The Compelling Case for NGVs

Utilities and Federal Agencies Working Together to Make the Most of The Opportunity




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Natural Gas Vehicles for America

A Compelling Case for Natural Gas Vehicles

- Natural gas is America's fuel: America's resource, America's jobs. Reduced reliance on volatile foreign oil supplies = Energy Security.
- A wide variety of NGVs are available from OEMs and SVMs. Natural gas engines emit far less emissions than diesel or gasoline and their performance now match/exceed diesel, gasoline
- Significantly lower fuel / O&M costs generate substantial life-cycle savings and, in many cases, provide fast payback of initial purchase premium. (Purchase price differential is shrinking each year)
- Vigorous NGV fueling industry emerging using a variety of business models that are expanding options for public and private fleets and consumers. LDCs and federal agencies have tremendous opportunity to work together to grow the market while meeting national goals.

Snapshot of US NGV Market Today

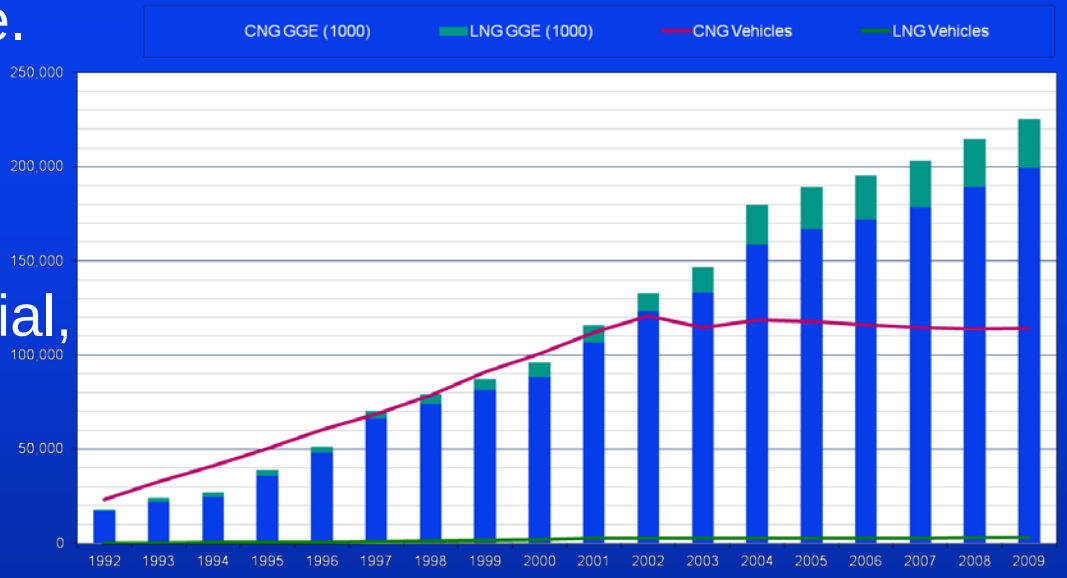
- Existing NGV inventory is estimated at ~120K
  - Pace of attrition of older LDVs is gradually declining; total counts are increasing
  - Steady growth in MDV/HDV inventory due to expanded truck OEM options
  - Consumer markets are burgeoning in areas with fueling infrastructure

- ~25-26,000 HDVs
  - 11,000 transit
  - 4,000 school bus
  - 5,200+ refuse
  - 2,600 ports/regional haul
  - 2,800 municipal/F&B/Misc
- ~72-74,000 LDVs
  (fleet and consumer use vehicles)
  - 35,000 Cars/SUVs
  - 39,000 trucks/vans

- ~17-20,000 MDVs
  - 7,500-8000 gov't
  - 1,800 package delivery
  - 1,700 airport
  - 1,000 transit/CTAA
  - 4, 500-6,000 utilities, F&B, commercial services, household goods, construction, misc

