Natural Gas as a Transportation Fuel

Policy Opportunities to Drive NGV Market Growth

Sherrie Merrow | Encana Natural Gas
July 24, 2012
Gas Shale Plays are an Industry Changing Breakthrough

- 2,600 Tcf of Total Resource
- 100+ Year Supply at 70 Bcf/d
- 70+ Year Supply at 100 Bcf/d

Source: EIA, CSUG, IHS Energy 2011
Historic Energy Commodity Price Spreads
Situation Enables Expanded Markets for Natural Gas

Abundance of Natural Gas expected to sustain price difference…
…making it an attractive economic choice

Source: NYMEX oil, coal, and gas spot prices 2011
U.S. Average Retail Fuel Prices
Natural Gas Consistently is the Lowest Price

Source: AFDC 5/3/2012
Natural Gas Vehicle Growth by Continent
Great North American Opportunity

Natural Gas Vehicles by Continent

Italy as an Example
- ~600,000 NGVs
- 37% growth since 2007
- NGVs have 7% market share of all new vehicles purchased
- Cost of CNG is 50% to 60% less expensive than gasoline
- Government incentives
- Imports 89% of natural gas

Source: IANGV, NGVA Europe, Fiat 2010
Taking Action
U.S. Transportation Sector Displacement

Fuel Consumption by Market Segment
Displaceable Market Volume: 61.6 Bcfe/d

Light Duty: 42.4 Bcfe/d (69% of total)
Heavy Duty: 10.8 Bcfe/d (18% of total)
Medium Duty: 3.2 Bcfe/d (5% of total)
Marine: 3.2 Bcfe/d (5% of total)
Rail: 2% (1.3 Bcfe/d)
Upstream: 1% (0.7 Bcfe/d)

Source: Data and forecast from EIA, Encana, 2010
Displacement opportunities exclude Air, International Shipping, Military, Pipeline Fuel
Natural Gas Solutions

Compressed Natural Gas (CNG)
- Source: Pipeline
- Compressed to 3,600 psi
- Primarily for light and medium duty vehicles
- Ideal for return-to base fleets or fleets that require fast-filling
- Time-fill and fast-fill capability / stored in pressurized tanks

Liquefied Natural Gas (LNG)
- Source: Liquefaction Plant
- Converted to liquid form for ease of storage and transport
  - (Cooled to -260 °F and 40 psi)
- Ideal for medium to heavy duty fleets
- Fast-fill / stored in tanks (similar to diesel size)
Vehicle Categories – Choices Already Exist

- Light Duty CNG
- Medium to Heavy Duty CNG
- Heavy Duty On Road LNG
- Heavy Duty Off Road LNG
And the U.S. Market is Responding
Natural Gas Infrastructure

- Since 2009:
  - 32% increase in CNG stations
  - 45% increase in LNG stations

- Planned Stations:
  - 95 CNG stations
  - 99 LNG stations

- Regional Corridors:
  - CA / NV / UT / CO / WY
  - TX / OK / LA
  - NY / I-75

1,015 CNG stations and 52 LNG stations

Source: US DOE Alternative Fuels & Advanced Vehicles Data Center as of 5/14/2012
Types of NGV Legislation, Regulation & Policy

- CNG/LNG Fuel Tax Incentives
- Vehicle Purchase/Conversion Funding
- Infrastructure/Station Funding
- Fleet Purchase Requirements
- Utility / Local Distribution Company Incentives
  - Rate tariffs – NG and electricity
  - Grant programs
  - Connection reductions
  - Higher pressure gas delivery
- Other
  - Use of HOV lanes
  - Use of carpool parking areas
  - Access to State alternative fueling stations
  - Emissions inspection exemption
  - AFV insurance discounts
  - Airport incentives (preferential taxi lanes)
  - Reduction in license / state fees
Options for Utilities to Grow the NGV Market

Adds market for natural gas for utilities

- Selling of distribution service / reduced gas usage tariff for public CNG fueling infrastructure
- Selling of bundled sales service
- Selling of compressed gas to third-party fueling stations
- Selling of bundled sales service plus “fueling” service
- Selling or leasing of home fueling appliances / reduced gas usage tariff for such appliances
- Reduced electric billed demand tariff for public CNG fueling infrastructure
- Dissemination of information on NGVs
- Marketing of NGVs through promotional and other practices
- Research and development (R&D) activities and funding
- Expansion of infrastructure to accommodate NGVs
U.S. Federal NGV Proposed Policy

