We have the Fuel, and it is Ours; Opportunities for Natural Gas Vehicles in Transportation

WGA Transportation Fuels Council
2010 SPRING WORKSHOP
Salt Lake City, UT
June 1-2, 2010
Outline

• Overview of NGV Market
• Policy Considerations Affecting Transportation Market
• Legislative & Regulatory Factors Affecting Market Growth
• Economics of NGVs
• Action Items for States
NGV Market Overview

- Worldwide there are more than 11.1 million NGVs on the road; the international market grew by more than 300% from 2003 - 2009
- Number of U.S. vehicles: 120,000 (out of 220 million)
- Total vehicle count has been growing -- but slowly
- Vehicle count masks volume growth since US focus is on urban fleets -- especially, trucks and buses
- 30 percent volume growth in 2007; 25 percent growth in 2008
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 19 natural gas models
World Wide NGV Growth Actual/Projected

- 1991 to 2005 actual annual sales growth of 17.6%
- 2006 to 2020 projected annual sales growth of 17.8%

- Today’s total world vehicle population is 750 million
- 9% of vehicles in world fueled with natural gas by 2020
Achievable NGV Gas Usage and Vehicle Growth

<table>
<thead>
<tr>
<th>Bcf</th>
<th>3.5 Tcf</th>
<th>Trucks (Thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.25 Tcf</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37 Bcf</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Natural Gas Usage
Number of Trucks

Year
We Have the Fuel – And It’s Ours

• Historic barrier to NGV growth: Concern over US gas supply:
  – Is supply adequate?

• That concern is now put to rest:
  – Navigant study
  – PGC study
  – EIA projections

• NGVs have the strongest foreign oil displacement message of all alts fuels
Gas Supply and Energy Security

• 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
Gas Supply and Energy Security

- 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
PGC Resource Assessments, 1990-2008

Total Potential Gas Resources (mean values)

Data source: Potential Gas Committee (2009)
Environmental Benefits of NGVs

• Performance as good (or better) than gasoline or diesel

• Lower urban emissions:
  – 1/6th the NOx 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:
  – Less expensive than gasoline or diesel
Biomethane Makes GHG Case Stronger

- Biomethane (renewable natural gas) can be produced from any organic material:
  - landfill gas, sewage, animal and crop waste and even energy crops

- CARB: Biomethane reduces GHG emissions by almost 90 percent

- Blending a little biomethane with natural gas makes further reduces GHG benefits of NGVs
Role of Natural Gas; Natural Gas Can Displace Diesel

- Light-duty consumer vehicles use 500 gallons of gasoline per year (12,000 miles x 25 mpg)

- Diesel trucks and buses use much more:
  - e.g., 18-wheeler: 20,000 gallons (120,000 miles x 6 mpg)

- Trucks and buses use about 25% of on-road fuel:
  - Equivalent to 4.5 Tcf

(continued)
Only Natural Gas Can Displace Diesel

• Many options for light-duty vehicles:
  – e.g., natural gas, ethanol, electricity, plug-hybrids

• Only two available options for diesel trucks and buses: biodiesel and natural gas

• Biodiesel is limited and has small diesel displacement benefits

• That leaves natural gas as only option

(continued)
NGVs are a Here-and-Now Technology

• 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 all available technologies and fuels – and NGVs ARE AVAILABLE NOW.
Traditional Target Markets

• Heavy-duty freight trucks:
  – Water ports and rail
  – “Less-than-Load” (e.g., Yellow-Roadway, Forward Air, Swift)

• Transit buses/shuttle buses/school buses

• Major metro fleet management and public works departments

• Trash, recycling, cement and other vocational work trucks

• Medium-duty delivery and commercial service trucks:
  – Telecom ─ food ─ beverage ─ snack food ─ newspapers
  – linen/laundry ─ grocery ─ furnishings/appliances ─ office products

• Taxis and light-duty service vehicles
Target Market Analysis

- ANGA Market Study for NGVs:
  - Evaluate the most effective means of increasing use of NGVs
  - Identify optimal market opportunities, e.g., over-the-road trucks, taxi fleets, refuse trucks, passenger cars, etc.
  - Identify factors affecting the development of markets for NGVs (e.g., regulations, economics, incentives, government policies)
  - Characterize the benefits provided by increased market penetration of NGVs (e.g., carbon reductions, jobs, economic stimulus, etc.)
  - Due: Aug/Sept 2010
NGVs Are a “Good Fit” for Many Fleets

