Welcome

Today’s MDC Webinar

**CNG and Emission Reductions**

will begin shortly

Tuesday, January 28, 2014


**Stephe Yborra**

Director of Market Development NGVAmerica

Director of Market Analysis, Education, and Communications Clean Vehicle Education Foundation
The Compelling Case For NGVs in Public and Private Fleets

Stephe Yborra
Director of Market Analysis, Education & Communications
Clean Vehicle Education Foundation

Director of Market Development
NGVAmerica

Snapshot of US NGV Market Today

• Existing NGV inventory is estimated at ~135K
  – 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

• ~28-30,000 HDVs
  • 11,000 transit buses + shuttles
  • 5,000 school bus
  • 7,500+ refuse
  • 2,500-3000 ports/regional haul
  • 3,000-3,500 municipal/F&B/Misc

• ~74-76,000 LDVs
  (fleet and consumer use vehicles)
  • Cars/SUVs, trucks/vans

• ~20-25,000 MDVs
  • 7,500-8000 gov’t
  • 1,500 package delivery
  • 1,700 airport shuttle
  • 1,000 community transit/CTAA
  • 7,500-8,500 utilities, F&B, commercial services, household goods, construction, misc
Snapshot of US NGV Market Today

- Vehicular natural gas consumption: ~10-12% AGR past 7 years
  - 2005: ~200MM GGE
  - 2011: ~325MM GGE
  - 2012: ~355MM GGE
  - 2013: ~390MM GGE
- Medium- and Heavy-duty vehicle fuel use is growing dramatically
- Growth rate will accelerate with new niche market successes, new platform availability for MD/HD truck sector…and consumer market?
- Factors affecting timeframe include pace of worldwide economic recovery, petroleum-natural gas differential, vehicle choices…

….vehicle and station tax credits, grants that accelerate adoption

Snapshot of US NGV Market Today

- Station count is ~1250 and growing fast; installed capacity is up significantly; ~300+ new in 2013
- Throughput via anchor accounts or aggregated loads drives investment, economies that lower pump price
- Emphasis today is on building/upgrading stations to deliver true “public access”
- CNG for local/regional, LNG for regional/long-haul

- Multiple Stakeholders Are Engaging NGV Fueling
  - Gas utilities, natural gas retailers, gas E&P companies
  - Leasing cos., customers, C-stores, truck stops, travel centers
Natural Gas is an Abundant Domestic

- 98+% of US gas consumption is supplied from North America (~88% from US)
- Well-developed distribution infrastructure:
  - ~300K miles of interstate pipeline
  - 1.2 million miles of LDC distribution lines
- Technology improvements are expanding our economically recoverable base so much so that the estimated supply is now @ 115+ yrs!
- Natural gas E&P activity is generating tens of thousands of quality jobs which gives direct and indirect economic boost

PGC Resource Assessments, 1990-2012

Translating Abundance into Savings

Major decoupling of price of natural gas and oil since 2009

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

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

If average MMBtu is ~$4.75; commodity % is $.59/GGE ($0.66/DGE). Add LDC delivery, compression, maintenance, equipment amortization: ~$1.55-1.75/GGE ($1.74 - 1.97/DGE) + fed and state taxes. LNG pricing derived differently but base stock gas cost is same
Benefits of Natural Gas/NGVs

• Natural gas is an inherently clean fuel
  – Natural gas is low-carbon fuel (CH4)
  – 23-28% lower GHGs; less NOx, PM
• Natural gas is very safe
  – Lighter than air; Limited combustion ratio (5-15%)
  – High ignition temperature: 1000+F
  – Colorless, odorless, non-toxic substance
  – Doesn’t leak into groundwater
• NGVs are proven and reliable
  – 16+ million worldwide;
• NGVs are quiet
  – HDVs are 80-90% lower db than comparable diesel
• NGV life-cycle costs are significantly lower
  – Fuel costs are far lower!
  – Maintenance costs are about = gasoline and +/- diesel

Key Attributes and Best Prospects

• High fuel use vehicles with return-to-base operations or repetitive route or pre-set geographic operating areas
  - Regional / long haul freight truck – 18-22K DGE
  - Transit buses – 11-13K DGE
  - Refuse/Concrete trucks – 7.5-10K DGE
  - Municipal sweeper – 5-6K DGE
  - Airport shuttle service – 5.5-7.5K GGE
  - Local goods/svcs: F&B, Textiles etc – 7K DGE
  - Taxi - 4.5-5.5K GGE
  - School Bus – 2.5-3K GGE
  - E&P pick-up 2-2.5K GGE
  - Courier sedan, newspaper van, utility/ telecom van, public works pick-ups – 1.2-1.5K GGE

