The Compelling Case For NGVs in Public and Private Fleets






CNG Focus Group Education Day

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The Compelling Case For NGVs in Public and Private Fleets






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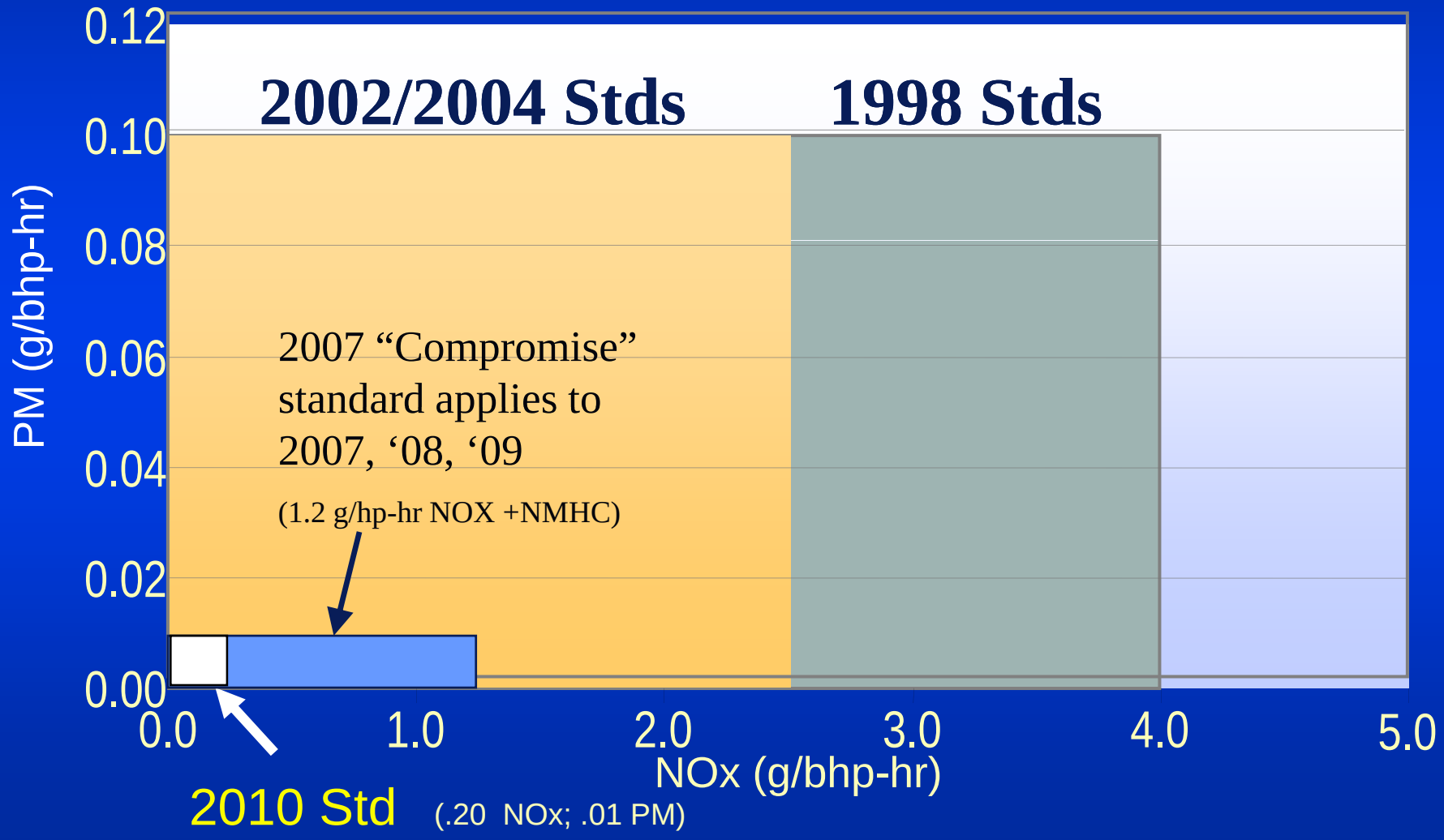
What is the Compelling Case?

- Environmental, energy security and economic market drivers are very favorable to fleets' use of NGVs. Developing fleet market will spur eventual consumer market.
- Many light-, medium- and heavy-duty NGVs are available from a growing number of OEMs and SVMs
- Variety of fueling options available – vendors have stepped in to partner with LDCs and E&P companies to develop fueling infrastructure
- Federal and state tax credits and grants further improve NGVs' already favorable life-cycle advantages

Market Driver For NGVs
AQ and Emissions Requirements

- Air quality issues are gaining added political traction as health toll and economic impact are tallied
  - NAAQS and State Implementation Plans (SIPs)
  - Large % of population lives in non-compliance areas; improvements made, new EPA emissions benchmarks
    - 149+ million people live in counties deemed as non-compliant
    - Costs: absenteeism, lost productivity, healthcare
  - Gradual improvements to LDVs over many years; trucking interests fought HDV requirements early on – now on a relatively fast track
  - Tightening EPA HDV emissions requirements create trade-offs in diesel-powered HDV performance and increase purchase and O&M costs

EPA's HD Engine Emissions and Fuel Requirements



The Price of Progress: OUCH!

