Light/Medium Duty Vehicles
CNG Workshop: March 20, 2012
Greater Philadelphia Clean Cities
PECO Energy
Why Natural Gas?
It Is Abundant and Domestic!

- Over 40 states have natural gas resources
- 22 shale basins
- Reserves and production forecasts have doubled
- Reserve-to-production ratios have climbed from ~10 to >100 years
- Shale gas is offsetting declines in conventional gas production

Photo courtesy of American Clean Skies Foundation

U.S. production of natural gas, 2008-2035

[Graph showing U.S. production of natural gas from 2008 to 2035]

barnettshaleanim.zip
Why Natural Gas?

※ **Cheaper** | 20-40% less than crude oil on an energy-equivalent basis; CNG price not correlated to oil prices (unlike propane, ethanol and biodiesel)

※ **Safer** | CNG is lighter than air and does not “pool” like gasoline, diesel and propane; CNG is far too rich to ignite at storage temperature/pressure

※ **Reduces Greenhouse Gases** | NGVs reduce CO₂ emissions by 20-25%

※ **Domestic Resource** | Only 3% of US natural gas consumption comes from outside North America compared to 68% of oil imports in 2010

※ **Abundant** | More than 120 years of available domestic supply

※ **Renewable** | Methane from landfills, stranded gas wells, agricultural operations and more can be converted into natural gas

Source: Clean Energy, “Natural gas is many things.”
BAF is the leading provider of natural gas vehicle conversions in the United States

- Founded in 1992 by industry veterans
- More than 15,000 conversions completed to date
- Proprietary fuel systems – dedicated and bi-fuel
- Extensive in-house engineering and design team
- BAF conversions maintain OBD-II functionality and full factory warranty
Why BAF?
Fully Integrated Alternate Energy Solutions

- Light-duty vehicles are crash tested to ensure conformance to FMVSS-303 (not done “by analysis” like others)

- The only CNG converter to achieve “3Q” Status with Ford
  - QVM - Qualified Vehicle Modifier
  - QFC – Quality Fleet Care
  - QCM – Qualified Calibration Modifier

- This means that BAF is utilizing Ford OEM calibration standards for CNG and not “hacking into” or performing an “unauthorized reflash” of the original calibration
Vehicles are ordered through a qualified Ford dealer with the “gaseous prep” option
- Includes hardened valves and valve seats
- Necessary to work with 130+ octane “dry” CNG fuel

Vehicles are shipped directly to BAF Dallas or one of our 20+ BAF-trained and certified upfitters throughout the country for conversion to CNG

Vehicles are delivered through the ordering Ford dealer
10 QC technicians monitor our conversion process from start to finish.

All vehicles have drivability data captures reviewed by QC technicians and our calibration engineers.

Daily analysis of defects:
- Immediate feedback for production supervisor
- Provides basis for installer training
- Identifies potential issues with vehicles currently in service

Why BAF? Quality Control
BAF’s QVM status means that the original Ford warranty is not voided as a result of the conversion process.

Any issues can be addressed directly through one of more than 70 BAF-trained Ford dealer service locations throughout the country.

Prefer to work on the vehicles yourself?
- BAF will also train customer fleet service personnel to perform warranty work on BAF conversion.
- We will also train drivers on how to operate and fuel the vehicles.
BAF Trained/Certified Upfitters

- Autotruck Denver / Colorado Springs
- Knapheide Quincy
- AutoTruck Chicago
- Creative Elkhart
- Autotruck Fort Wayne
- Zoresco Pittsburgh
- FYDA Pittsburgh
- NAEU Hooksett
- CVS/Empire East Brunswick
- DeJana Baltimore
- AutoTruck Louisville
- Altec Elizabethtown
- Sortimo Norcross

★ Represents BAF locations
Headquarters is Dallas

BAF - A CLEAN ENERGY COMPANY
**BAF Dedicated CNG Conversion Process**

1. All gasoline components removed
2. Tanks are installed and fuel lines run to regulator
3. Underhood components added
   - Fuel injectors
   - Fuel lines
4. Computer reprogrammed for CNG
5. QC inspection/14-mile driving loop
CNG Cylinders

- Designed to NGV-2 standards:
  - Burst tested a 2.25 times service pressure
  - Pressure and temperature cycle tested
  - Bonfire tested
  - Gunfire tested