- Local/State Government
- Airports
  - Terminal Buses, Hotel/Parking Shuttles, Taxis, Door-to-Door
- Refuse
  - Collection/Transfer
- Transit
  - Buses, Maintenance, Supervisors
- School Districts
  - Buses, District personnel, Maint.
- “Short-Haul” Delivery
  - Food/Bev., Port/Rail, Linen Svc,
- Utilities
  - Gas/Electric/Water, Telco
NGVs Are a “Good Fit” for Many Fleets

- NGVs are proven and reliable
  - Fleets are best *(high fuel use, central fueling, local routes/op. areas)*
    - 11,000+ transit buses (1 in 5 on order),
    - Nearly 4000 refuse trucks – new fleets transitioning, existing fleets expanding
    - 3000 + school buses
    - 15-17,000 MDVs in shuttle and wide variety of work truck applications,
    - 25,000+ LDVs in federal, state local government fleets; private fleets
NGVs Are a “Good Fit” for Many Fleets

• 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 new federal tax credits
American Honda Civic GX

“Cleanest Production Vehicle on Earth”

- Natural gas version of Civic LX with 1.8L 4-cylinder engine; 8 GGE tank: 225-250 mile range
- American-made – (Mfd in Greensburg, In - 70% US-sourced parts)
- Great for sales reps, project supervisors, document and medical lab couriers, transit route supervisors, social service workers, code officials, parking enforcement, security/police (non-pursuit),
- Sold through network of approved Honda dealers, expanded service network
Establishing installation/service QSR network. Comparable OEM warranty coverage and 8yr/80K CNG/emissions system coverage.
NaturalDrive Dedicated Vehicles

- 3.5L and 3.9L Impala ('08/09/10)
- 4.8L ('09), 5.3L ('08) and 6.0L ('09) Express and Savana Vans
- 4.8L ('08) and 5.3L ('09) Tahoe
- 5.3L ('08) Suburban, Yukon/Yukon XL
- 5.3L ('08) Colorado and Canyon
- 5.3L ('08) Avalanche
- 4.8L ('08), 5.3L ('08) and 6.0L ('09/10) Sierra, Silverado pick-ups

Installation/service QSR network includes some GM dealers, independent shops. 8yr/80K CNG/emission system warranty + intact OEM warranty.
Altech-Eco Corporation Bi-Fuel and Dedicated Vehicles

2.0L (‘08/’09/’10) Ford Focus (bi-fuel and dedicated)

2.3L (‘08, ‘09) Ford Fusion and Mercury Milan (bi-fuel and dedicated)

2.0L (‘10) Bi-fuel and dedicated Ford Transit Connect

Establishing installation/service network of QSRs including Ford dealers, performance shops, commercial up-fitters. 8 yr/80K emissions component warranty coverage. Ford factory warranty intact on remaining components/systems.
Baytech Corporation
4.8L + 6.0L ('09, '10) GM LDV, MDVs

Chevy or GMC 2500 Series Express/ Savana Vans
Chevy or GMC 3500 Series Express/ Savana Van
Chevy or GMC 3500 Series Cab & Chassis
Chevy or GMC 3500 Series Van Cutaway

Chevy or GMC 2500HD, 3500 Series Silverado/ Sierra
Chevy or GMC 2500HD, 3500 Series Cab & Chassis
GMC W3500/Isuzu NPR chassis
Workhorse W42 Chassis step-van (<14,000#)
Baytech Corporation
6.0L ("09/’10) + 8.1L (’09/’10) GM HDVs

W4500/Isuzu NPR HD w 6.0L (‘09, ‘10)

Workhorse W42 w 6.0L (‘09, ‘10) or W62 w 8.1L

GMC C 6500/7500/8500 Topkick Series with 8.1L GM engine

GMC C4500/5500 Series with 8.1L GM engine

GMC and Chevy G4500 Cutaway w 6.0L (’09, ‘10))

Service provided by installer or – in cases where customer has skilled M&O staff - Baytech trains customer. Provides 8yr/80K CNG/emission system warranty + full remaining OEM warranty coverage.
BAF Technologies Dedicated Vehicles

- 4.6L (‘08, ‘09, ‘10) Ford/Lincoln/Mercury sedans (Crown Vic, Town Car, Grand Marquis)
- 5.4L (‘08, ‘09, ‘10) E250 cargo/passenger and E350 extended passenger/cargo van
- 6.8L (‘08, ‘09, ‘10) E450 cutaway.
- 6.8L (‘10) F450,550 pending