Complexity, Confusion and Cost

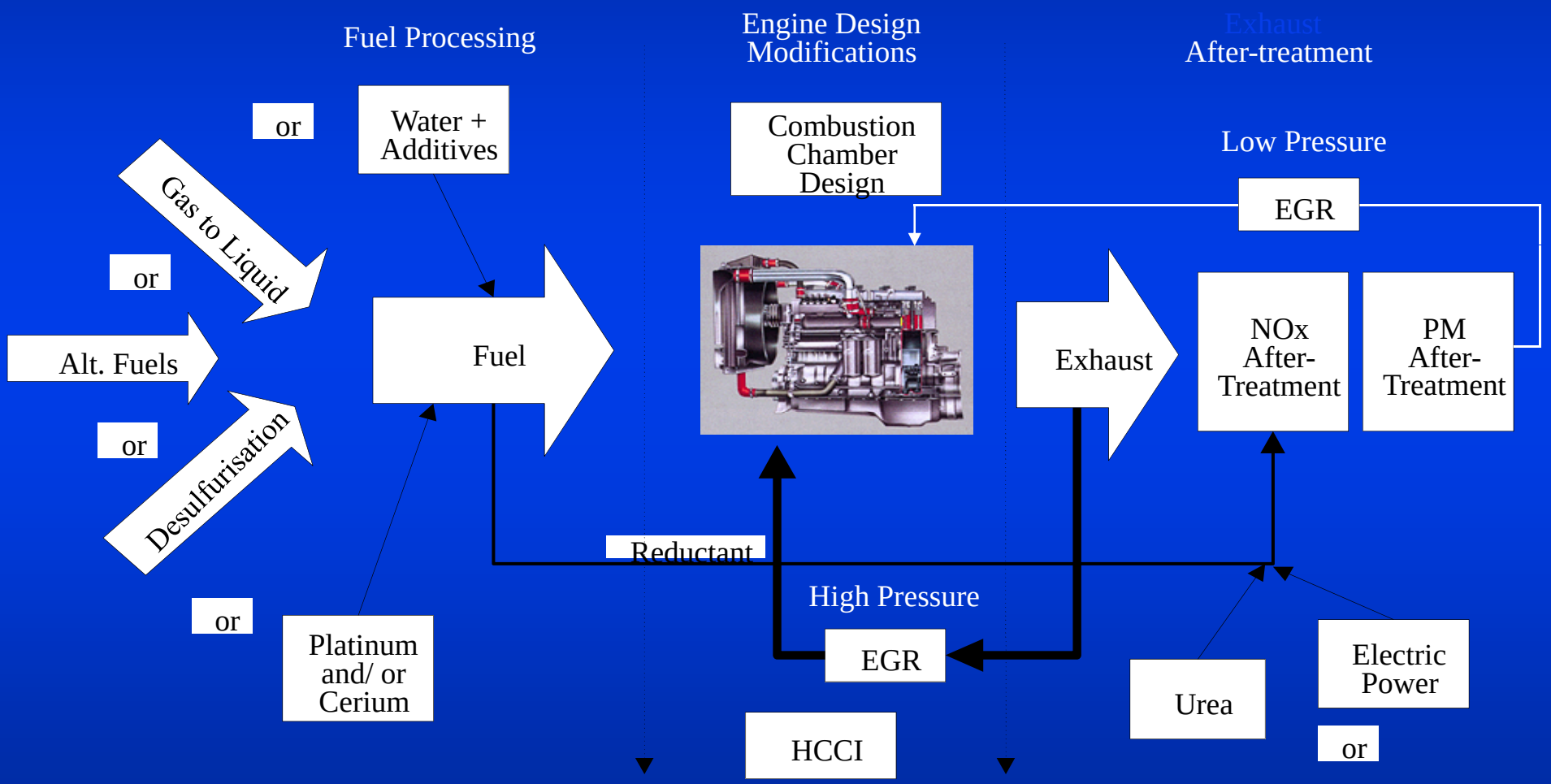


Diagram Courtesy of TIAX LLC

The Emissions Hurdles for Fleet Operators
Impact of EPA's 2004, 2007 and 2010 Requirements

- Diesel performance trade-offs were required to achieve 2004 emissions benchmarks and again in 2007
  - 2004 diesels: decreased fuel economy (3-6%), decreased power/performance; further declines in 2007.
  - Complex exhaust after-treatment technologies are expensive and maintenance intensive
- Achieving 2010 NOx requirement
  - Most have elected to use SCR w urea + ionized water -"DEF"
  - Ratio of DEF to diesel will vary from 1:50 to 1:25 based on duty cycle
  - Added complexity; compliance strategies when vehicle runs out of DEF
  - DEF system adds weight as well.
  - Concern about "slippage" – unreacted by-product is ammonia

Market Driver for NGVs
Lower Greenhouse Gases (GHG)

- The Environmental, Economic and Political Realities of Global Warming and Greenhouse Gases
  - Issue is quickly gaining traction internationally and here in US
  - California Adopts Low-Carbon Fuel Standard
  - Additional states are likely to follow as they have done with vehicle emissions standards (NESCAUM in northeast is developing GHG reduction MOU – potential for LCFS)
  - EPA has begun tackling GHG emissions rulemaking

- **Natural gas vehicles reduce GHGs between 20-29%**
  - For HDVs, about 20-23%; for LDVs, 26-29%
  - Depends on comparative vehicles and duty cycles

Market Driver For NGVs

Energy Security and Economics

- Global oil supply-demand imbalance getting worse, which pushes fuel prices up
  - US = <5% of world pop but 25% of oil use
  - Asian economies compete for oil supply; demand outpacing supply; New oil discoveries lag growth; existing refinery capacity is at/or near peak – new capacity is lengthy process
  - Barrel of oil topped $145 in late spring 2008! Slump in world economy pushed prices down but higher prices will return. Are you prepared?
  - Traditionally ratio between MCF and barrel was 6/7-to-1. Now @ 25-to-1 and regularly hovers in this range!
- **CNG savings compared to diesel are currently $.90-1.50 less per DGE depending on location, size of station, ownership/O&M arrangements**
  - **Differential was as high as $2.50 in Spring '08**

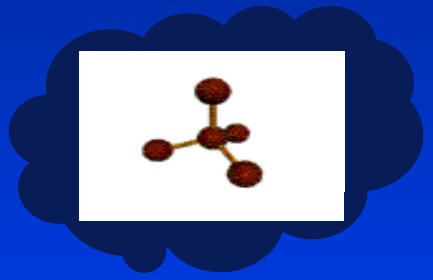
Traffic in Shanghai China: Chinese vehicle ownership per capita is equal to where US was in 1919!

Diversifying America's Transportation Fuel Portfolio

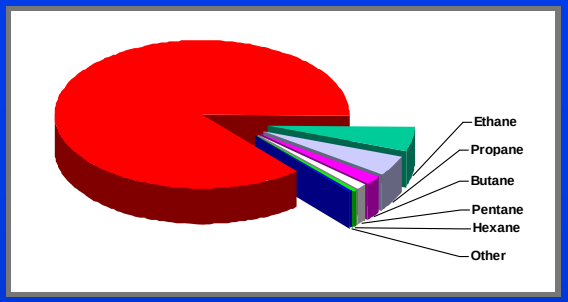
- Many Alternative Fuels and Vehicles Needed
  - Electricity
    - All-electric
    - Hybrids, PHEVs
  - Bio-diesel (B100) and blends
  - Ethanol
    - E85 (limited production/distribution – majority is in Midwest market)
    - Oxidant additive to gasoline (e.g. E10 gasoline – perhaps to be increased)
  - Propane
  - Natural Gas
    - CNG for light and medium duty and LNG for heavy duty vehicles
  - Hydrogen
    - Internal combustion engines (H/CNG blends like Hythane)
    - Fuel cells (eventually)

Natural Gas and the Hydrogen Future

- Natural gas and NGVs are the logical energy pathway and technology bridge to the hydrogen transportation energy future
  - Natural gas is 87-95% Methane
  - Methane is CH4 - 80% Hydrogen
  - Reform at station or on-board
  - H/CNG blending in internal combustion engines is likely precursor to wider use of H2
  - Market acceptance of gaseous fuel compression, storage vessels, engine maintenance
  - NGV industry is spearheading Codes & Standards development