Snapshot of US NGV Market Today

- Vehicular natural gas consumption :~10-12% AGR past 6 years
  - In 2005, ~200 million GGE; In 2011: ~350 million GGE (44BCF)
  - Medium- and Heavy-duty vehicle fuel use is growing
  - Early models of consumer adoption show promise
  - Growth rate expected to accelerate in next several years as successes in niche markets build confidence.
  - Factors affecting growth include pace of worldwide economic recovery, petroleum-NG differential, vehicle and station tax credits, grants that accelerate adoption



Snapshot of US NGV Market Today

- Station count is ~1100. Although < peak of ~1350, count has grown steadily and installed capacity is up significantly
  - Attrition of older stations built in 1990s is finished;
  - New investment/upgrades to older stations
  - Newer stations are based on better economics, higher throughput with anchor accounts;
- Less than half are “public access” and most of those are not meet public expectations
- Increased interest in LNG and L/CNG
- New players / new business models
- Potential for 200-250 new stations in 2012!

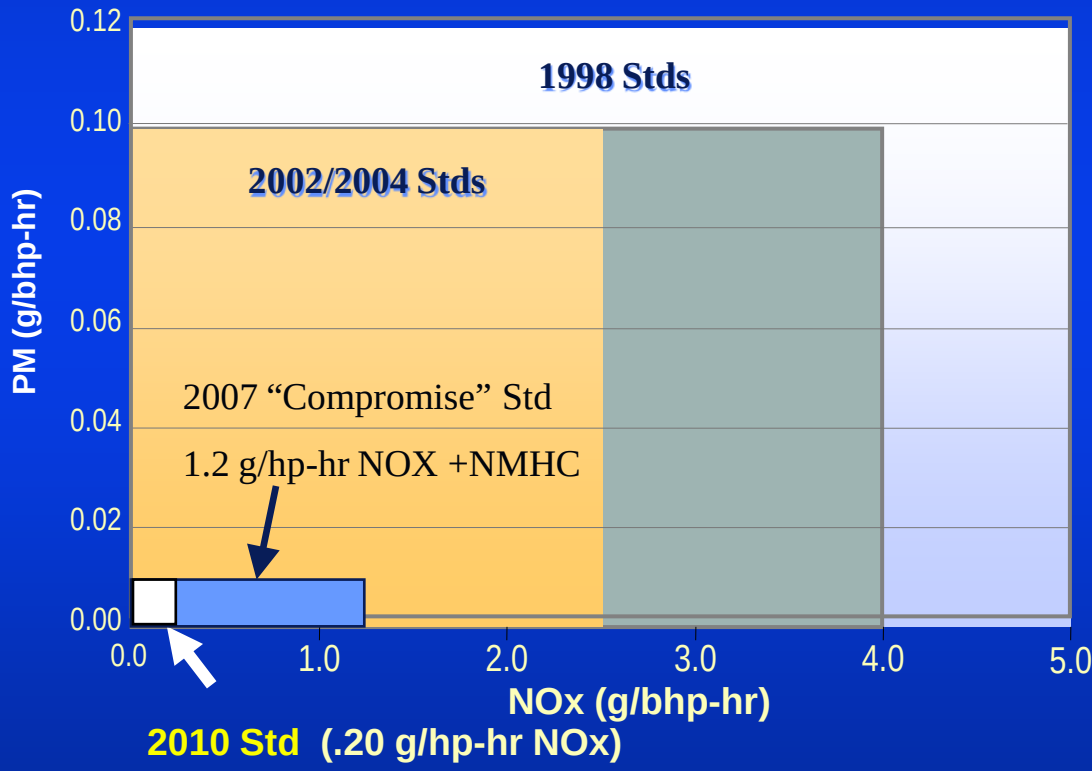
Snapshot of US NGV Market Today

- Favorable fuel cost differential between natural gas and petroleum is expected to improve further as economy recovers
  - Ratio of BBL to MCF hit over 40:1 in recent weeks and now regularly hovers at 25-30:1; this “new norm” is up from long-time 7:1 ratio