- Pres. Obama – remarks indicate new support for natural gas (NGVs; ARPA-E; OEMs)
  - ARPA-E recently awarded $30M for CNG technology research
- New Alternative Transportation to Give Americans Solutions Act (NAT GAS Act)
- U.S. HR 3832 LNG Excise Tax Equalization Bill
- U.S. HR 1712 (effort to delete the $5M cap on retail sales)
- EPA Light Duty CAFE Ruling

- No vehicle or station incentives for NGVs
NGV Incentives:
- All States have some AF Policy
- 37 states with NGV policy
- 6 states with good vehicle incentives
- 6 states with good station incentives
- 18 states with some incentives
- 7 states with Gov. only incentives/requirements

Source: AFDC 2011
## Natural Gas Vehicle Incentive Comparisons

<table>
<thead>
<tr>
<th></th>
<th>Federal</th>
<th>Texas</th>
<th>West Virginia</th>
<th>Oklahoma</th>
<th>Ohio</th>
<th>Colorado</th>
<th>Louisiana</th>
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</thead>
<tbody>
<tr>
<td>Natural Gas Vehicle Count*</td>
<td>117,446</td>
<td>10,440</td>
<td>22</td>
<td>2,932</td>
<td>929</td>
<td>1,197</td>
<td>361</td>
</tr>
<tr>
<td>Natural Gas Stations (E/P)</td>
<td>1,036 / 197</td>
<td>39 / 27</td>
<td>1 / 0</td>
<td>69 / 6</td>
<td>5 / 4</td>
<td>20 / 15</td>
<td>15 / 7</td>
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<td><strong>Infrastructure / Home fuel</strong></td>
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<td>Texas Clean Transportation Triangle funds up to $2MM</td>
<td>50% of the construction costs up to $250,000 ($312,500 if allows public access) Expires: 01/01/21</td>
<td>75% of infrastructure Expenses: 01/01/14</td>
<td>80% of the purchase or installation cost of fueling infrastructure Expires: 01/01/14</td>
<td>50% of the cost of constructing an alternative fueling station Expires: No expiration</td>
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<tr>
<td><strong>Vehicle Incentives</strong></td>
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<tr>
<td>Accelerated depreciation on 50% of the vehicle cost in 2012</td>
<td>Texas Gas Services offers $2,000 rebate for the purchase of a NGV / $3,000 for the conversion Texas Clean Transportation Triangle funds 60-90% of cost up to $8MM</td>
<td>35% of the purchase price or 50% of the conversion cost up to $7,500 for &lt; 26,000 GVWR and up to $25,000 for &gt; 26,000 GVWR Expires: 01/01/21</td>
<td>50% of the incremental cost Expires: 01/01/14</td>
<td>Incentives available for diesel school bus conversions Expires: 01/01/21</td>
<td>55% of incremental cost in 2012 Decreases: 35% : 2013 25% : 2014 and 2015</td>
<td>50% of the incremental cost, or 10% of the cost of the motor vehicle or up to $3,000 Expires: No expiration</td>
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<td><strong>Fuel Credits</strong></td>
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<td>Preferential NG Fuel rates</td>
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<td>Deregulation of CNG as a Motor Fuel</td>
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<td><strong>Mandates / Goals</strong></td>
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<td>Acquisition Requirements CNG highway/station every 100 miles by 2015</td>
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<td><strong>Funding</strong></td>
<td>Grants / Loans</td>
<td>Grants / Loans</td>
<td>Grants / Loans</td>
<td>Infrastructure Loans</td>
<td>Grants</td>
<td>Grants</td>
<td>Loans</td>
</tr>
</tbody>
</table>

Source: AFDC 2012, EIA 2009
NGV MOU

- Led by CO, OK, PA and WY, states are joining together to use NGVs in state fleets
  - Aggregate vehicle purchase numbers for auto manufacturers – joint RFP that all states can use
  - Commit to converting state fleets (county, municipal, and other government)
  - ME, UT, NM, WV, KY, TX, OH, MS, LA have joined and others are in progress
Completed Picture for Market Growth

Effective NGV Policy

- HOME FUELING
- FUELING STATIONS
- FLEETS & CONSUMERS
- OEMs & MULTIPLE PLATFORMS
- COMPETITIVE PRICING
- MAINTAIN INDUSTRY SAFETY & COMPLIANCE
Why Ohio?