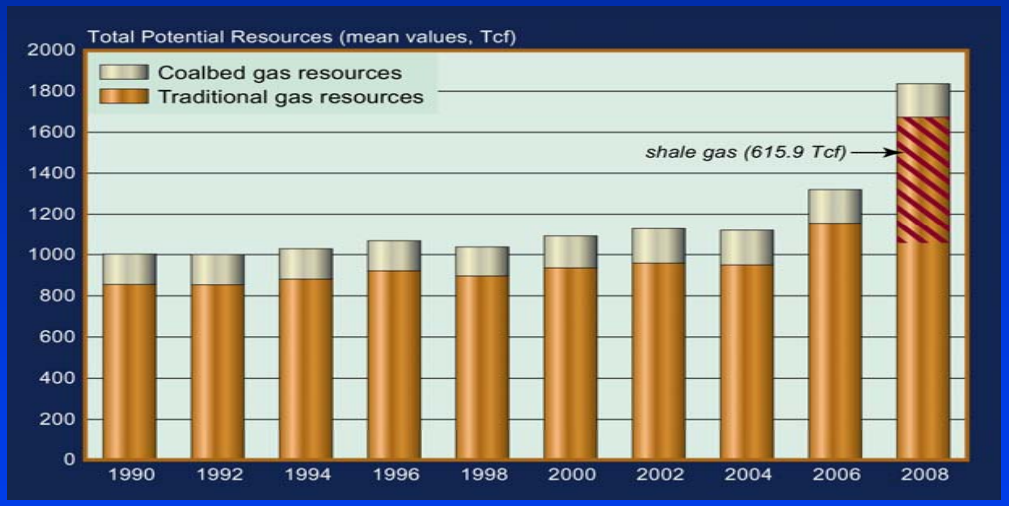


Methane Molecule



- Still a LONG way to go before H2 vehicles are commercially viable and represent significant impact

Natural Gas is an Abundant Domestic Fuel



PGC Resource Assessments, 1990-2008

Shale Basins and the U.S. Pipeline Grid

Source: American Clean Skies Foundation.

98+% from North America
(~87% US, ~12% Canada, ~1-2% imported LNG)

Well-developed distribution infra-structure; (290K miles of interstate pipeline provides gas to 1.2 million miles of LDC distribution lines)

American fuel = American jobs

Consistent buffer of supply in proved reserves, technology improvements keep expanding recoverable base.

Improved technologies have made shale gas economically viable and significantly bumped our supply base. Supply now estimated @ 115+yrs!

Facts About Natural Gas

- Natural gas is an inherently clean fuel
  - Natural gas is mostly methane: one carbon atom
  - (Diesel – C14H30; Gasoline – C8H18; Propane – C3H8)
  - Less NOx, soot and greenhouse gases than petroleum fuels

- Natural gas is very safe
  - Lighter than air… dissipates when released
  - High ignition temperature: 1000-1100F
  - Limited range of air/fuel combustion ratio (5-15%)
  - Colorless, odorless, non-toxic substance
  - Doesn't leak into groundwater
  - Comprehensive fuel tank, vehicle and station design/mfg codes & standards

Methane Molecule

Facts About Natural Gas

- Liquefied Natural Gas (LNG)
  - Cryogenically cooled to liquid @ ~(260)F, stored in liquid form onboard vehicle and vaporized before it enters engine cylinder
  - Preferred by many heavy-duty fleets due to its energy density, which translates into increased range, greater payload, reduced space requirements.
  - Most vehicular LNG used today is produced at limited number of plants and trucked to fleets' onsite storage vessels. Transport costs are major determinant of economic feasibility
  - Growing interest in small- and medium-scale liquefaction plants located nearer to point of end-use; likely higher production cost/gallon but lower transportation cost.
  - Gas supply from pipeline, landfills, sewage/agricultural waste digesters

Facts About Natural Gas

- Compressed Natural Gas (CNG)
  - Gas delivered to site by local gas utility and compressed and stored onsite and/or distributed directly to vehicles….or
  - L/CNG - LNG made on-site or delivered to site, then compressed to higher pressure and passed thru evaporator/heater to turn to vapor stage, then dispensed into onboard storage
  - Onboard 3600psi vehicle cylinders; 4 types of onboard cylinders;
    - Type I (all metal)
    - Type II (metal liner, partial wrap)
    - Type III (metal liner, full wrap)
    - Type IV (plastic liner, full wrap)

Benefits of NGVs

- NGVs are proven and reliable
  - ~12 million NGVs in use worldwide; ~110K operating on US roads
  - Fleets are best **(high fuel use, central fueling, local routes/op. areas)**
    - ~11,000 transit buses (1 in 5 on order),
    - ~4000 refuse trucks – new fleets transitioning, existing fleets expanding
    - ~3600-3800 + school buses
    - ~20,000 MDVs in shuttle and wide variety of work truck applications,
    - ~25-30,000+ LDVs in federal, state local government fleets; private 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 federal tax credits**

NGVs Are a “Good Fit” for Many Fleet Applications

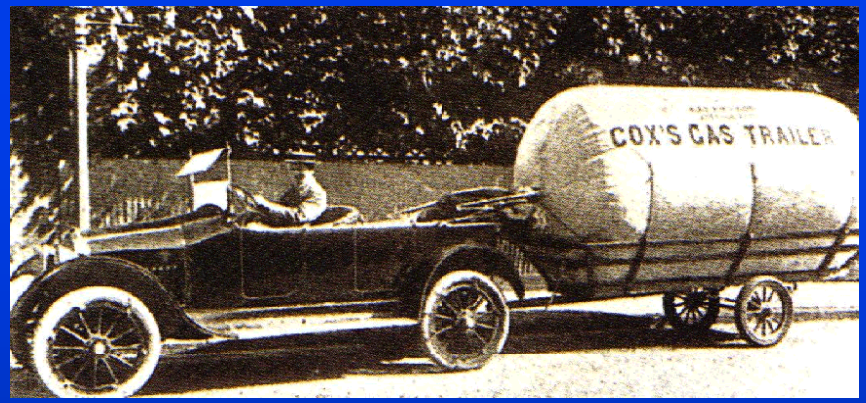
- Local/State Government
  - All Departments
- Airports
  - Terminal Buses, Hotel/Parking Shuttles, Taxis, Door-to-Door services
- Refuse
  - Collection-Recycling/Transfer
- Transit
  - Buses, Maintenance, Supervisors
- School Districts
  - Buses, Admin. staff, Maintenance
- “Short-Haul” Delivery
  - Food & Beverage, Package, Port-Rail, Linen /Textile Services, Newspapers
- Utilities
  - Gas/Electric/Water, Communications





Wheels

Available Natural Gas Vehicles and Engines and the Sales /Service Channels that Support Them



("We've come a long way baby")

Growing Selection of NGVs from OEMs, SVMs

OEMs

- American Honda
- General Motors
- VPG/MV-1
- Thomas Built Bus
- Blue Bird Bus
- Optima/NABI
- El Dorado
- New Flyer
- Orion
- Foton
- Gillig
- Elgin
- Allianz/Johnston
- Schwarze
- Tymco

