California Greenhouse Gas/Vehicle Pollution Challenge: How the State is Promoting Innovations

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Alternative Fuel Refuse and Recycling Trucks
Leading the Way to Energy Independence and a Cleaner Environment
Rutgers University – Busch Campus Center
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Key Air Quality Challenges

• “Easy” Reductions Achieved
• New 8-hour Ozone & PM 2.5 Air Quality Standards
• Local Cancer Risks
• Goods Movement Sources
  – Marine Vessels, Locomotives, Aircraft, On-Road Trucks . . .
• Climate Change
Energy Security Concerns – Key Driver

![Graph showing domestic oil production and fuel use for different vehicle types.]

- Domestic Oil Production
- Heavy Trucks
- Light Trucks
- Automobiles
- GAP


Typical Fuel Use

- Transit Buses
- Refuse Trucks
- Shuttles
- Taxis
- HD Freight Trucks
- Airport Grd. Vehs.
- MD Freight Trucks
- School Buses
- LD Freight Trucks
- Average Light Truck

![Bar chart showing typical fuel use in gallons/vehicle/year for different vehicle types.]

Source: U.S. Department of Energy
Role of Natural Gas Vehicles in Petroleum Reduction

- Heavy Duty Vehicle Population – 884,000
- Heavy Duty Natural Gas Vehicles – 5,063
- Estimated Diesel Usage in Heavy Duty Vehicles – over 2 billion gallons per year

Source: California Energy Commission

Potential Petroleum Fuel Displacement

- Assuming 15% of Garbage Trucks, Buses, and Trucks are Natural Gas Vehicles
- 125 Million Gallons of Diesel Displaced per Year
- California Demand – 3 Billion Gallons of Diesel per Year

Source: California Energy Commission
Natural Gas Engine Availability

- One Light-Duty Vehicle – American Honda
- Currently Two U.S. Manufacturers – Cummins Westport (8.9L) and Westport (14.9L)
- Autocar, Kenworth, Freightliner – Offering Natural Gas Products
- Blue Bird, ThomasBuilt – Integration of Natural Gas Engines
- Several Uplifters Providing Conversions
  - BAF Technologies (Crown Victoria, E450)
  - Baytech (GM Engines)
  - Emission Solutions (International DT466)

![Image of Natural Gas Engine Availability](source.img)

2007 Heavy-Duty Engine Certifications

![Graph of 2007 Heavy-Duty Engine Certifications](source.img)
2008 Heavy-Duty Engine Certifications (as of January 11, 2008)

SCAQMD Fleet Vehicle Rules

- 1191 - Light- and Medium-Duty Public Fleets
- 1192 - Transit Buses
- 1193 - Refuse Collection Vehicles
- 1194 - Commercial Airport Ground Access
- 1195 - School Buses
- 1196 - Heavy-Duty Public Fleet Vehicles
- 1186.1 - Less-Polluting Sweepers
Natural Gas Vehicles Operating in Fleets in Southern California

~ 3,430 Light- and Medium-Duty Public Fleet Vehicles
~ 276 Heavy-Duty Public Fleet Vehicles
~ 3,691 Transit Buses
~ 697 School Buses
~ 1,390 Refuse Trucks
~ 222 Street Sweepers
~ 540 Taxicabs and Airport Shuttles

Countries With Over 100,000 NGVs

<table>
<thead>
<tr>
<th>Country</th>
<th>NGVs</th>
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<tbody>
<tr>
<td>Pakistan</td>
<td>~1,600,000</td>
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<tr>
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<tr>
<td>Colombia</td>
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</tr>
</tbody>
</table>
Worldwide NGV Automobile Manufacturers

- Over 15 Passenger Vehicle Manufacturers
- Over 34 Different Models

Natural Gas Fueling Facilities

Legend
Fuel
- CNG
- LCNG
- LNG
Greenhouse Gas Lifecycle Analysis (Percent Change in GHG Emissions)

-90.9% -67.7% -56.0% -46.8% -41.4% -28.5% -22.6% -21.8% -19.9% -8.5% 3.7% 6.5% 8.6%

Road to Success

- Need for Long-Term and Near-Term solutions
- Continue Investments Research/Demonstration Technologies
- Looking Beyond 2010 HD Engine Standards (i.e. Hydrogen Blends, Hybridization)
- Public-Private Partnerships

Road to Success (cont.)

- Continue Implementation of Fleet Rules
- Work with Engine Manufacturers to Expand Availability of Rule Compliant Engines
- Collaborative Efforts to Leverage and Accelerate Deployment of Clean Vehicles