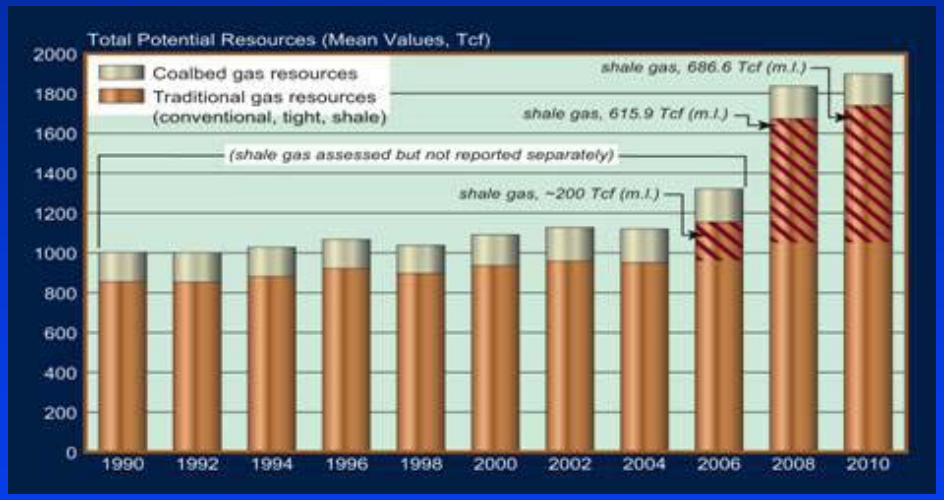
  - Savings at pump vary depending on station O&O model but are easily 40-50% less than gasoline or diesel (as much as 60% less in some areas)
  - Fleet O&O stations can save even more

Market Drivers of Change

- Emissions/Improved AQ
  - Diesel technology has become more expensive to buy, maintain and own. Differential with NG engine and vehicle technology is diminishing
- GHG -- Global Warming
  - NGVs emit 20-29% less GHG (20-23% for HDVs) (26-29% for LDVs)
- Energy Security and Economics
  - Global oil supply-demand imbalance getting worse, which pushes petroleum fuel prices up



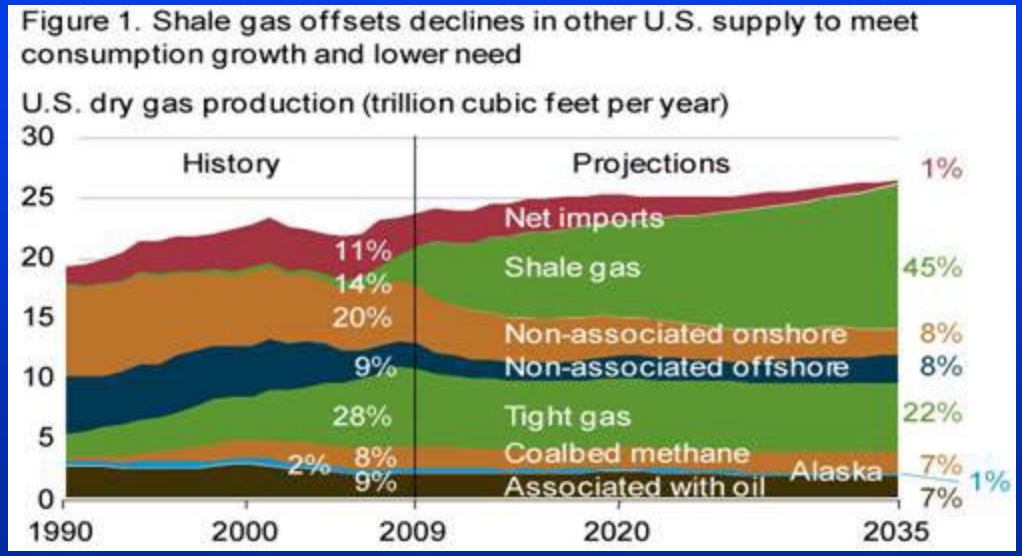
Natural Gas is an Abundant Domestic Fuel