OEMs

- Freightliner Truck
- Freightliner Custom Chassis
- International
- Kenworth
- Peterbilt
- Mack
- ALF Condor
- Crane Carrier
- Autocar Truck
- Capacity

OEM/Repower Engines

- Cummins Westport
- Emission Solutions Inc
- Westport Innovations
- Doosan America

SVMs (LDV/MDV/HDV)

- Altech-Eco
- BAF Technologies
- Landi Renzo/Baytech Corp
- IMPCO Technologies
- Natural Drive
- NGV Conversions/Motori
- NatGasCar
  - GM
  - Ford
  - Dodge
  - Workhorse
  - Isuzu
  - FCCC

Light-Duty NGV Availability
Impact of EPA Certification and OBD II on retrofit-conversion SVMs

- 1994: EPA sets certification requirements for CNG.
  - OEMs use of ECMs; concern about conversion emissions
  - SVMs given alternative option (Memo 1A Option 3).
  - Dozens of “kit manufacturers” leave market (this is “good”)
- April 2002: Option 3 phased out
  - SVMs must meet full certification requirements; very costly, technically difficult , requires expertise and $$$ equipment
  - Only a few SVMs had technical + financial resources to remain and certify
- 2006: OBD II goes into effect for LDVs
  - Limited number of companies with the technical expertise to get COCs
  - Additional EPA and CARB certifications being added as NGV demand grows
- 2011: EPA to revise aftermarket certification rules

1.8L Dedicated Honda Civic GX (OEM @ factory).

3.5L and 3.9L BiFuel and Dedicated Impala, Malibu, Lucerne and G6

2.0L BiFuel and Dedicated Ford Focus

4.6L Dedicated Ford Crown Vic, Lincoln Town Car and Mercury Grand Marquis

2.3L and 2.5L BiFuel and Dedicated Ford Fusion and Mercury Milan

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

4.8L, 5.3L and 6.0L BiFuel and Ded. GMC Sierra + Chevy Silverado C/K 15/25/35

5.4L BiFuel and Dedicated Ford F150, (F250, F350 ‘10); 6.2L Super Duty F250, F350 (soon)

5.4L Dedicated Ford Expedition and Lincoln Navigator.

4.8L and 5.3L BiFuel and Dedicated Chevy Tahoe

5.3L Dedicated Chevy Colorado and GMC Canyon

5.3L Chevy BiFuel and Dedicated Suburban, GMC Yukon/Yukon XL

5.3L BiFuel and Dedicated Chevy Avalanche

4.7L BiFuel and Dedicated Dodge Ram 1500, Dakota, Mitsubishi Raider

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

2.0L BiFuel and Dedicated Ford Transit Connect

4.8L, 5.3L and 6.0L BiFuel and Dedicated Chevy Express and GMC Savana vans

5.4L Dedicated Ford E150, E250, E350 cargo and passenger van (bi-fuel soon)

4.6L Dedicated VPG Auto MV-1 paratransit

6.0L Chevy or GMC G3500 Series Cab & Chassis and Van Cutaway

6.8L 2V Dedicated Ford E350 and E450 cutaway vans

6.0L GMC and Chevy G4500 Cutaway

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

Isuzu NPR and NPR HD cab-over chassis w GM 6.0L engine

Workhorse W42 Chassis step-van chassis w GM 4.8L engine, and Workhorse W62 with GM 6.0L engine; FCCC MT45 chassis with GM 6.0L (soon)

GMC C 6500/7500/ 8500 Topkick Series with 8.1L GM engine (**retrofits of existing stock only)**

GMC C4500/5500 Series Cutaway w 8.1L GM engine **(retrofits of existing stock only)**

Ford F450 and F550 with 6.8L 3V engine

Ford F59 strip chassis with 6.8L 3V engine

See “Available Natural Gas Vehicles and Engines” for specific model year and EPA/CARB certification status

Cummins Westport Inc

- 8.9L ISL-G (in-line 6c, 2200 rpm engine), 2010 certified
- 250/260/280/300/320HP; 660-1000 ft-lb torque
- Factory OEM/DOEM via:

Refuse collection trucks

(Crane Carrier LET, Autocar Xpeditor, ALF-Condor, Peterbilt LCF 320 and Mack TerraPro; many 2nd stage upfitters)

Buses, shuttles, trolleys

(NABI, New Flyer, Orion, Thomas, ElDorado, Blue Bird, Optima, Gillig, variety of shuttle 2nd stage up-fitters)

Sweepers

(Elgin, Tymco, Schwarze, Allianz-Johnston)

Work /Vocational Trucks

(Freightliner M2 tractor and straight truck; Autocar and Capacity hostlers; Kenworth T440, T470, W900; Peterbilt 384 and 365)

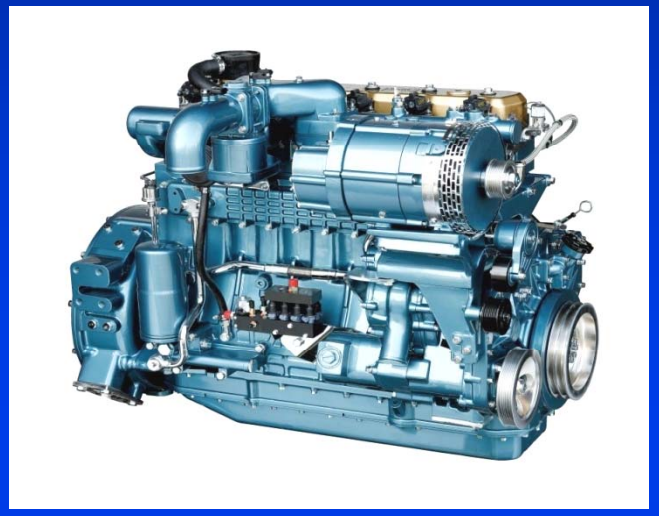
Emission Solutions Inc.

- 7.6L NG Phoenix (S.I.N.G. engine)
  - Based on International's DT466/MaxxForce DT block
  - EPA-/CARB- 2010 certified @ .2NOx / .01PM
  - Food/beverage delivery, refuse trucks, school buses, utility/public works trucks

- Repower DT466 (308 2V and 313/326 4V) with 225-300Hp /460-900 ft-lb torque (done through ESI partners including some Int'l dealers)
- OEM/factory-installed on WorkStar 7300/7400 at Garland TX plant (DuraStar in May 2011)
- Max rating: 300Hp/860 ft-lb torque
-

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
- 2010 bid award for 332 CNG engines for LACMTA



LACMTA

Riverside

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: Diesel pilot fuel (1-10%) ignites natural gas (LNG) @ 99-90%
  - CARB certification @ .2NOx (w SCR)/.01PM
- GX is now available in the Kenworth T800 and the Peterbilt 386 and 367
- Initial units deployed in Long Beach/LA Ports' fleets. Additional drayage, LTL and niche fleets deploying in select markets.