Vehicle sales thru qualified Ford dealers and select distributor up-fitters
Service thru BAF, local BAF-trained dealer or service shop or, customer’s own techs. Comparable warranty coverage (see BAF ppt for details)
7.6L NG Phoenix (S.I.N.G. engine)
- Based on International’s DT466/MaxxForce DT block used in Int’l/Navistar trucks/ buses.
- Repower older DT466 units with 175-260 Hp / 460-760 ft-lb torque remanufactured
- In-place retrofit of new MaxxForce DT with 300HP/900 ft-lb unit
- EPA / CARB- 2010 certified @ 2NOx / .01PM

Engine change-out/retrofit

Food/beverage delivery, refuse trucks, school buses, utility/public works trucks
- Anheuser Busch, Silver Eagle Dist., Manhattan Beer, Sysco Foods
- Smithtown NY Dept of Environment
- Kansas City Public Works
- Tulsa Public Schools
8.9L ISL-G (in-line 6c, 2200 rpm engine)

- Stoichometric combustion w EGR+3-way cat
- .2 NOx/.01 PM – 2010 compliant
- Engine Ratings

<table>
<thead>
<tr>
<th>Model</th>
<th>Horsepower</th>
<th>Peak Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>320</td>
<td>320 @ 2200</td>
<td>1000 @ 1300</td>
</tr>
<tr>
<td>300</td>
<td>300 @ 2100</td>
<td>860 @ 1300</td>
</tr>
<tr>
<td>280</td>
<td>280 @ 2000</td>
<td>900 @ 1300</td>
</tr>
<tr>
<td>260</td>
<td>260 @ 2200</td>
<td>660 @ 1300</td>
</tr>
<tr>
<td>250</td>
<td>250 @ 2200</td>
<td>730 @ 1300</td>
</tr>
</tbody>
</table>

- 80% of parts are same as with Cummins L
Cummins Westport Inc

• Primary supplier to OEMs in

  • **Refuse collection trucks**
    (Crane Carrier LET, Autocar Xpeditor, Int’l Condor, Peterbilt LCF 320 and Mack TerraPro; many 2nd stage upfitters e.g. Heil, McNeilus, Amrep, Labrie, PennFlex)

  • **Buses, shuttles, trolleys**
    (NABI, New Flyer, Orion, Thomas, ElDorado, Blue Bird, Optima, Gillig, variety of shuttle/trolley 2nd stage upfitters)

  • **Sweepers**
    (Elgin, Tymco, Schwarze, Allianz-Johnston)

  • **Work /Vocational Trucks**
    (Freightliner M2 tractor and straight truck; Autocar and Capacity yard hostlers; Kenworth T8SH, T440/470, Peterbilt 384 and 365)
Doosan Infracore America

- GK12 11L lean-burn engine
- 2010 Compliant using SCR (no EGR)
- Excellent low-end torque
  - 290 HP @ 2200 rpm
  - 905 ft-lb torque @ 1260 rpm
- Demo projects with transit
  - Valley Vista
  - RTA
  - LACMTA
  - WMATA
  - MARTA
- Recent bid award for 332 CNG engines for LACMTA
Westport Innovations, Inc.

- GX (formerly known as ISX-G)
  - Based on Cummins ISX platform
  - 15L engine, 400-475 HP
  - High-Pressure Direct Injection (HPDI) technology: 5% diesel pilot fuel, 95% natural gas (LNG)
  - CARB certification @ .2NOx (w SCR)
- Kenworth now offering GX in T800; Initial units are being built for Long Beach/LA Ports’ fleets (LNG). Additional drayage and LTL fleets targeted in select markets.
- Successful field test of 4 Peterbilt trucks in Wal*Mart fleet (factory-built units now available for early 2ndQ 2010 delivery)
Government Policymakers are Recognizing the Value of NGVs
Federal: Natural Gas Caucuses

- What’s a Congressional Caucus?