PGC Resource Assessments, 1990-2010

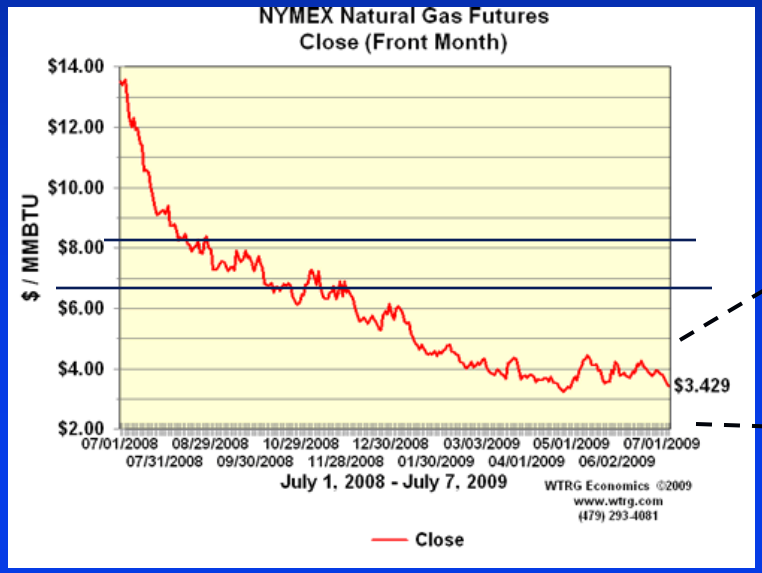
- 98+% from North America
- Well-developed distribution infra-structure;
  - ~300K miles of interstate pipeline
  - 1.2 million miles of LDC distribution lines
- Technology improvements expand recoverable base. Shale gas is major player
- Supply is now estimated @ 115+ years!

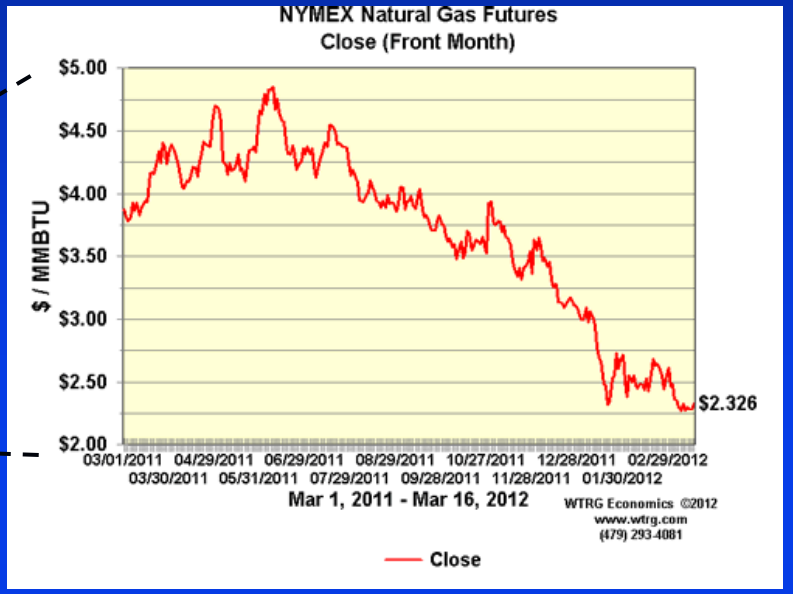
Shale Basins and the U.S. Pipeline Grid



Source: American Clean Skies Foundation.

Translating Abundance into Savings





One MMBtu is ~8.0 GGE of (uncompressed) natural gas
One MMBtu is ~7.2 DGE of (uncompressed) natural gas.