- 15 or 20 year tank life

- Cylinders must be inspected by a qualified inspector every 3 years or 36K miles or in the event of an accident
Modern CNG vehicles operate at 3,600 PSI system pressure

Four types are used on CNG vehicles:

- **Type I** – All metal
  - Cheapest, heaviest but most abrasion and impact resistant option
- **Type II** – Metal w/hoop-wound fiber overwrap
  - Not commonly used due to advances in Type III and IV cylinders
- **Type III** – Metal w/full fiber over wrap
  - Most common option; good balance of cost/durability
- **Type IV** – Plastic liner w/full carbon fiber over wrap
  - Pricey, used only where low weight is of primary importance
CNG Vehicle Operation

- Starts Just Like Any Modern Fuel-Injected Vehicle:
  - Do not depress accelerator pedal, and crank as normal
  - Noise levels will be slightly higher than gasoline (remember that CNG is a dry fuel) and much quieter than diesel

- Bi-fuel vehicles will initially start on gasoline, and then switch to CNG after ~45 seconds
  - Done to prevent fuel spoilage

- CNG fuel level is displayed on OEM instrument cluster
  - High-side pressure gage also serves as a back-up fuel level indicator
Vehicle fuel economy and performance are comparable to a gasoline vehicle

- CNG is sold on a “Gas Gallon Equivalent” basis
- CNG vehicles will not have the same fuel economy and performance as a diesel vehicle

System malfunctions displayed using OEM warning lights

Initially operators should refuel vehicles at ¼ tank until comfortable with CNG operation
Products

BAF provide the largest offering of CARB/EPA Certified Ford Vehicles

Transit Connect

Ford E-Series

Ford F-Series
Dedicated CNG Ford Transit Connect

- Transit Connect, passenger, cargo and work truck configurations available
- BAF dedicated CNG system
- 11 → 18 Gasoline Gallon Equivalent fuel capacity
- EPA/CARB and SULEV Certified
- HOV eligible in many states
Dedicated/Bi-Fuel CNG
F-Series Pickup Overview

- Ford F-250/350 w/6.2L V8 (2011)
- **Bi-fuel (CNG/gasoline) option available on F-250/350**
- 10 – 40+ Gasoline Gallon Equivalent capacity available
- EPA certified; CARB available from MY12
- Certified SULEV; HOV eligible in many states
• Ford F-450/550 with 6.8L V10
• Gaseous prep package also to be offered on F650/750 from March 2012
• EPA/CARB certified
• BAF is the industry leader in offering unique solutions to deal with the unique needs of these vehicles:
  • Customized tank placement/mounting
  • Fuel capacity to 60+ GGE
Ford E-250/350

Conversion available on 5.4L V8 (E-250/350) with gaseous prep option

CARB/EPA Certified SULEV

20 – 25 Gasoline Gallon Equivalent (GGE) capacity standard on dedicated E250/350

Bi-fuel (CNG/gasoline) option available on E-250/350

10 GGE standard on bi-fuel; 15 or 20 GGE optional
Dedicated CNG
E-450 Shuttle Overview

- Ford E-450
- Conversion available 6.8L V10 (E-450) with gaseous prep option
- CARB/EPA Certified SULEV
- 29 GGE standard on E450; additional capacity available
- Wide variety of tank mounting options
Sources of Additional Information

※ www.ngvamerica.org – NGV America – the pre-eminent organization advocating the use of natural gas as a vehicle fuel
※ www.cleancities.energy.gov – Clean Cities national website
※ www.pickensplan.com – Information on T. Boone Pickens’ plan for US energy independence
※ www.cngnow.com - CNG fueling station locator
※ www.cleanenergyfuels.com - The nation’s largest provider of CNG/LNG fueling stations
※ bcarr@baftechnologies.com : THANK YOU!!!
CNG is the logical alternate fuel choice:

- Cleaner
- Most economical/stable pricing
- Safer
- Abundant domestic resource

Ford and our partners have partnered with BAF to provide your customers with the industry’s premier CNG vehicle solution:

- “3Q” Status – QVM, QCM, and QFC
- FMVSS 303 compliant through actual crash testing
- Extensive training and support available – just call!
BAF has a nationwide sales presence – contact us!

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