

The Role of NGVs in America's Transportation Future

Presentation to
Clean Technology & Expo 2009

May 5, 2009

Transportation Energy Reality 1

- When the world recession is over, growth in demand for oil will again exceed growth in supply of oil
 - Vehicle penetration in China (vehicles per thousand population) is at the level of the US during World War I

(continued)

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 - Vehicle penetration in China (vehicles per thousand population) is at the level of the US during World War I
- Oil prices will rise again to \$150 per barrel or more.

Transportation Energy Reality 2

Transportation is the only major energy market (residential, commercial, industrial, electricity generation, transportation) reliant on only one fuel.

That must change.

Transportation Energy Reality 3

For energy security, balance of trade, military flexibility, America job protection, climate change, and urban pollution reasons ...

... America must significantly reduce its use of petroleum – especially foreign oil.

In fact, that *will* happen – plan-fully or painfully.

Transportation Energy Reality 4

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- We have many *options* – natural gas, ethanol, methanol, propane, gasoline/diesel hybrids and plug-in hybrids and natural gas hybrids.

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- For the foreseeable future, there is no one, silver-bullet, panacea technology or alternative fuel that is going to replace petroleum.
- We have many *options* – natural gas, ethanol, methanol, propane, gasoline/diesel hybrids and plug-in hybrids and natural gas hybrids.
- But we don't have *choices*. We have to use them all – in the applications and in the parts of the country where they make the most sense.

Transportation Energy Reality 5

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- We can't and shouldn't:
 - We should invest heavily in R&D on those future options
 - If and when they come to market and they are as wonderful as hoped, great
- In the meantime, we should act *now* -- with the technologies and fuels that are available *now*.

Transportation Energy Reality 6

- Most of the options being discussed are for the light-duty market.
- There are few options for the heavy-duty and medium-heavy duty market.
- That's a real problem:
 - These vehicles are the heart of our economic system.
 - They use a lot of fuel (over 20% of on-road petroleum use)
 - They are most affected by high fuel prices.
 - High fuel costs are passed along to all of us as a hidden tax.

Natural Gas Reality 1

- Natural gas vehicles offer:
 - Lower urban emissions:
 - 1/6th the NO_x of the best available diesel engine
 - Lower greenhouse gases:
 - 22% less than diesel; 29% less than gasoline
 - Reduced foreign oil use:
 - 98% of natural gas used in US is produced in N. America
 - Better economics:
 - On average, 40% less than gasoline or diesel

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Natural Gas Reality 1

- Effective fuel for heavy-duty vehicles
 - Available options are:
 - Bio-diesel/petroleum diesel blends (B20 max)
 - Diesel-hybrids (limited applications)
 - Natural gas (as CNG or LNG)

Natural Gas Reality 2

- America's natural gas resource base is huge:
 - Because of technology improvements, in just the last few years, the economically recoverable volume of natural gas almost doubled
 - With technology and at current production levels, America has over 115 years of natural gas resources