If average MMBtu is ~$3.20; commodity % is $.40/GGE ($.45/DGE)
Add LDC, compr., maint., equip. ammortization: ~$1.30-1.75/GGE
LNG pricing derived differently but base stock gas cost is same

Benefits of NGVs

- NGVs are proven and reliable
  - 12+ million NGVs in use worldwide; ~120K operating on US roads
  - Fleets are best target applications based on fuel use **(high fuel use, central fueling, local routes/operating areas)**
  - Consumer market represents tremendous opportunity
- NGVs are clean (lower PM, NOx and GHGs!)
- NGVs are quiet
  - HD NGVs are 80-90% lower db level than comparable diesel
- NGV life-cycle costs are lower
  - Fuel costs are far lower! Maintenance costs are =/< than gas or diesel
  - **Life-cycle cost advantage improves with tax credits, grants**

Key Attributes and Best Prospects

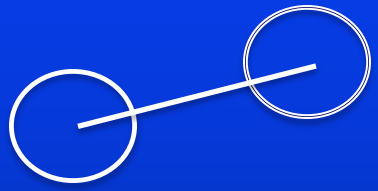
- High fuel use vehicles with return-to-base operations or repetitive route or pre-set geographic operating areas

  Freight truck – 16-20K GGE
  Transit buses – 12.5-15K GGE
  Refuse trucks – 7.5-10K GGE
  Municipal sweeper – 5-6K GGE
  Airport shuttle service – 5.5-7.5K GGE
  F&B, Textile Svcs, Household Goods – 3-5K GGE
  Taxi - 4.5-5.5K GGE
  School Bus – 2-3K GGE
  Courier sedan, newspaper van, utility/telecom van, PW pick-ups , E&P LDVs– 1.2-1.5K GGE

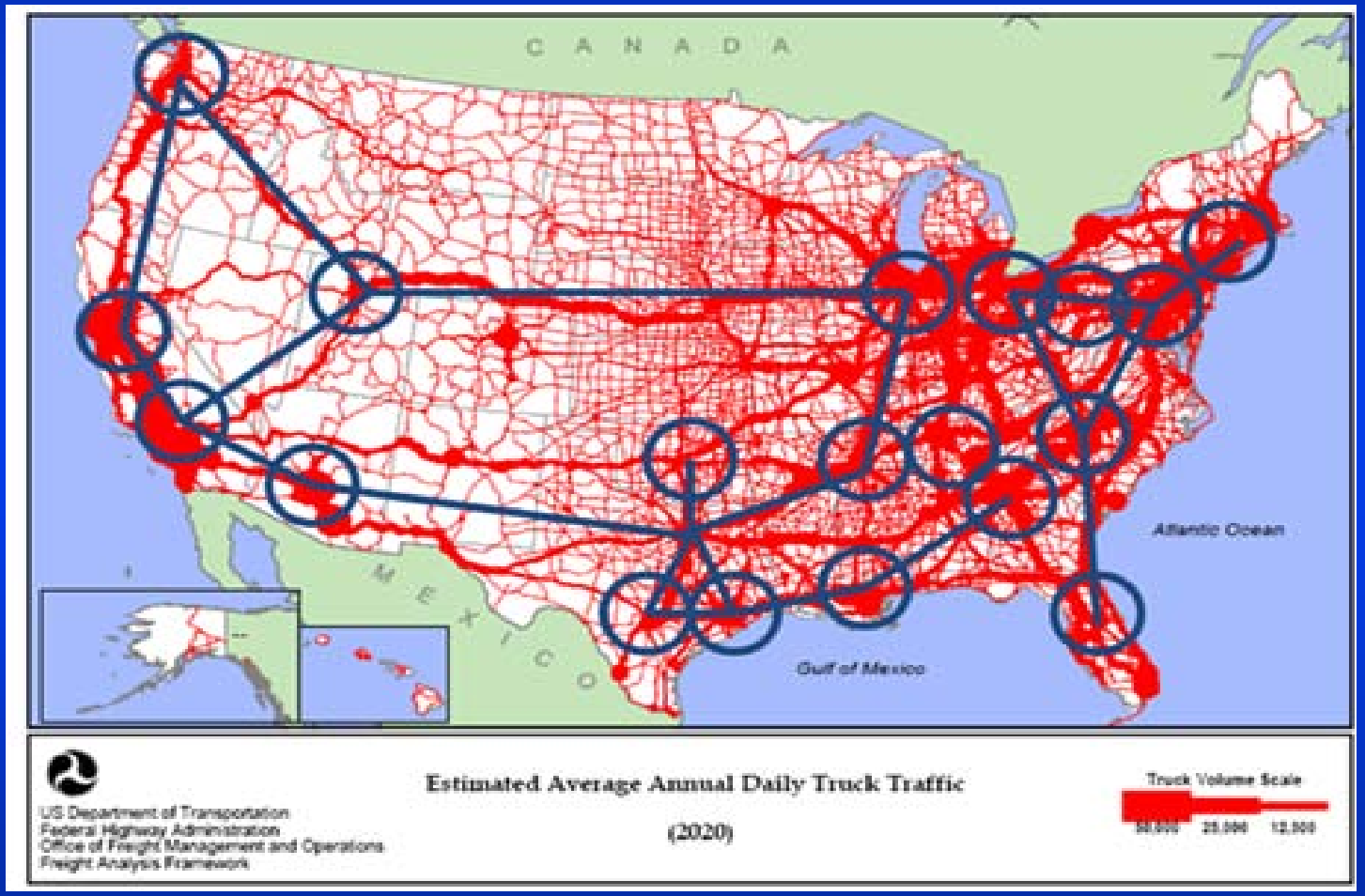
- Consumer market tends to follow infrastructure