• Consumers have already shown that they will adopt given sufficient infrastructure
Expanding Infrastructure: “Hub and Spoke” and Corridor Development

**Hub and spoke:**
Local fleets with predictable “limited” range needs (CNG or L/CNG).

**Corridor:**
Lanes that connect the hubs (CNG or LNG, depending on range)

Example: Kwik Trip station network

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Growing Selection of NGVs from OEMs, SVMs

**OEMs**
- American Honda
- General Motors
- Chrysler Ram Trucks
- Thomas Built Bus
- Blue Bird Bus
- Optima/NABI
- El Dorado
- New Flyer
- MCI -Motor Coach Ind.
- Gillig
- DesignLine
- Elgin
- Johnston
- Schwarze
- Tymco

**OEMs**
- Freightliner Truck
- Volvo
- International/Navistar
- Kenworth
- Peterbilt
- Mack
- ALF Condor
- Crane Carrier
- Autocar Truck
- Capacity
- Freightliner Custom Chassis*
- Isuzu Truck North America*

**SVMs (LDV/MDV/HDV)**
- Altech-Eco
- Landi Renzo USA / Baytech
- IMPCO Technologies
- Westport/BAF Technologies
- NGV Motori USA
- NatGasCar
- Auto Gas America
- Go Natural CNG
- Greenkraft
- PowerFuel Conversions
- EcoDual
- American Power Group
- Peake Energy Solutions
- Clean Air Power

Retrofits of GM, Ford, Dodge, VW, Mitsubishi, Mazda, Workhorse, Isuzu, JAC, UtiliMaster, FCCC; Cummins, Daimler/MB, Cal.

**HD OEM/Repower Engines**
- Cummins Westport
- Westport Innovations
LDVs Available from OEMs

Honda Natural Gas Civic Sedan (dedicated)

General Motors Silverado/Sierra pick-up (bi-fuel)

General Motors Express/Savana Cargo Van / Passenger Van (dedicated)

Ram 2500 dual-cab pick-up (bi-fuel)

Vehicles Available Through SVMs
Vehicles Available Through SVMs
OEM HD Natural Gas Powertrains

- **CWI 8.9L ISL-G**
  - Spark Ignition
  - CNG or LNG
  - Peak Rating: 320 hp / 1,000 ft-lbs

- **CWI 11.9L ISX-G**
  - Spark Ignition
  - CNG or LNG
  - Peak Rating: 400 hp / 1,450 ft-lbs

- **(2014) Volvo 13L D13**
  - Dual Fuel (LNG+Diesel)
  - LNG Only
  - Peak Rating: TBD

- **(2015) CWI 6.7L ISB-G**
  - Spark Ignition
  - CNG or LNG
  - Peak Rating: TBD

- **(?) CWI 15L ISX-G**
  - Spark Ignition
  - CNG or LNG
  - Peak Rating: TBD

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**Aftertreatment Comparison**

**ISL9 (diesel)**
- SCR Catalyst
- Particulate Filter
- Heated DEF Tank
- DEF Dosing Control Unit
- ECM
- Three Way Catalyst

**ISL G (natural gas)**
Transit and School Bus Platforms

Vocational/Specialty/Work Truck
Local-Regional Haul/Line Haul

Dual Fuel Technologies: Re-emerging Opportunity

- Dual fuel technology is making a comeback, primarily being marketed to “Intermediate Use (IUL)” and “Out of Useful Life (OUL)” HD engine applications; one company has “new” COC. Could see this option in trucks offered by OEMs
  - Varying amounts of diesel is displaced by natural gas during duty cycle
- 3/11 - EPA established a lower cost “approval” process that reduced cost and data burden thus making this dual fuel retrofit system option economically attractive to legacy fleets
- “Approval” process requires technical paper, supporting documentation, field data
- Took 6-8 months to see first “EPA listing.” Presently, 500+ engine families have been approved and more are added
  - E.g., EcoDual, APG, Clean Air Power, Peake Energy, NGV Motori, Omnitek Eng.
Step Van

• Sample Applications (e.g., textile rental service, comm. bakery)
• MPG: 6.0, 95mpd x6 dys/wk, 30K/yr
• Fuel Use: 16DGE/day; 5000GGE/yr
• CNG Premium: $25,000
• Without grant, simple payback = 3.3 years; savings = $50,250
  (based on 10 yr life and 1.50 savings/DGE)
• Grant: $15,000
• Remaining premium: $10,000
• Simple Payback: 1.3 yrs; LCC savings: $65K !!!

