



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

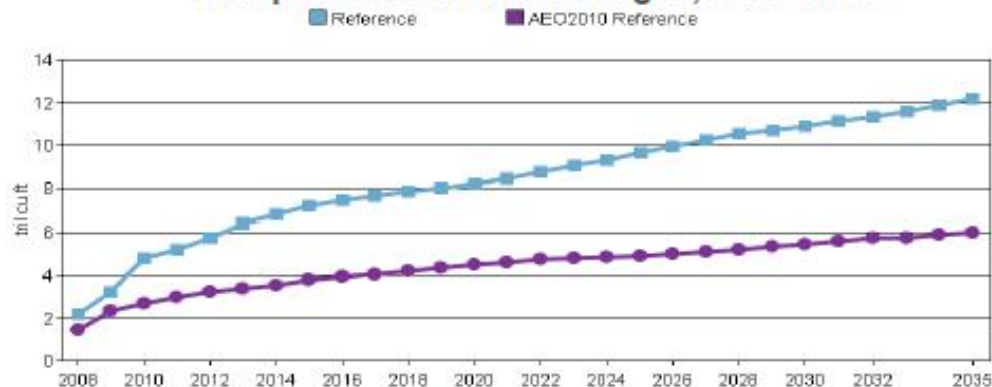


barnettshaleanim.zip



Photo courtesy of American Clean Skies Foundation

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



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

✱ **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



at&t



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



Why BAF?

Ease of Ordering

- ⌘ 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

Why BAF?

Quality Control

- ✘ 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?

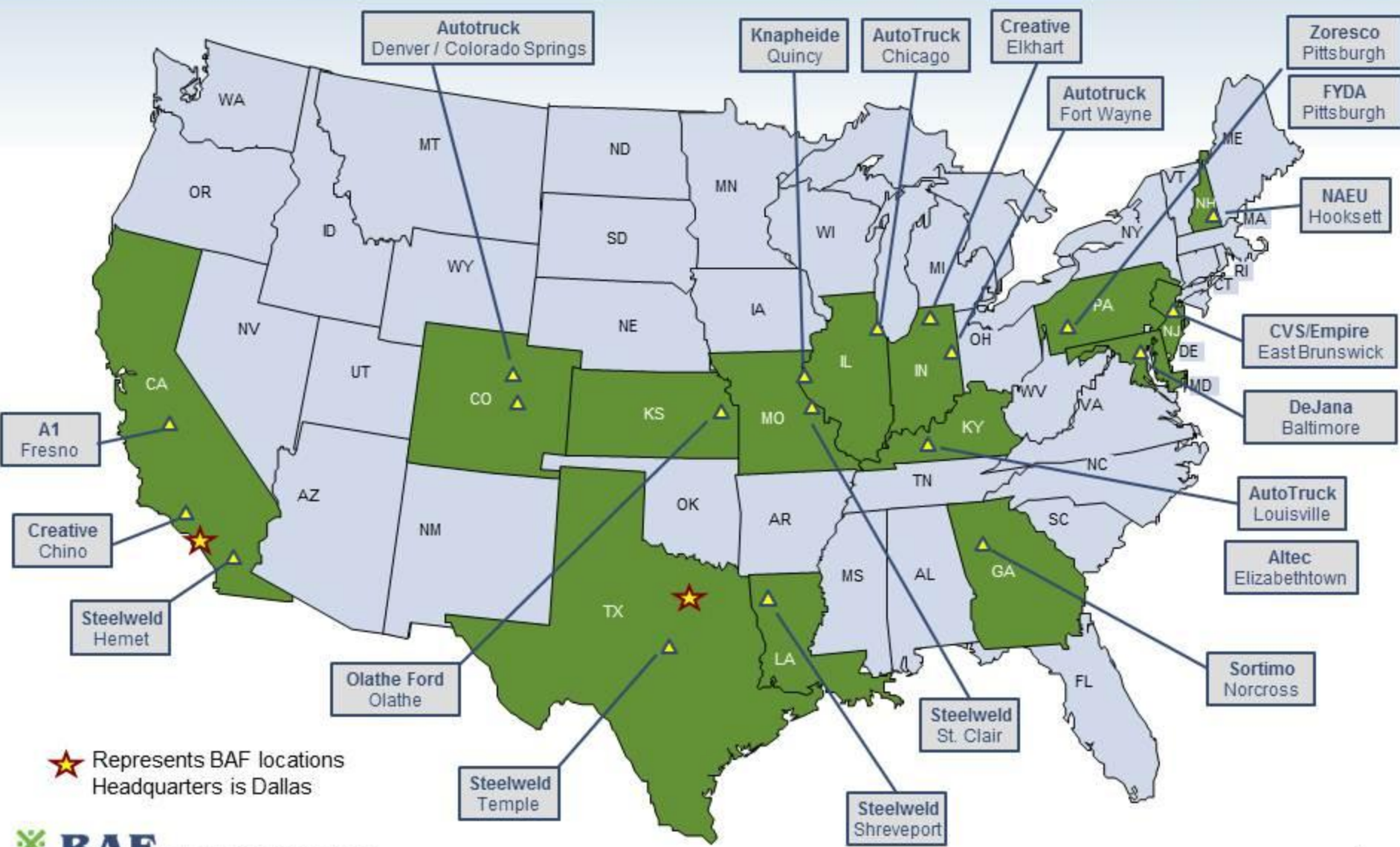
Unparalleled Levels of Service and Support