Expanding Infrastructure: "Hub and Spoke" and Corridor Development

Step 1:
Serve local/regional fleets with hub+spoke operations. Build confidence for consumer adoption.



Step 2:
Serve lanes that connect the hubs



Additional Players Have Engaged

- Local Gas Dist Cos.
- NG Retailers
- NG Expl &Prod. Cos.
- Leasing Cos
- Traditional Retailers
- Customers

Multiple Models of Station Dev/O/O&M

- Dev/Own/Oper./Maint.
- Delegate Completely
- Own, Delegate O&M
- Co-Develop/Co-Own.

Truck Stops Are Embracing Public-Access Fueling Infrastructure

- Pilot/Flying J is working with third party natural gas fueling retailer Clean Energy to develop LNG and L/CNG stations at locations across the country. Dillon Trucking is the anchor at this Seville OH site.

- Love's is also working with Chesapeake Energy to co-develop CNG locations in the Midwest. Backyard and front-of-store retail options are both in the mix.

- Additional TSOs are evaluating this option

C-Stores Are Embracing Public-Access Fueling Infrastructure

- Kwik Trip has installed LNG and CNG dispensing capability at its central warehouse/HQ in LaCrosse, WI and is deploying 11 Class 7 & 8 trucks. The company plans to add CNG and/or L/CNG at additional retail locations near KT fuel truck depots (KT's fleet is serving as its own anchor)

- OnCue Express has built 12 locations in OK and AR. Working with Chesapeake Energy, focus is on retail consumer sales.

- Additional C-store chains are in process of evaluating similar options

Customers Are Embracing Public-Access Fueling Infrastructure

- Waste Management has been co-developing retail locations under the Clean-N-Green brand. WM fleet serves as anchor load inside the fence (primarily time fill) while promoting to public outside the fence (and extending their “green” branding)

- Transit agencies, municipalities, F&B companies, small businesses are collaborating with other fleets to aggregate load to meet critical throughput thresholds.

Growing Selection of NGVs from OEMs, SVMs

OEMs

- American Honda
- General Motors
- Chrysler Ram Trucks
- Vehicle Production Group
- Thomas Built Bus
- Blue Bird Bus
- Optima/NABI
- El Dorado
- New Flyer
- Orion
- Foton America
- Gillig
- Elgin
- Allianz/Johnston
- Schwarze
- Tymco

OEMs

- Freightliner Truck
- Freightliner Custom Chassis
- Volvo
- International/Navistar
- Kenworth
- Peterbilt
- Mack
- ALF Condor
- Crane Carrier
- Autocar Truck
- Capacity

OEM/Repower Engines

- Cummins Westport
- Emission Solutions Inc
- Westport Innovations
- Doosan Infracore America

SVMs (LDV/MDV/HDV)

- Altech-Eco
- BAF Technologies
- Landi Renzo USA / Baytech
- IMPCO Technologies
- NGV Motori USA
- NatGasCar
- Auto Gas America
- Go Natural CNG
- Parnell
- Greenkraft
- Westport LD

Retrofits of the following

- GM, Ford, Dodge, VW, Mitsubishi, Mazda
- Workhorse, Isuzu, JAC, Freightliner Custom Chassis

1.8L Dedicated Honda Civic Natural Gas Sedan (OEM @ factory).

