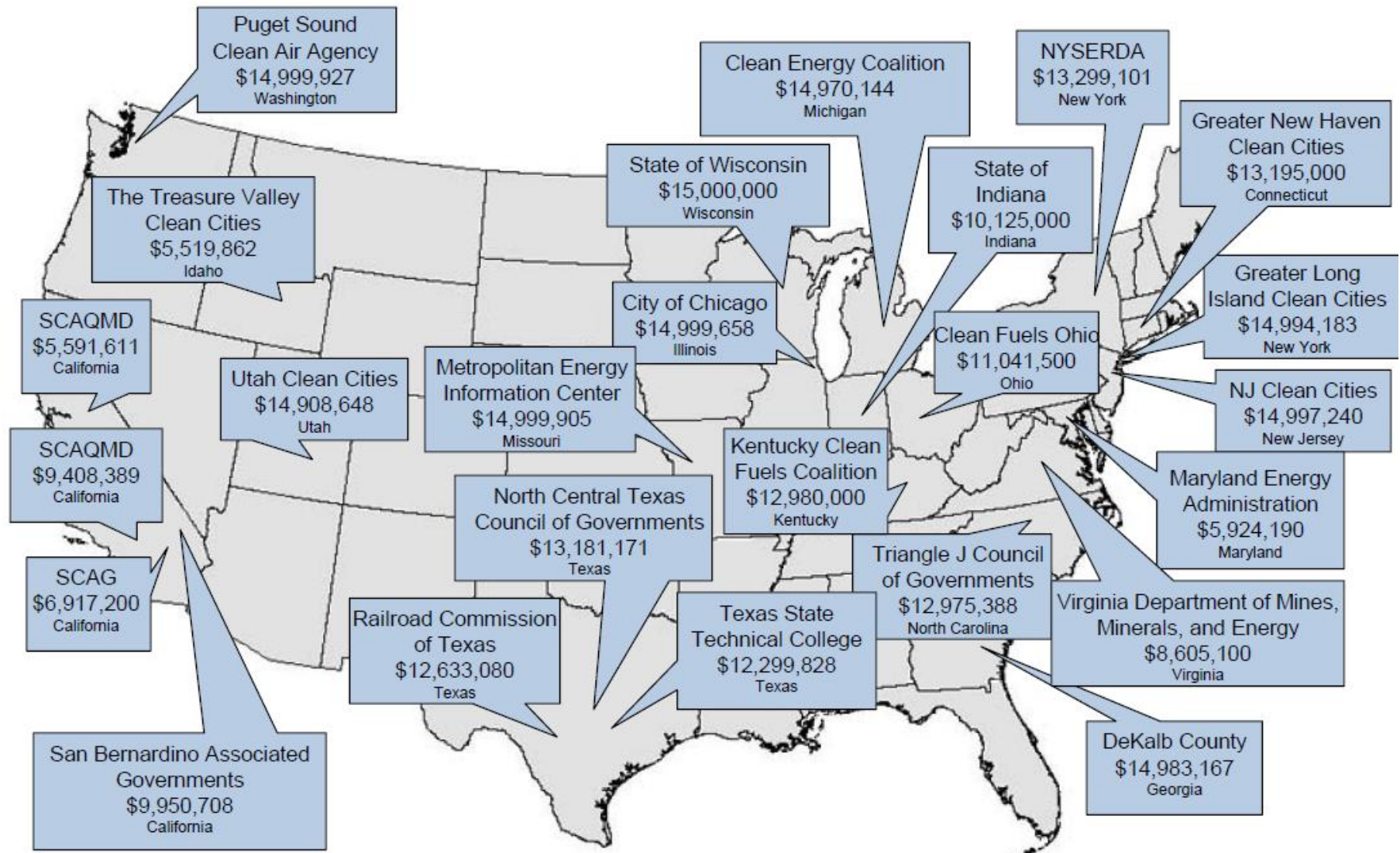
•Rounded up figures

Data source:
The GVR,
September
2009

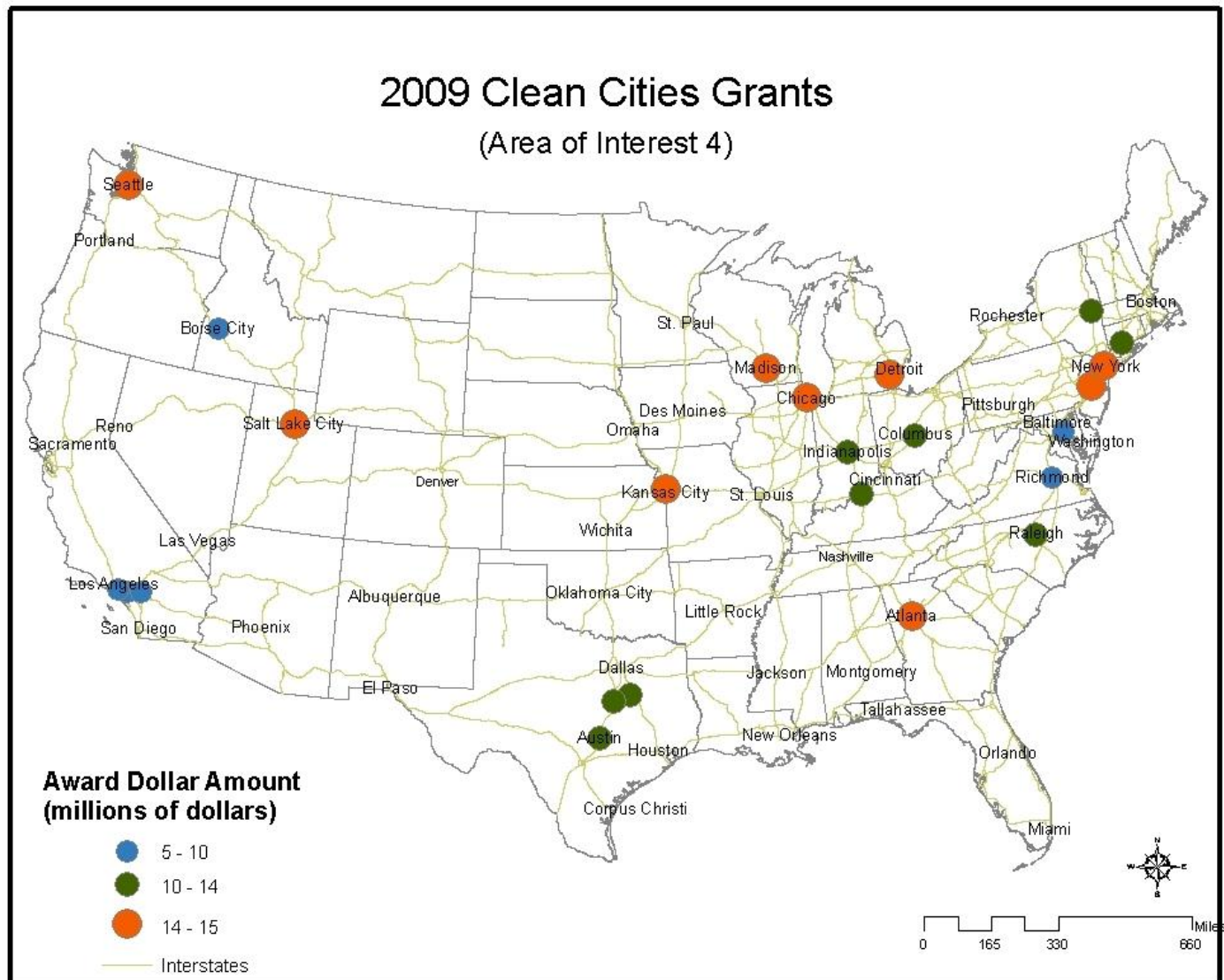
4. Clean Cities ARRA Grants Summary

- 25 cost-share projects under the Clean Cities program
- \$300 million from the American Recovery and Reinvestment Act
- more than 9,000 alternative fuel and energy efficient vehicles on the road
- 542 refueling locations across the country
- The U.S. Department of Energy (DOE) also estimates they will help displace approximately 38 million gallons of petroleum per year
- 19 out of the 25 Awards include natural gas vehicles and fueling infrastructure

Clean Cities AOI#4 Awards



Clean Cities AOI #4 Awards



Utah Clean Cities Coalition's

Clean Cities Transportation Sector Petroleum Reduction Technologies Program

- 16 new compressed natural gas (CNG) public fueling facilities
- Upgrades to 24 CNG public fueling facilities
- Three new liquid/compressed natural gas facilities
- Three new biodiesel public refueling stations
- Increases the number of natural gas vehicles operating in Utah by 678
- DOE estimates that this initiative will help displace 1.1 million gallons of petroleum annually.

Thank You!

Clean Cities Technical Response Service

- **Email:** technicalresponse@icfi.com
- **Voicemail:** 800-254-6735

Yoshio Coy

- **Email:** yoshio.coy@nrel.gov
- **Phone:** 303.275.4393