Kenworth T800

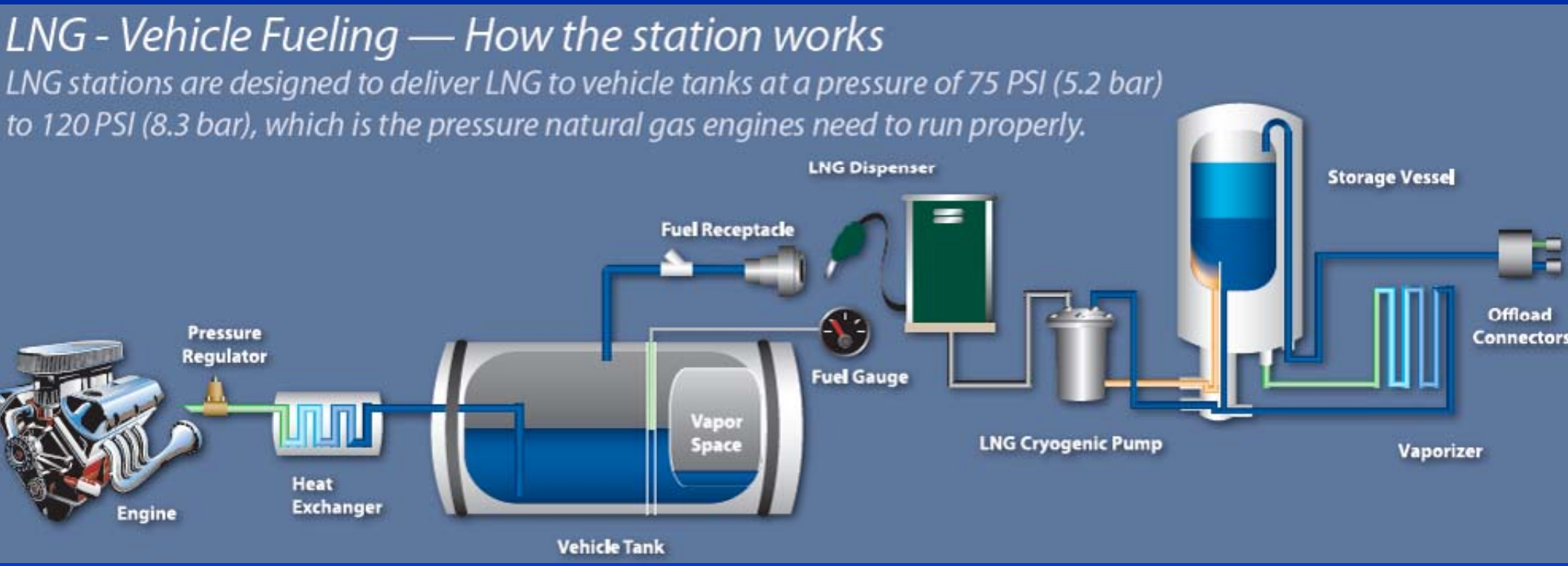
Fill’er Up

Natural Gas Fuel Station Types

Development, Ownership and Operations Options

Sizing/Design Considerations

LNG Fuel Station – How it Works



LNG Fuel Station Types

- Mobile: LNG ORCA
  - 3500 gal tank with dispensing/metering system on a truck.

- Starter/Containerized System:
  - Complete fueling station in a box. Includes storage tank, dispensing and metering and required containment.

- Custom Large Stations
  - Larger bulk tank(s), multiple traditional dispensers, LNG and/or CNG dispensing

CNG Fuel Station Types

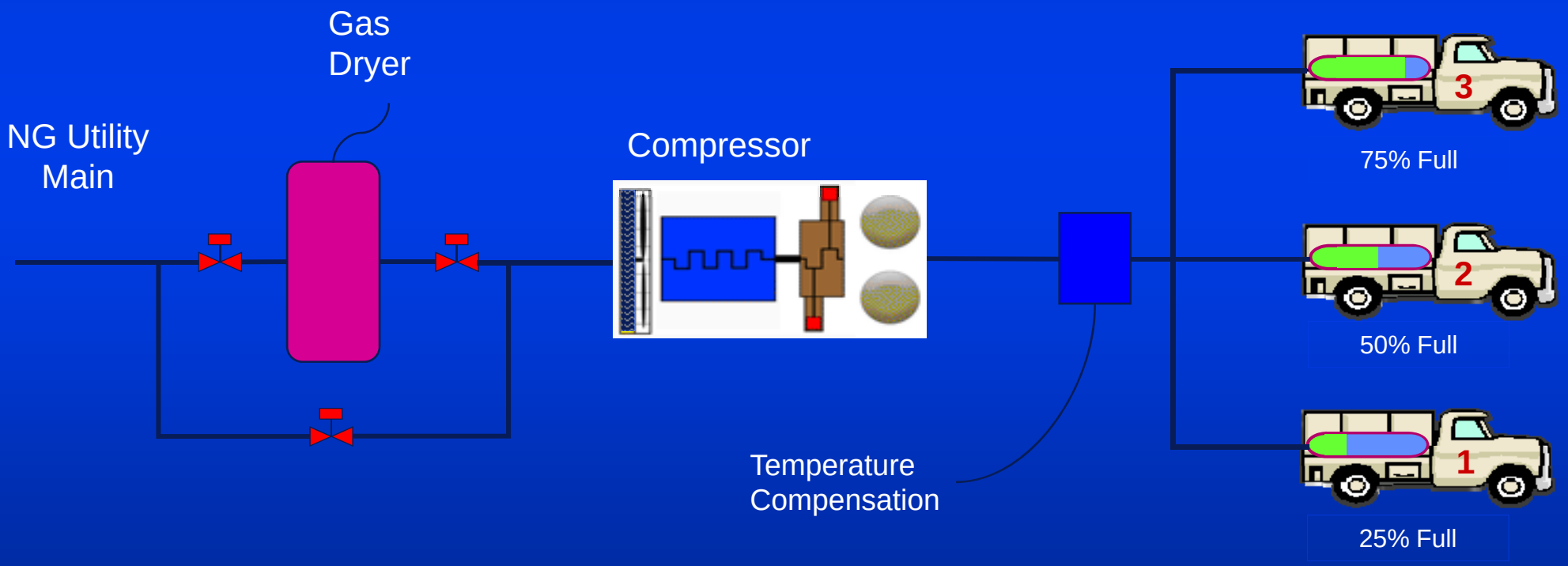
- **Time-fill capability**
  CNG is dispensed slowly directly to vehicles' onboard storage tanks. Lower cost station investment. Best for fleets that return to central lot and sit idle overnight or for extended periods and do not need fast fill capability.