3.5L and 3.9L BiFuel and Dedicated Impala, Malibu, Lucerne and G6

2.0L BiFuel and Dedicated Ford Focus

4.6L Dedicated Ford Crown Vic, Lincoln Town Car and Mercury Grand Marquis

2.3L and 2.5L Bi-Fuel and Dedicated Ford Fusion and Mercury Milan

3.6L Chrysler 200 (Bi/Ded),

3.6L Journey (Bi/Ded),

3.6L Avenger (Bi/Ded),

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

3.6L VW Routan (Bi/Ded),

2.5L Bi-Fuel and Dedicated Ford Escape, Mazda Tribute

5.4L Dedicated Ford Expedition and Lincoln Navigator.

4.8L and 5.3L BiFuel and Dedicated Chevy Tahoe

5.3L Chevy BiFuel and Dedicated Suburban, GMC Yukon/Yukon XL

5.3L BiFuel and Dedicated Chevy Avalanche

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

4.8L and 5.3L and BiFuel and Ded. GMC Sierra + Chevy Silverado C/K 15/25/35

5.0L and 5.4L BiFuel and Ded. Ford F150

6.0L BiFuel GMC Sierra + Chevy Silverado C/K 2500

5.7L BiFuel Dodge Ram 2500

6.2L Super Duty BiFuel and Ded. Ford F250/F350

4.7L BiFuel and Dedicated Dodge Ram 1500, Dakota, Mitsubishi Raider

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

5.4L Dedicated and BiFuel
Ford E150, E250, E350
cargo and passenger van

4.6L Dedicated MV-1
Paratransit Vehicle

2.0L BiFuel and Dedicated
Ford Transit Connect

4.8L, 5.3L and 6.0L Bi-Fuel
and Dedicated Chevy Express
and GMC Savana vans

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

6.8L 3V F450/ 550/650

GM 6.0L Bi-Fuel and Dedicated in Isuzu NPR, NPR HD COE trucks

Freightliner Custom Chassis MT45 w 6.0L

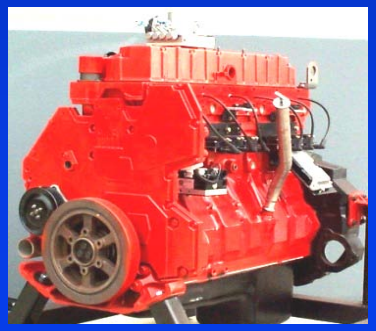
4.8L dedicated GM engine in Workhorse W42 and 6.0L dedicated GM engine in W62

GM 6.0L Bi-Fuel and Dedicated in G4500 cutaway/cab-chassis

Ford 6.8L 2VDedicated in E450 cutaway/cab-chassis

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

Expanding Selection of NG Power trains

ESI 7.6L Phoenix	CWI 8.9L ISL-G	Westport HD 15.L	CWI 11.9L ISX-G
			
• Spark Ignition	• Spark Ignition	• Dual Fuel Ignition – LNG+5-10% Diesel	• Spark Ignition
• CNG or LNG	• CNG or LNG	• LNG Only	• CNG or LNG
• Peak Rating: – 300 hp / 900 ft-lbs	• Peak Rating: – 320 hp / 1,000 ft-lbs	• Peak Rating: – 475 hp / 1,750 ft-lbs	• Peak Rating: – 400 hp / 1,450 ft-lbs • 2013 Release