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Natural Gas Reality 2

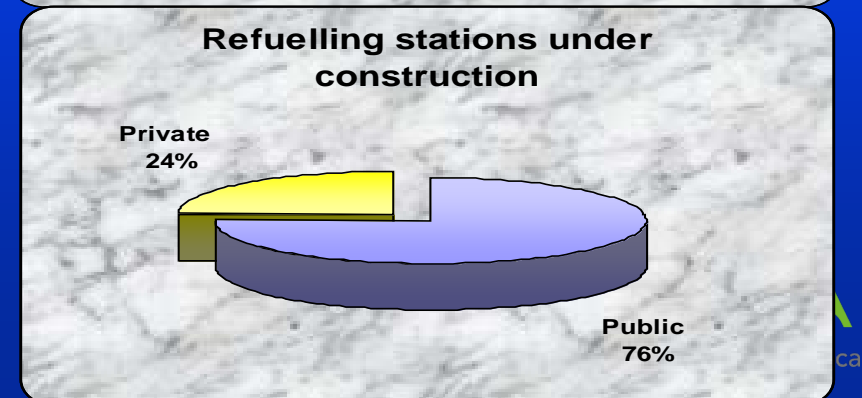
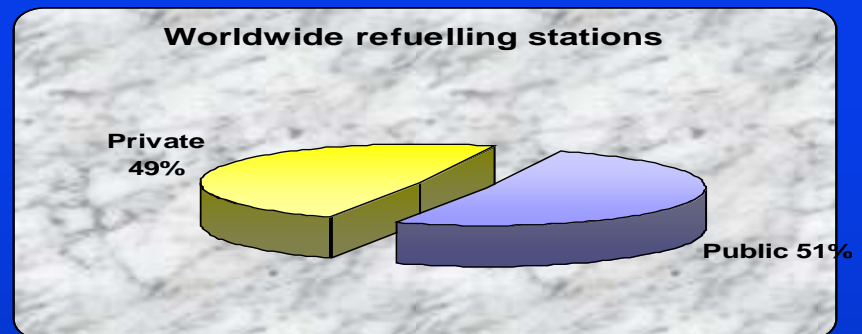
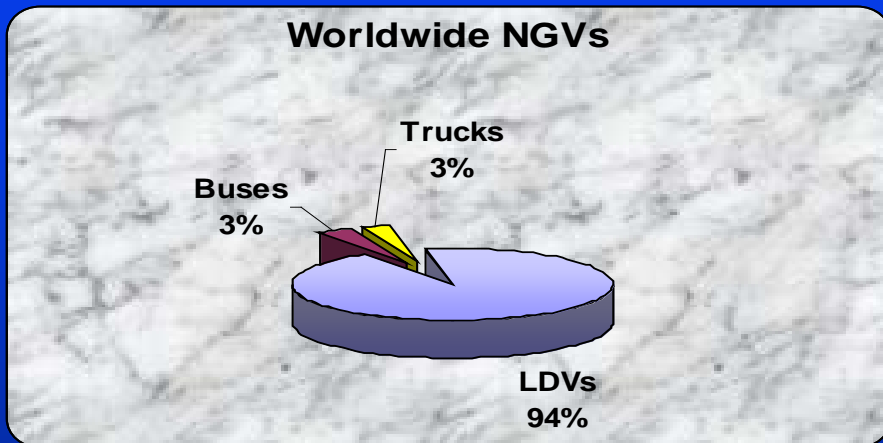
- America's natural gas resource base is huge.
 - Because of technology improvements, in just the last few years, the economically recoverable volume of natural gas almost doubled
 - At current technology and production levels, America has over 115 years of natural gas resources
- Renewable natural gas (biomethane can make the supply unlimited:
 - Landfill gas, sewage and animal waste can generate enough biomethane to fuel 10 million cars
 - Cellulosic biomethane can be limitless

Natural Gas Reality 3

- Natural gas is the best alternative to gasoline -- and especially diesel -- in high fuel-use, urban vehicle applications – especially fleet applications – including:
 - Transit buses – school buses – trash trucks,
 - airport vehicles (e.g., hotel and door-to-door shuttles)
 - water port vehicles (e.g., drayage trucks and yard hostlers)
 - goods delivery vehicles – taxis – commuter vehicles

International NGV Position

	August 2003	April 2009	
Global NGV Total	2,814,438	10,055,340	+357%
Global Station Total	6,455	14,897	+231%



Notable NGV Growth

Country	NGVs 2003	NGVs 2009	Stations '03	Stations '09
Pakistan	350,000	2,000,000	200	2,600
Argentina	1,000,000	1,750,339	1000	1,808
Brazil	550,000	1,588,331	535	1,705
Iran	*	1,215,593	*	764
India	137,000	821,887	116	325
Italy	400,000	580,000	490	700
China	69,300	400,000	270	1,336
Colombia	*	280,638	*	437
Global Total	2,814,438	10,055,340	6,455	14,887

International Vehicle Availability

- Every major car manufacturer is making natural gas vehicles for some market somewhere:
 - GM/Opel – Chevrolet – Ford – Mercedes
 - Volkswagen – Fiat – Citroen – Hyundai
 - Renault – Peugeot – Tata – Mitsubishi
 - Toyota – Honda – Nissan – Isuzu
 - Skoda – Volvo – Geely – Lifan
- GM alone makes 18 natural gas models

U.S. Overview

- Number of vehicles: 110,000 (out of 220 million)
 - Total has grown slowly
 - But focus has been on urban fleets -- especially, trucks and buses
 - Consumer interest skyrocketing when gasoline was \$4.00 per gallon
- 2008 NGV consumption:
 - 300 million GGEs (37 BCF)
- 2020 Industry Target:
 - 10 billion GGEs (1.25 TCF)

Why?

- Customer and national policy benefits of NGVs

(continued)

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- Sympathetic and pragmatic Congress
- New HD engine emission standards

Why NGV Market Will Grow

- Huge domestic supply
- Lower urban emissions
- Lower greenhouse gases
- Reduced foreign oil use
- Better economics
- Effective fuel for heavy-duty vehicles
- Political support

Questions?

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“If You’re So Smart, Why Ain’t You Rich”

- Inertia/cheap gasoline and diesel
- Greater first cost
- Natural gas option not available for all models
- Sparse fueling infrastructure
- Less truck space/range on small sedans
- Lack of natural gas industry support
- Lack of political support