- **Fast-fill capability**
  Similar to liquid fueling station, same fill rates and times. A MUST for public access. Also good for larger fleets where fueling turn-around time is short.

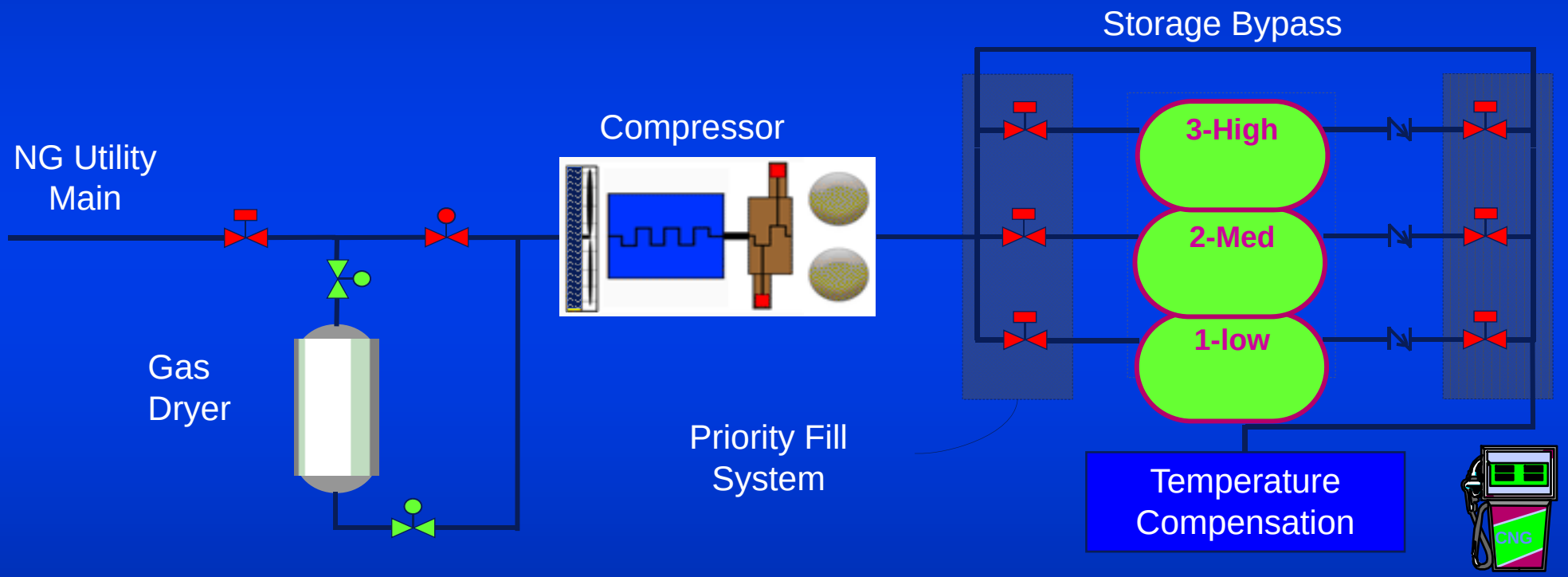
- **Combo-fill capability**
  Comprises both time-fill and fast-fill. Often good for fleets that can fuel on time-fill but need occasional "top off" or want/need ability to provide public access

Time-Fill Fueling Station

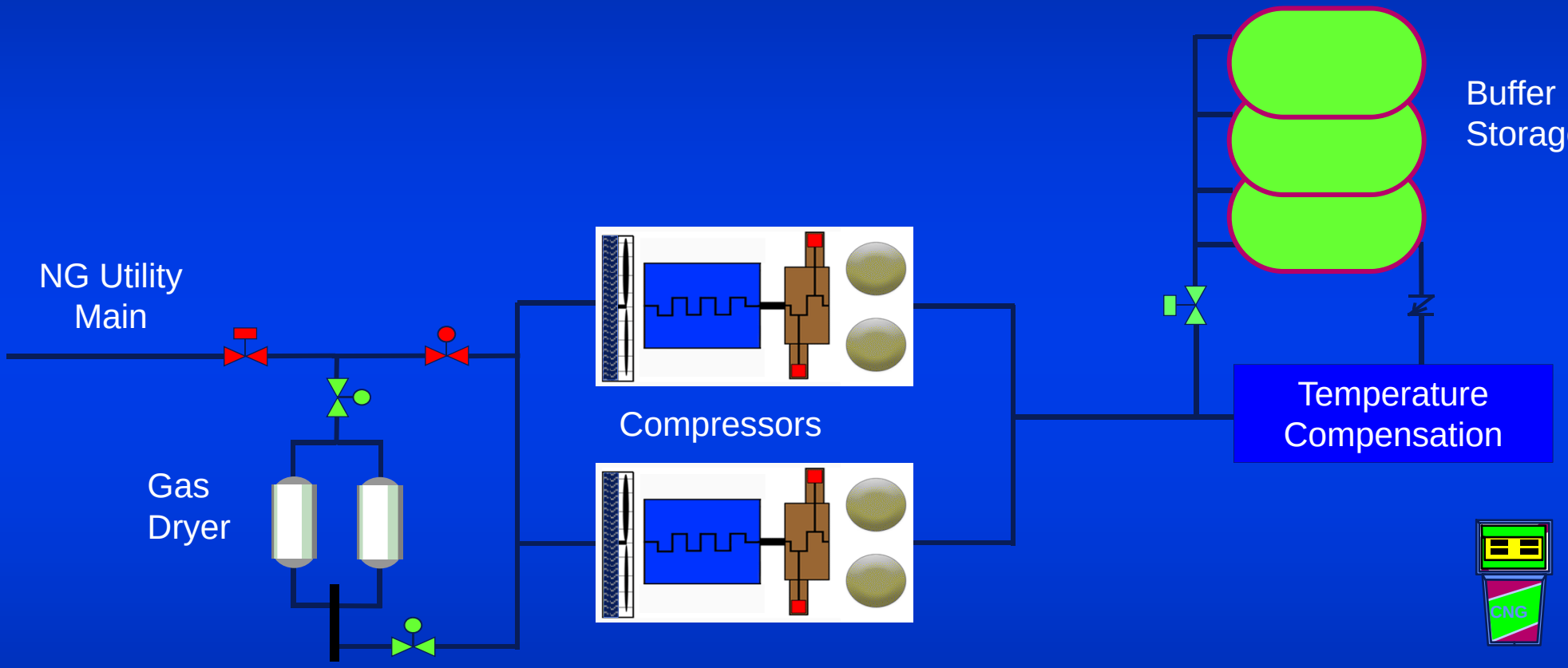
Vehicles connect to time-fill dispensers as they return to the yard.