Refuse Truck
  (LCF model)

• Crane Carrier LET, Autocar Xpeditor, Peterbilt LCF 320, Condor, Mack TerraPro
• MPG: 2.5 – 3.0 (lots of idle and PTO time)
• Fuel Use: 35-40gge/day; 10,500DGE/yr
• CNG/LNG Premium: $30,000
• If no grant, payback is 1.9 years and Life-Cycle Cost savings = $96+K
  (based on $1.50 savings/DGE and 8 year life)
• Grant $15,000
• Remaining Premium: $15K
• Simple Payback: 0.95 years; LCC savings: $110K
Grocery Truck

- Volvo VNM/VNL, Freightliner M2/Cascadia
- MPG: 5.6 miles/DGE; 100K miles /year
- 17,850 DGE/yr
- CNG Premium (w 84 DGE capacity): $60,000
- If no grant, payback is 2.25 yrs
- Life-cycle cost savings: $127K
  (based on $1.50/DGE savings, 7-year /700K life before resale)

- Grant $25K; Remaining Premium: $35K
- Simple Payback: $26,775 yr savings = 1.3 yrs
  (based on 1.50 savings /DGE)
- Life-cycle cost savings: $152+K

Q: How Do We Solve The “Chicken & Egg” Conundrum?

(A: Make a chicken-egg omelet*)

- Throughput (sales volume) is key to generating economies of scale for the public access station owner, thus allowing pump price differentials that drive reasonable payback and life-cycle savings for customers

- Minimum load thresholds vary based on a variety of factors including: station type, station size, fuel price differential, ability to amortize maintenance costs, equipment depreciation, grants …..ROI expectations

- Achieve minimum load thresholds by:
  - Identifying an anchor fleet that justifies the investment…or
  - Aggregate several semi-anchor fleets’ loads if their depots or operating areas are geographically acceptable…or
  - Create retail public access for small fleets and consumers….or
  - All of the above
What is the Compelling Case?

- Environmental, energy security and – now, more than ever due to domestic natural gas abundance - **economic** market drivers are behind the trend toward greater use of NGVs. While fleet fuel use has been the primary focus, potential consumer market is now spurring additional investment in infrastructure.

- A growing selection of light-, medium- and heavy-duty NGVs are available from OEMs and SVMs, delivering performance and reliability that are on par with gasoline and diesel counterparts.

- A variety of fueling options are available – LDCs, E&Ps, leasing companies, other customers and independent fuel retailers – both NGV-focused and, now, more traditional fuel retailers - are engaging to develop fueling infrastructure.

- Natural gas is America’s fuel: America’s resource, America’s jobs. Reduced reliance on volatile foreign oil supplies = Energy Security

For more information please contact:

Stephe Yborra

Director of Market Development
NGV America
400 N. Capitol Street, NW - Suite 450
Washington, DC 20001

Director of Market Analysis, Education and Communications
Clean Vehicle Education Foundation
6011 Fords Lake Court
Acworth, GA 30101

syborra@ngvamerica.org / syborra@cleanvehicle.org
(301) 829-2520
Kerry Campbell
Manager of the Energy Policy and Technology Deployment Division within the Office of Pollution Prevention and Energy Assistance for the Pennsylvania Department of Environmental Protection (DEP).

PA Natural Gas Vehicle Programs
Presentation for Mid-Atlantic Diesel Collaborative
January 28, 2014
Overview

- Act 13 Natural Gas Energy Development Program (NGEDP)
- Summary from Act 13, Round 1
  - Awards
  - Vehicles
  - Fuel stations
- Project summaries
- NGEDP Round 2

Overview (continued)

- Alternative Fuels Incentive Grant Program (AFIG)
- Summary from AFIG 2013 Round 1
  - Awards
  - Vehicles
  - Fuel stations
  - Innovative
- AFIG Round 2
• Authorized by Act 13 of 2012
  – Competitive reimbursement grant for purchase or retrofit of natural gas vehicles

• Available funding
  – $20 million over 3 years ($10, 7.5, 2.5 million)
  – Round 2: $11.1 million
  – 50% to Local Transportation Organizations (LTO)

• Eligible costs:
  – Incremental purchase costs for new NGVs
  – Retrofit costs for existing vehicles
  – Equipment & installation costs only

• Ineligible costs:
  – Fueling infrastructure
  – Project development costs (engineering/FS/design)
PA NGEDP