- ✘ 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

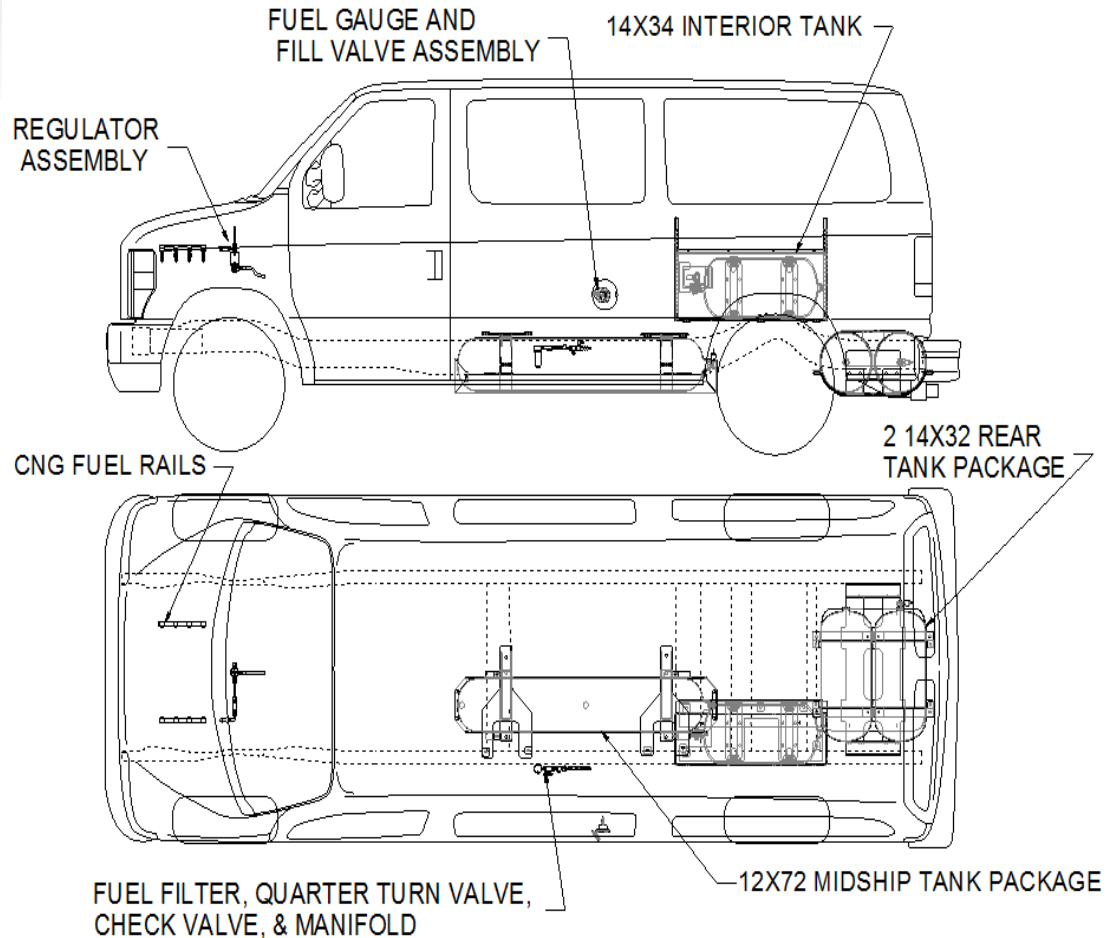
BAF Trained/Certified Upfitters



★ Represents BAF locations
Headquarters is Dallas

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

CNG Cylinders

✘ 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

CNG Vehicle Operation

- ✘ 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



Dedicated CNG F450/550/650/750 Overview

- ✘ 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



Dedicated/Bi-Fuel CNG E-250/350 Van Overview

- ✘ 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
- ※ www.fleet.ford.com/truckbbas - Ford Fleet Alternative Fuels Buyer's Guide
- ※ bcarr@baftechnologies.com : **THANK YOU!!!**

Summary:

✘ 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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