- Ranks 21\textsuperscript{st} in the country for reserves of natural gas with 896 Bcf
- Consumed 2.0 Bcf/d of natural gas in 2009
- Produced 243 MMcf/d of natural gas ranking 20\textsuperscript{th} in the nation for production
- Interstate corridors (I-70, I-71, I-75, I-80, I-90)
- Utica & Marcellus Basins

Source: EIA, 2009
U.S. & Ohio Transportation Fuel Portfolio
2009 Consumption

America & Ohio rely on one primary fuel for transportation - Petroleum

U.S. (193.9 Billion gge / 61.6 Bcfe/d)
- Gasoline – 137.9 Billion gge
- Diesel – 55.6 Billion gge
- Alternative Fuels – 0.4 Billion gge

Ohio (7.0 Billion gge / 2.2 Bcfe/d)
- Gasoline – 5.0 Billion gge
- Diesel – 2.0 Billion gge
- Alternative Fuels – 9.1 Million gge

Source: Energy Information Administration (EIA), 2009
U.S. & Ohio Alternative Fuel Portfolio
2009 Consumption

America & Ohio alternative fuel portfolio is dominated by natural gas products.

U.S. – 431 Million gasoline gallon equivalents (gge)

Excludes Biodiesel, estimate for 2009 not available

Source: Energy Information Administration (EIA), 2009

Ohio – 9.1 Million gasoline gallon equivalents (gge)
Natural Gas Fueling in Ohio
As of December 21, 2011

Existing CNG Stations

- 3 public stations (Columbus, Coshocton, Newark)
- 12 private stations (Akron, Ansonia, Cincinnati, Cleveland, Columbus, Fairborn, Garfield Heights, Hamilton, Lima, Logan, Sandusky, Wooster)

Planned CNG Stations

- 20 stations (Akron, Bowling Green, Brooks Park, Canton, Cincinnati, Cleveland (2), Columbus (2), Dayton, Dublin, Findlay, Haviland, Norton, Saint Clairsville, Seville, Sheffield Village, Toledo, Wooster, Zanesville)

Source: AFDC
### Ohio Vehicle Payback Example

<table>
<thead>
<tr>
<th></th>
<th>Pickup Truck</th>
<th>School Bus</th>
<th>Refuse Truck</th>
<th>Transit Bus</th>
<th>Class- 8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incremental Cost</strong></td>
<td>$10,000</td>
<td>$36,000</td>
<td>$29,000</td>
<td>$50,000</td>
<td>$70,000</td>
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<tr>
<td><strong>Incentives</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Net Incremental Cost</strong></td>
<td>$10,000</td>
<td>$36,000</td>
<td>$29,000</td>
<td>$50,000</td>
<td>$70,000</td>
</tr>
<tr>
<td><strong>Annual Mileage</strong></td>
<td>30,000</td>
<td>20,000</td>
<td>30,000</td>
<td>40,000</td>
<td>100,000</td>
</tr>
<tr>
<td><strong>Annual Mileage Fuel Efficiency (mpg)</strong></td>
<td>14</td>
<td>7.7</td>
<td>3.1</td>
<td>3.6</td>
<td>5.6</td>
</tr>
<tr>
<td><strong>Gallons of Fuel / Year</strong></td>
<td>2,143</td>
<td>2,597</td>
<td>9,677</td>
<td>11,111</td>
<td>17,857</td>
</tr>
<tr>
<td><strong>Petroleum Fuel Cost per Gallon</strong></td>
<td>$3.49</td>
<td>$3.89</td>
<td>$3.89</td>
<td>$3.89</td>
<td>$3.89</td>
</tr>
<tr>
<td><strong>Natural Gas Cost per GGE</strong></td>
<td>$1.80</td>
<td>$1.80</td>
<td>$1.80</td>
<td>$1.80</td>
<td>$1.80</td>
</tr>
<tr>
<td><strong>Annual Fuel Savings</strong></td>
<td>$3,621</td>
<td>$5,429</td>
<td>$20,226</td>
<td>$23,222</td>
<td>$37,321</td>
</tr>
<tr>
<td><strong>Simple Payback (years)</strong></td>
<td>2.76</td>
<td>6.63</td>
<td>1.43</td>
<td>2.15</td>
<td>1.88</td>
</tr>
</tbody>
</table>

Source: CNGPrices.com as of 12/21/11
Who’s Converting in Ohio?