• Eligible vehicles:
  – Dedicated CNG or LNG vehicles
  – Bi-fuel vehicles
    – Fueled in part by NG and in part by diesel or gasoline
  – 14,000 lb. or greater GVW
• Must be registered in PA

PA NGEDP

• Minimum vehicles per project application is 5
• All vehicles must be registered in PA
• Primary fueling station must be in PA
• All NGVs must meet EPA requirements
• Eligible applicants:
  – For-profit companies
  – Non-profit organizations
  – Commonwealth or municipal authorities
  – PA Turnpike Commission
  – State owned or state related universities
  – Local transportation organizations

• Eligible applicants may partner to aggregate under one application to support a fueling station

PA NGEDP

• Awards capped at 50% or $25k per vehicle, whichever is lower

• $300,000 grant award limit for projects using existing fueling infrastructure

• $500,000 grant award limit for projects that include construction of new fueling infrastructure
NGV Round 1 Summary

- # of Grants: 18
- Total $ Awarded: $6.7 million
- Number of NGVs: 311
- Total fuel usage: 3.7m gge/yr

NGV Round 1 Fuel Station Summary

- Total new fuel stations: 17
- CNG: 14
- LNG: 3
- Full public access: 3
- Limited access: 10
- Private access: 4
NGV Program Planned Fueling Stations

PA Natural Gas Vehicle Grant Program

Round 1 Awarded Project Summaries
Penske Truck Leasing Co., L.P.

- $500,000 awarded for 20 CNG trucks
- 293,000 GGE
- Location: Wilkes-Barre, Luzerne County
  - New fast fill station to be constructed in 2014
  - Restricted public access

Burgmeier’s Hauling Inc.

- $287,980 awarded for 12 CNG refuse trucks
- 173,000 GGE
- Location: Altoona, Blair County
  - Time fill station constructed in 2013
  - Private access
Rose Tree Media School District

- $499,994 awarded for 22 CNG buses
- 66,000 GGE
- Location: Media, Delaware County
  - Time fill station to be constructed in 2014
  - Private Access

Greater Phila. Clean Cities

- $492,216 awarded for 35 CNG vehicles
- 114,000 GGE
- Location: King of Prussia, Montgomery County
  - Fast fill constructed in 2013
  - Public access
Erie Metro Transit Authority

• $300,000 awarded for 12 CNG vehicles
• 131,000 GGE
• Location: City of Erie, Erie County
  – Existing fast fill station
  – Private access

Hoopes Turf Farm, Inc.

• $250,000 awarded for 10 LNG vehicles
• 305,000 GGE
• Location: Ulysses, Potter County
  – LNG fueling station constructed in 2013
  – Restricted Access
Giant Eagle, Inc.

- $500,000 awarded for 20 CNG vehicles
- 292,000 GGE
- Location: Cranberry Twp., Butler County
  - Fast fill constructed in 2013
  - Full public access

PA Natural Gas Vehicle Grant Program

- Round 2 closed January 10, 2014.
- 38 applications have been received.
- Will be awarded this spring.
- Round 3 to open late 2014.
Alternative Fuel Incentive Grant

- AFIG has existed since 1992
- In addition to grants, offers consumer rebates for Electric, CNG, Fuel Cells or LPG (formerly HEV)
- Previously funded infrastructure
- Previously funded biofuels production
- Previously funded biofuel purchases

Alternative Fuel Incentive Grant

- DEP closed this year’s AFIG round summer 2013
- Funds available for two project types:
  - Vehicle purchase/retrofit to operate on alternative fuel
    - Similar to NGEDP, but included other clean fuels, e.g. electricity, propane, any alternative to conventional
    - NGV < 14,000 lbs., others no limit
    - NGV limit may change for next round
  - Innovative Technology
AFIG – Vehicle Purchase & Retrofit

• Eligible applicants:
  – School districts
  – Municipal authorities
  – Political subdivisions
  – Incorporated Nonprofit entities
  – Corporations, limited liability companies or partnerships incorporated or registered in the state

• Eligible applicants may partner to aggregate under one application to support a fueling station

AFIG – Innovative Technology

• Innovative Technology Projects
  – Includes R&D, demonstration, pilot projects for next phase alternative transportation fuels or vehicles
  – Expected to directly result in commercialization
AFIG Vehicles Summary

- DEP Awarded over $3 million 33 Vehicle Purchase and Retrofit projects November 2013
- 351 CNG vehicles
- 337 Propane Vehicles
- 1.5 M GPY of gasoline/diesel displaced
- Will support 15 new fueling stations

AFIG Summary - Innovative

- DEP Awarded nearly $2 million for 4 Innovative Technology projects December 2103
  – Dual Fuel LNG locomotive
  – Electric vehicle batteries
  – Hydrogen fueling stations
  – Natural gas retrofit kits for gasoline
Alternative Fuel Incentive Grant

- Next round expected to open/close later this winter/early spring

Kerry Campbell
kcampbell@pa.gov
717-772-5985

www.depweb.state.pa.us and click on “Natural Gas Vehicle Program”
Perry Babb
President of Fleet Energy American, Inc.
The Move to Natural Gas as a Primary Transportation Fuel

Obstacles to Commercialization

I. Education & Promotion:

Education and promotion are still the top barriers to a rapid expansion into natural gas for transportation.