Cascade Fast-Fill Fueling Station



Buffered Fast-Fill Fueling Station



Natural Gas Fuel Station Options

- Offsite – use existing public access station
  - Station may be operated by independent retailer, utility or another fleet
  - Development usually driven by anchor fleet and/or the ability to "pool" fleets to achieve fuel use needed to warrant investment

- Onsite - private access (e.g., only for the fleet operator)
  - Many existing large fleets (e.g., transit, refuse) or fleets with restricted access sites (e.g., federal property such as military bases) still operate private-access-only stations. Time-fill-only stations are always private access.

- Onsite - public access (often "outside the fence" pump)
  - Growing trend: public access pump installed at fleet location - located adjacent to or "outside the fence" of fleet's secure fueling area. Takes advantage of economies of scale, promotes greater public network

Natural Gas Station Development and Ownership-Operations Options: #1

- Fleet owns & operates station
  - Fleet takes responsibility for building and then operating its own station. Fleet works with vendors or design consultant, manages build-out and takes responsibility for PM (parts, etc).
  - Applies to small-to-mid sized fleets that do not have offsite options nearby, b/c their fuel use does not meet the threshold required by most LDCs or independent developers to invest in developing, owning and operating station for them.
  - Some large fleets also opt for this but many do not have experience nor want responsibility for station operations and maintenance

Natural Gas Station Development and Ownership-Operations Options: #2

- Outsource station development, ownership, O&M to independent fuel provider
  - Fleet serves as anchor for independent operator's station, contracts long term fuel agreement with set price(s) and expected throughput for duration.
  - One stop shop. All capital investment and O&M risks are borne by independent fuel provider while fleet focuses on core competencies.
  - Fleet usually provides low-cost lease for property – important to making deal work - land is costly!
  - Often allows fuel provider option to create public access as well – sometimes a "royalty" paid back to fleet for retail sales from premises

Natural Gas Station Development and Ownership-Operations Options: #3

- Fleet owns/leases station but contracts out operations for a fee (e.g., monthly fee or GGE basis)
  - Option used by many large fleets that need/desire ownership of their own station equipment but want to reduce risk, assure best O&M practices, etc
  - Contract is often (but not always) awarded to the firm that builds station; usually a 5-7yr contract.
  - Some fleets that initially Own & Operate their own stations decide that they want to delegate to others – put out RFP for O&M contract
  - Decision weighs pros/cons of “leaving $ on table” versus potential downtime risks, maintaining parts inventories, updated training of techs, etc

CNG Station Design Considerations

How Much Fuel in How Much Time?

- What is the projected number of vehicles per day and what is the required fuel per vehicle?
- What are the fueling patterns?
  - Are all fueled at once?
  - Can they be staggered throughout the day?
- What is the maximum *daily* flow and maximum *hourly* flow
  - This affects equipment selection and/or storage amount, especially when designing CNG station
- If CNG station, is backup fueling available nearby (even if only on an emergency basis) or is design redundancy required?

Station Design/Cost Considerations

Station Design/Cost Factors *other than* Fuel vs Time

- Real estate
  - Location:
    - Urban/Suburban/Rural and cost of land
    - Competition with other commercial businesses for prime locations
    - Traffic access
  - Size of property
    - Required space for equipment footprint
    - Required space for vehicle traffic (including # of islands, vehicle entry/exit)
  - Site Development
    - Remediation of existing fueling site
    - Permits, Codes & Regulations

Station Design/Cost Considerations

Station Design/Cost Factors Impacted by Fuel vs. Time

- Fueling equipment needs/costs
  - Compression:
    - Electric drive or gas engine drive
      - Size of electric service?
      - Inlet gas psi and peak flow rates
    - Sizing (HP and SCFM rating) is critical
    - Enclosures for sound attenuation
    - Sophistication of controls
  - GGE/hr = 0.5 x SCFM (@ rated inlet psi)
    - Ex: 200 SCFM compressor = ~100 GGE/hr
    - Ex: 75 SCFM compressor = ~35-37 GGE/hr

Station Design/Cost Considerations

Station Design/Cost Factors Impacted by Fuel vs Time

- Fueling equipment needs/costs
  - CNG Storage:
    - Is it needed? If so, what is balance between compression capacity and storage needs
    - Peak storage requirements and dispensing projections
    - Cascade vs buffer system
    - Type of storage containers (Spheres or cylinders)
    - Available space

Station Design/Cost Considerations

Station Design/Cost Factors Impacted by Fuel vs Time

- Fueling equipment needs/costs
  - Natural gas dryers:
    - Projected volume and flow rates
    - Inlet gas pressure and potential variance from spec
    - Moisture content (gas analysis) and historical variances from spec
    - Manual vs automated regeneration
    - Single tower versus dual towers

Station Design/Cost Considerations

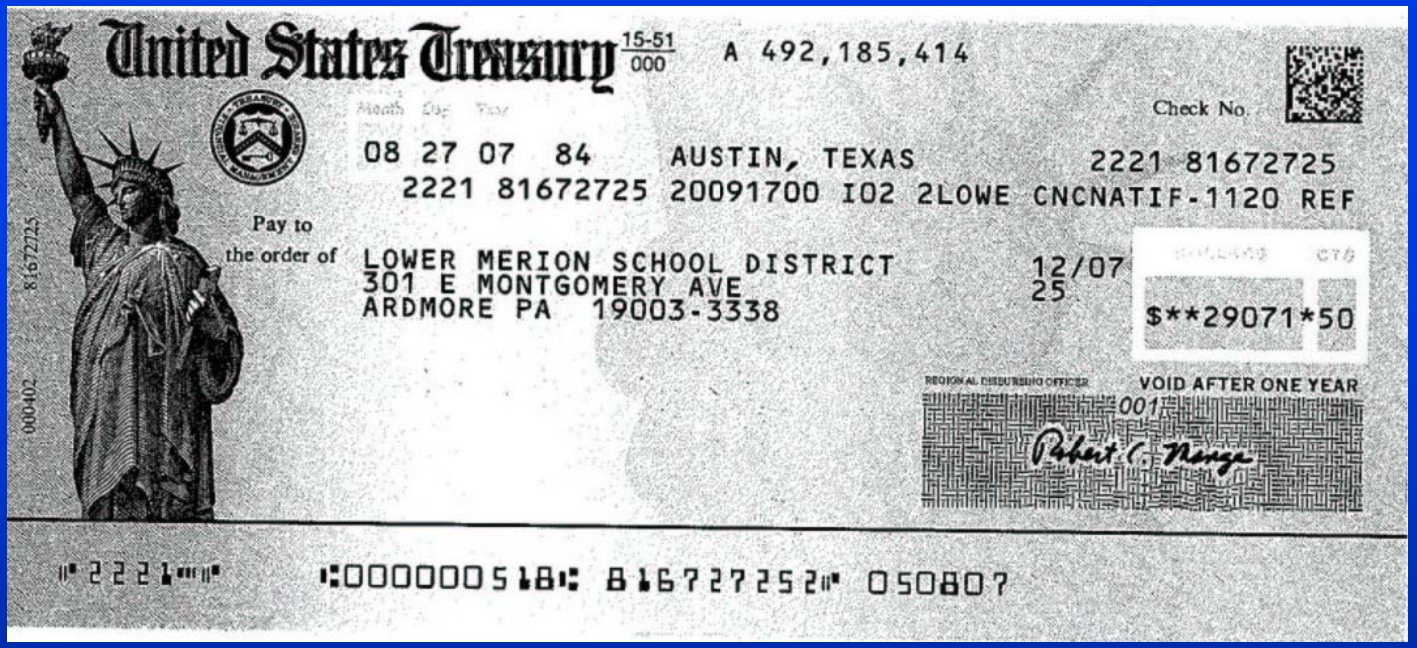
- Fueling Equipment Needs/Costs
  - Dispensers and Fuel Management:
    - Time fill posts? Or Fast Fill dispensers? Both?
    - Number and type to meet expected vehicle types/counts
    - Fuel metering/data capture, payment system?
    - CCs/pmt cards, training video (e.g. in CA)?