- Ansonia Local School District
- Akron Metropolitan Regional Transit Authority
- City of Columbus
- City of Dublin
- Franklin County
- Glenn Research Center
- Hamilton County
- Hocking College Energy
- Kirk Energy Group
- Ohio Department of Transportation
- Peabody Landscaping
- Quasar
- Rumpe
- Sandusky International
- University of Northwestern Ohio
- Vectren
Creating a Unique Value Proposition

<table>
<thead>
<tr>
<th>Economic Benefits</th>
<th>Social Benefits</th>
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</thead>
<tbody>
<tr>
<td>![Money Image]</td>
<td>![Employment Image]</td>
</tr>
<tr>
<td>![Environment Image]</td>
<td>![Energy Security Image]</td>
</tr>
</tbody>
</table>

- **Economic Benefits**
- **Social Benefits**
- **Environmental Benefits**
- **Energy Security Benefits**
Additional Information
Resources

- American Natural Gas Alliance (ANGA)
  - http://www.anga.us/

- Alternative Fuel Stations and Prices
  - http://www.altfuelprices.com/
  - http://www.cngprices.com/
  - http://www.fueleconomy.gov/

- Clean Vehicle Foundation

- Natural Gas Vehicle Institute
  - http://www.ngvi.com/

- Natural Gas Vehicles for America

- US DOE Alternative Fuels & Advanced Vehicles Data Center
  - http://www.afdc.energy.gov/afdc/

- Weld County Smart Energy
  - http://www.weldsmartenergy.org/
### Market and Technology Movement

#### LD Market
- OEMs bring bi-fuel CNG PU Trucks to market 2013
- 13 States sign MOU for NGVs
- GE & Whirlpool initiate Home Fueling Appliance projects
- Encana deploys CNG station-in-a-box in Riverton, WY

#### HD Market

<table>
<thead>
<tr>
<th>Engine Size (liters)</th>
<th>CAT</th>
<th>Westport</th>
</tr>
</thead>
<tbody>
<tr>
<td>9L</td>
<td></td>
<td></td>
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<tr>
<td>12L</td>
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<tr>
<td>15L</td>
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</table>

- Cummins/Westport to introduce new dedicated 12L in Q1 2013 – Fill the Gap
- Volvo & Navistar enter the market with natgas options for Class 8
- Encana develops and deploys new mobile fueling solutions
- EPA approved dual fuel systems

#### Dual Fuel
- CAT ad Cummins announce OEM Dual Fuel engines for 2013, Tier II
- Encana conducts 1st Dual Fuel PPS Canadian Pilot project w/field gas
- Encana develops and deploys new LNG regas solutions

#### Dedicated
- E&P Ops
- Off-Road Market
Natural Gas Vehicle Option Examples

- **Light Duty Vehicles**
  - Honda Civic Natural Gas (NG)
  - Chevrolet – Impala, Silverado, Tahoe, Malibu
  - Ford – Focus, Fusion, F150, Milan, Transit Connect
  - Dodge – Ram

- **Medium Duty Vehicles**
  - Chevrolet – W4500, C4500 / 5500, Express, Savana
  - Ford – F250, F350, E450, F450, F550, F53 / F59
  - Transit Bus – Blue Bird, Thomas Built, El Dorado, Foton America, NABI, New Flyer, Orion, Motor Coach Industries
  - Work Trucks – Workhorse, Sterling, International, MaxxForce
  - Refuse – American LaFrance, Mack, AutoCar, Crane Carrier, Freightliner, Kenworth, McNeilus
  - Street Sweeper – Elgin, Freightliner, Schwarze

- **Heavy Duty Vehicles**
  - Short-Haul – Freightliner, Kenworth, Peterbilt, Volvo Trucks N.A.

- **Heavy Duty Engine Manufacturers**
  - Cummins Westport 8.9L ISL G
  - Westport 15L
NGV Conversion in Ohio

NGV Conversion Centers:

- **CNG Solutions**
  - Light and Medium duty conversion
  - Also offers Diesel Dual Fuel

- **Alternative Vehicle Solutions**
  - Located in Cleveland, Ohio
  - CNG auto repair, installation, and maintenance of factory vehicles to Dedicated Natural Gas or Bi-Fuel
  - Distributes / installs AutoGas, BAF, Baytech, GoNatural, IMPCO, Landi Renzo and NatGas Car
Ohio Planned and Existing LNG/CNG Stations