- Dozens of such caucuses are in place:
  - Tourism -- Pro-life -- Steel -- Beef
  - Rural -- Taiwan -- Appalachian -- Bourbon

- In 2009, for the first time (ever), natural gas caucuses were established in both Houses:
  - House: 76 members (29 states)
  - Senate: 14 members (not yet official)
Support from Congress
Existing Federal Fuel Tax Incentives

• Excise tax credit for fuel
  – Not just an income tax offset
  – 50 cents per GGE
  – Works like a rebate

• For non-tax paying entities (e.g., municipal government or transit agency), money provided as a rebate
Existing Federal Vehicle Tax Incentives

- Federal government providing tax credits for conversions, repowers, or purchase of new dedicated NGVs:
  - 50 percent of the incremental cost of the vehicle
  - Plus an additional 30 percent if the vehicle meets certain tighter emission standards.

(continued)
## Alternative Motor Vehicle Tax Credit Values

<table>
<thead>
<tr>
<th>Vehicle Size</th>
<th>Incremental Price Cap</th>
<th>80% Credit</th>
<th>50% Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 8,500 lbs. GVWR</td>
<td>$5,000</td>
<td>$4,000</td>
<td>$2,500</td>
</tr>
<tr>
<td>8,501 – 14,000 lbs. GVWR</td>
<td>$10,000</td>
<td>$8,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>14,001 – 26,000 lbs. GVWR</td>
<td>$25,000</td>
<td>$20,000</td>
<td>$12,500</td>
</tr>
<tr>
<td>26,001 lbs. GVWR &amp; Up</td>
<td>$40,000</td>
<td>$32,000</td>
<td>$20,000</td>
</tr>
</tbody>
</table>
Support from Congress
Existing Fueling Station Tax Incentives

- Tax credit of 50 percent of the cost of a station up to $50,000
Support from Congress

Extension of NGV Tax Credits (Plus)

• New Alternative Transportation to Give Americans Solutions Act of 2009 (NAT GAS Act):
  – HR 1835: Introduced in House on April 1, 2009
  – S. 1408: Introduced in the Senate on July 8, 2009

• Lead Sponsors:
  – House: Dan Boren (D-OK); John Larson (D-CT); John Sullivan (R-OK) – 143 cosponsors so far
  – Senate: Robert Menendez (D-NJ); Orrin Hatch (R-UT); Harry Reid (D-NV) plus 4 cosponsors
Support from Congress
Extension of NGV Tax Credits (Plus)

• Current provisions include (subject to change):
  – Extend the fuel, vehicle and infrastructure credits:
    • House: for 18 years
    • Senate: for 10 years
  – Make dedicated NGVs eligible for 80 percent credit
  – Make bi-fuel NGVs eligible for 50 percent credit
  – Increase the allowable incremental cost limits:
    • For LDV, increase 150% (from $5,000 to $12,500)
    • For all other weight classes, increase by 100%

(continued)
Support from Congress
Extension of NGV Tax Credits

– Increase station credit from 50 percent or $50,000 credit per CNG or LNG station to 50 percent or $100,000
– Extend the home refueling credit, $2,000

• OEM production incentives

• NGV RD&D Funding
Federal: NGV RD&D

- For the first time since 2006, DOE has funding for NGV RD&D:
  - For FY2010, Congress approved $5 million
  - NREL through NGVTF has put forward a solicitation
  - Solicitation valued at $14.5 million
    - $5 million came from DOE and the balance from CEC and SCAQMD.
  - The solicitation identified three specific areas:
    - 1) engine development;
    - 2) chassis integration; and
    - 3) demonstration of on-road products.
Federal: NGV RD&D

- The Natural Gas Vehicle Research, Development, Demonstration, and Deployment Act of 2009 also passed the House:
  - Authorizes the Department of Energy to spend $30 million annually for a five-year
  - Passed the House by a vote of 393-35
  - Awaiting Senate action.
Federal: Reducing Conversion Costs

- EPA emission certification process for aftermarket NGV conversion systems is a cumbersome and expensive one:
  - Hinders the development and use of NGVs

- The Streamline Alternative Fuel Vehicle Conversions Act (HR 3431 and S. 1809)
  - Would require EPA to streamline certification process, and reduce costs
  - EPA has issued guidance
Clean Cities Authorization

• The Clean Cities Program Authorization Act (HR 3488) was introduced on July 31st:
  – Lead sponsors: Rep. Steve Israel (D-NY) and Mark Kirk (R-IL)
  – Bill now has 48 cosponsors

• NGVAmerica working with House Energy and Commerce Committee to get the measure enacted

• Senator Orrin Hatch (R-UT) and Mark Udall (D-CO) will introduce Senate version shortly.
Federal Funding Opportunities