Common info gaps, weaknesses, inaccuracies:
Common info gaps, weaknesses, inaccuracies:

1. To much emphasis on the 'Why', but weak emphasis on the 'How'.
2. Myth of inordinate and costly retrofit requirements for facilities which will service natural gas vehicles.
   (Additional slides to be posted at http://marama.org.)
3. Safety Concerns
   Great DOT video from the '80s.  
   [www.youtube.com/watch?v=NqH_s3YC4sE](http://www.youtube.com/watch?v=NqH_s3YC4sE)
   Consumer Reports
4. Cost of fueling infrastructure.....'That'll be $1.5 million, please.'

Common info gaps, weaknesses, inaccuracies:

5. Improper planning......lack of coordination, planning both fleet replacement/conversion with fueling infrastructure/speed/location.
   'Build it and they will come.'
6. Future price of fuels......will diesel stay high and natural gas stay low...
   'When they start exporting LNG, natural gas prices will go through the roof.'
8. Confusion with Propane (LP)......price, delivery, etc.
A movement to promote and facilitate the use of natural gas as a transportation fuel in Pennsylvania and across America.
Obstacles to Commercialization....

II. Diesel Fleet Replacement vs. Conversions:

Many municipal and private fleets are defaulting to fleet replacement because fleet conversions are so complex/confusing/horror stories.

This is slowing down the transition to natural gas.

Fleet Replacement/Retrofit Options:

3 major options or approaches

1. OEM Dedicate CNG/LNG Powered Engines
   - uses only natural gas
   - diesel replacement/savings is easy to calculate
2. **Dual-Fuel Conversions**
   - the engine uses both natural gas and diesel simultaneously
     - a % of diesel is replaced, commonly 15% to 55%
     - diesel replacement can vary widely depending upon load, terrain, driving patterns
     - can be difficult to accurately calculate diesel replacement
   - fleets should be encouraged to access demonstration vehicles which can be tried under fleet normal operating parameters
   - space for and weight of tanks may be an issue since both diesel and natural gas tanks are needed
   - conversion costs range from $25,000 to $55,000

   www.AmericanPowerGroupInc.com
   www.EcoDual.com

3. **Engine Rebuild Conversions**
   - as part of an engine rebuild, the diesel engine is converted to run only on natural gas.
     - this is not an add-on system, but a major change to the motor.
     - diesel replacement/savings are easy to calculate
     - engine rebuild is included in this cost
     - this conversion adds $15,000 to $20,000 to an engine rebuild
   - rebuild conversion costs range from $40,000 to $55,000

   www.OmnitTekCorp.com
   www.SeraphEnergy.com
III. Government Regulations & Incentive Program Approach:

1. Require MFPA Safety Program Training for garages/mechanics converting vehicles. (Similar Oklahoma model)

   An accident could set back this new industry by a decade.

2. States to recognize both EPA Certified & EPA Compliant Conversions as eligible for grant programs

   Kits for gasoline vehicles:
   Changes in EPA regulations provide for these 2 categories of compliance.
   Kits meeting the EPA reporting requirements for vehicles more than 2 years of age. This will allow many vehicles more than 2 years old to be converted where the ROI makes sense.

   Ex. Utility Trucks/Step-Vans

3. There should be an emphasis on fueling infrastructure incentives over conversion incentives:

   A lack of conversion incentives will lead the market to find conversion solutions with a workable ROI, but conversions go nowhere without fueling infrastructure.

4. Move from a grant approach to a rebate approach for light-duty conversions:

   The grant cycle and time laps is slowing conversions and the ability to develop conversion garages. Oklahoma rebate model.

   'We received a $___,____ grant. We don't know what to do with it.'
Thank you to today’s Speakers

Stephe Yborra
syborra@ngvamerica.org
301-829-2520

Kerry Campbell
kcampbell@pa.gov
717-772-5985

Perry Babb
pbabb@fleetenergy.com
814-867-3590