Vocational/Specialty/Work Truck

Local-Regional Haul/Line Haul

Legacy Diesel Fleets: New Opportunity

- Recent revisions to EPA regulations open tremendous new opportunity for EPA approval of “Out of Useful Life (OUL)” HD engine dual-fuel natural gas retrofits
- Lower cost “approval” process will make introduction of these retrofit systems economically attractive to legacy fleets
- Approval process requires technical paper, supporting documentation, field data

- Presently, 3-4 engine families have been approved but more are added each month

Components of CNG Cost

- **Gas Bill**: (roughly $..60-65/GGE but could be lower /higher in different markets)
  - Commodity (assumes avg utility cost of $.40 (3.20/MMbtu),passed on at cost
  - Regulated tariff covering utility's gas acquisition, pipeline /planning services, and delivery to customer's meter: ($.20-.25/GGE)

- **Compression** - Rule of thumb: One fully-loaded kWh/GGE ($.10-15/GGE)

- **Station Maintenance** - Normal PM, repair/replace parts, rebuild ($.25-.40/GGE)

- **Equipment amortization** ($.35 - .60)
  - Cost of equipment or cost of capital factored into each GGE over life of station equipment . **The smaller the station throughput, the higher this goes**.

- CNG: $1.30-1.80/GGE before taxes

- Add applicable motor fuels excise tax (if applicable)
  - Federal excise tax = $.183/GGE; states vary widely

Federal Legislative and Executive Actions of Consequence re AFV and Alt Fuel Use

- EPACT 1992 and 2005
  - LDV purchase requirements but often skirted due to lack of fuel use requirements, ubiquitous credits, waivers
- E.O. 13423 *"Strengthening Federal Environmental, Energy and Transportation Management"* (1/24/2007)
  - Reduce petroleum use 2% per year until 2015 (later amended under E.O. 13524 to extend this provision until 2020)
  - Increase alternative fuel use 10% per year
- EISA (2007) Section 141
- E.O.13524 *"Federal Leadership in Environmental, Energy and Economic Performance"* (10/5/2009)
  - Reduce GHGs, Reporting / Compliance
- E.O. 13589 (May 2011) Presidential Memo sets 2015 AFV goal

Q: How Do We Solve The "Chicken & Egg" Conundrum?
(A: Make a chicken-egg omelet*)

- Throughput is key to generating economies of scale thus allowing pump price differentials that drive reasonable payback and life-cycle savings

- Identify anchor fleets that meet minimum load thresholds and/or aggregate several customers' loads if their depots or operating areas are geographically acceptable
  - Minimum load thresholds vary based on a variety of factors including: station type, station size, fuel price differential, ability to amortize maintenance costs, grants/subsidies, …..ROI expectations
  - LDVs rarely generate sufficient economics unless they have very high fuel use
  - For federal agencies focused on LDVs, local utilities need to look to build/aggregate load via other area fleets, preferably MDVs and HDVs

42 USC § 6374: Alternative Fuel Use by Light Duty Federal Vehicles

- **(c) Availability to public**
- To the extent practicable, at locations where vehicles acquired under subsection (a) of this section are supplied with alternative fuels, such fuels shall be offered for sale to the public. The head of the Federal agency responsible for such a location shall consider whether such sale is practicable, taking into account, among other factors—
- (1) whether alternative fuel is commercially available for vehicles in the vicinity of such location;
- (2) security and safety considerations;
- (3) whether such sale is in accordance with applicable local, State, and Federal law;
- (4) the ease with which the public can access such location; and
- (5) the cost to the United States of such sale.

Summary

- Fleet managers increasingly aware that NGVs are good fit because of their fuel use, repetitive route/RTB operations. Consumer market will follow initial development of infrastructure generated by fleet economics.
- Growing selection of vehicles available from OEMs/SVMs. Performance of NGVs equals and/or exceeds that of their gasoline/diesel counterparts.
- Economics are good – payback is reasonable and will get even better as fuel price differential grows. Life-cycle savings are excellent.
- LDCs are re-engaging opportunity either as full partners or facilitators. Partnering with federal agencies to aggregate load and develop stations can help meet national mandates while spurring more ubiquitous infrastructure.

Thank you
for your interest and attention!

For more information please contact:

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