- ARRA Stimulus Funding
- U.S. DOE’s Clean Cities Program
- EPA Supplemental Environmental Projects
- FTA, FHWA, VALE & CMAQ Funding
- U.S. EPA Diesel Emission Reduction Act Funding (includes Clean School Bus Program)
Stimulus Package Awards

- Clean Cities Program at the end of August awarded $300 million for alternative fuel projects
- 19 of 25 awards included NGV projects
- Provides funding for 3,000 plus NGVs and 130 plus natural gas fueling stations
- NGV projects includes shuttle buses, taxis, school buses, biogas fueling stations, 600 LNG trucks, among other things
- DOE has released summary of the individual awards
EPA - Diesel Emission Reduction Act (DERA) Grants

- ARRA funding in 2009: $400M!
- FY 2009 & 2010 ($60M each year)
  - National Clean Diesel Funding - $32 M
  - State Clean Diesel Funding - $18M (States apply for allocations annually)
  - SmartWay Finance Funding - $6M
  - Emerging Technologies Program Funding - $4M
EPA DERA Program

- Qualifying projects include:
  - Repower: *(including NG engine replacement for diesel at 50% of cost to repower)*
  - Retrofit (w DPFs, DOCs, etc)
  - Clean fuel incremental cost: 100% (CNG is already cheaper)
  - Vehicle replacements: 25% of cost *(including NG vehicle for diesel)*
    - 50% for school buses that meet 2010 standard
  - Fueling infrastructure projects *NOT* allowed, but are allowed in conjunction with school bus purchases
JOB CREATION

• A $7 Billion Investment in the Nat Gas Act over 5 years added:
  – 230,000 HD and LD vehicles
  – 600,000 direct and indirect jobs
Regulatory Drivers

• US EPA 2010 Emission Standards for Heavy Duty Engines/Vehicles
• Diesel fleet rules in CA and elsewhere
  – Public fleets
  – Private fleets
  – Refuse fleets
  – Port facility vehicles
• Low Carbon Fuel Standard
  – California has adopted it
  – Northeast states looking to adopt
New Diesel Engine Emission Standards

- PARTICULATE [g/HP-hr]
- NOx / NOx+NMHC [g/HP-hr]
- SULFUR

- 1994
- 1998
- 2002
- 2007
- 2010

PARTICULATE [g/HP-hr]

- 0.0
- 0.01
- 0.10
- 0.2
- 1.2
- 2.5
- 4.0
- 5.0

NOx / NOx+NMHC [g/HP-hr]

- 0.01
- 0.10
- 0.2
- 1.2
- 2.5
- 4.0
- 5.0

SULFUR

- 15 PPM
- 500 PPM

Graphic courtesy of Cummins-Westport

NGVAMERICA
Natural Gas Vehicles for America
Natural Gas Engines Meet 2010 Standards Early

• Cummins-Westport’s Class 6 and 7 engine already meets the 2010 standard
  – Use stoichiometric engines with three-way catalyst

• Emission Solutions Class 7 engines do, too.
New Diesel Engine Emission Standards

- Diesel vehicles will cost more to buy
- Diesel vehicles will cost more to operate
- Diesel vehicles will cost more to maintain
State, Regional and Local Government Support

- California leads the way:
  - Carl Moyer Program
  - SCAQMD
  - LA/LB Ports Program

- Texas TERP Program

- Tax and other incentives:
  - Utah; NY; Oklahoma; Louisiana; others
State Action Items

- Initiate Pro NGV Tax incentives for vehicles, fuels and infrastructure;
- Good examples can come from:
  - Oklahoma; Colorado; Utah; Louisiana; Texas; NY
State Action Items

• Establish a dedicated funds for support for NGV RD&D and the Clean Cities Program
  – See: CEC; SCAQMD; NYSERDA

• Other possible Federal Sources for such a Fund:
  – CMAQ
  – DERA
    • Work with EPA’s Regional Collaboratives
    • Use of DERA’s State funds.
State Action Items

• Safety issues:
  – Conversion equipment
  – Conversion equipment installers
  – Tank Lifetimes
Contact Information:

Paul Kerkhoven
Director, Government Relations
NGVAmerica
(202) 824-7363
pkerkhoven@NGVAmerica.org
www.NGVAmerica.org
We have the Fuel, and it is Ours; Opportunities for Natural Gas Vehicles in Transportation

WGA Transportation Fuels Council
2010 SPRING WORKSHOP
Salt Lake City, UT
June 1-2, 2010