Station Development Steps

- Assess fueling needs, site requirements and feasibility; develop conceptual design/site plan and station performance expectations
  - Pull site plats, check available utilities (location and size of electric and gas services, distances to mains, potential upgrades necessary and costs)
  - Check applicable building/fire codes, permitting process, timing
- Determine project delivery process
  - Engineer/Procure/Construct (EPC) Contract? – typical with private project
  - Traditional architect-engineer proposal with public tender – typical with gov't
- Identify potential qualified construction bidders – cast wide net
  - GCs'/ sub-contractors' experience with like CNG projects, permitting experience
- Issue RFP; respond to bidder requests for information
  - Avoid over-specification; allow for flexibility to meet performance, reduce costs
- Review bids, re-assess/adjust (but don't value-engineer it to death)
- Upon construction completion, commission/performance check and put in place PM/service contract for best equipment performance

Identifying and Securing OPM

("other people's money")



Existing Federal Tax Credits for Vehicles, Stations and Fuel

- Vehicle income tax credit *(for buyer)* covered 50-80% of incremental cost or conversion cost. Applied to dedicated vehicles only.

Gross Vehicle Weight Rating	Incremental Cost Cap (ICC)	50% Credit At ICC	80% Credit at ICC
Less than 8500 lbs.	$5000	$2500	$4000
8501 to 14,000 lbs.	$10,000	$5000	$8000
14,001 to 26,000 lbs	$25,000	$12,500	$20,000
More than 26,000	$40,000	$20,000	$32,000

CREDIT SUNSETTED 12/31/10

- Station income tax credit (*for buyer*) equal to 30% of the cost of CNG and LNG refueling equipment, up to $30,000. Credit began at this level, bumped to 50% or $50,000 in December 2009, then reverted back to 30%/$30,000 on 1/1/11

- Motor fuels excise tax credit (*for fuel seller):* $.50/GGE or LNG gallon. IRS guidance: owner of fuel as it is dispensed into vehicle gets credit, regardless of who owns equipment or compresses fuel. Credit expired 12/31/09 but was retroactively reinstated to 1/1/10 and extended to 12/31/11 on 12/23/10

New Alternative Transportation to Give Americans Solutions

NAT GAS Act of 2011 (filed today)

Will likely contain many provisions similar to those included in
NAT GAS Act of 2009 as proposed in House Bill H.R. 835; Senate Bill S. 1408

- Vehicle Purchase Income Tax Credit extension by 5 years
  - Dedicated NGVs - 80% tax credit ; Bi-fuel NGVs – 50% tax credit
  - Increases tax credits for NGVs
    - LDV: < 8501# - $8,000; LHDV:8501-14000# - $16,000;
    - MHDV: 14,001-26,000# - $40,000; HHDV 26.001+#: $64,000
- Refueling Property Income Tax Credit extension by 5 years
  - Increases to lesser of 50% of the property's cost or $100,000
- $.50/GGE Motor Fuels Excise Tax Credit extension by 5 years
- Transferability/improved ability of tax exempt organizations to monetize vehicle and station credits. Taxable entities will be able to apply toward AMT

Gaseous Fuel Vehicle/Infrastructure Incentives

- Federal grants are usually dispersed through state and/or local channels
- Federal grants of particular interest to AFV programs:
  - DOT Congestion Mitigation & Air Quality (CMAQ) grants
  - DOE Clean Cities grants
  - DOE Block Grants for Energy Efficiency and Conservation
  - EPA Supplemental Environment Project and DERA grants (National "Clean Diesel", Clean School Bus USA, SmartWay programs).
  - FTA Clean Fuels Grants for transit projects
  - FAA Voluntary Airport Low Emission Program (VALE)
  - GSA Federal Acquisition of Fuel Efficient Vehicles Grants
- ARRA stimulus bill appropriated additional funding to many of these programs and, in some case, modified application guidelines

Federal Grants - DOT

- DOT Congestion Mitigation & Air Quality (CMAQ) grants
  - Fed provides funds to state DOTs to allocate through local/regional Metro Planning Organizations (MPOs). Funding may go toward 100% of cost of various CMAQ initiatives (e.g., AFVs and stations, HOV lanes, AFVs, bicycle racks, commuter van pools, etc)
  - Most funds are allocated to areas in “Non-Attainment” or “Maintenance” with NAAQS. States with no non-attainment areas get minimal allocation of CMAQ funds

Federal Grants - DOE

- **DOE Clean Cities Grants**
  - DOE funds public or private fleet projects based on competitive proposals. Traditionally, these grants have been submitted by designated Clean Cities Coalition but 2009 opened up process to all but federal agencies.

  - FY 2009 : DOE allocated ~$6 million over 2 yrs for 3 Areas of Interest:
    - #1 - Alt fueling infrastructure
    - #2 - Alt fuel vehicles(OEM and conversions qualify)
    - #3 - AFV educational outreach programs, etc.

  - Mid-March 2009, additional **$300 million** in ARRA funding was allocated. DOE Clean Cities FOA was issued for Area of Interest #4 “Clean Cities Pilot Projects” resulting in big boost for AFV projects!

(continued)

Federal Grants - DOE

- **Clean Cities General Guidelines (subject to change)**:
  - Usually dedicated LD/MD/HD vehicles (AOI#4 allowed bi-fuel vehicles and load-bearing off-road vehicles)
  - Vehicle funding is typically limited to incremental cost with a cost-cap/vehicle based on GVWR
  - Qualifying alternative fuel infrastructure includes new dispensing facilities; expansion, upgrades or improvements to existing facilities such as garages, maintenance, and service centers (including opening up closed/private facility to public access);
  - Priority consideration given to shared or open access stations
  - No mandated fleets (no fed fleets or stations, no “double dipping”)

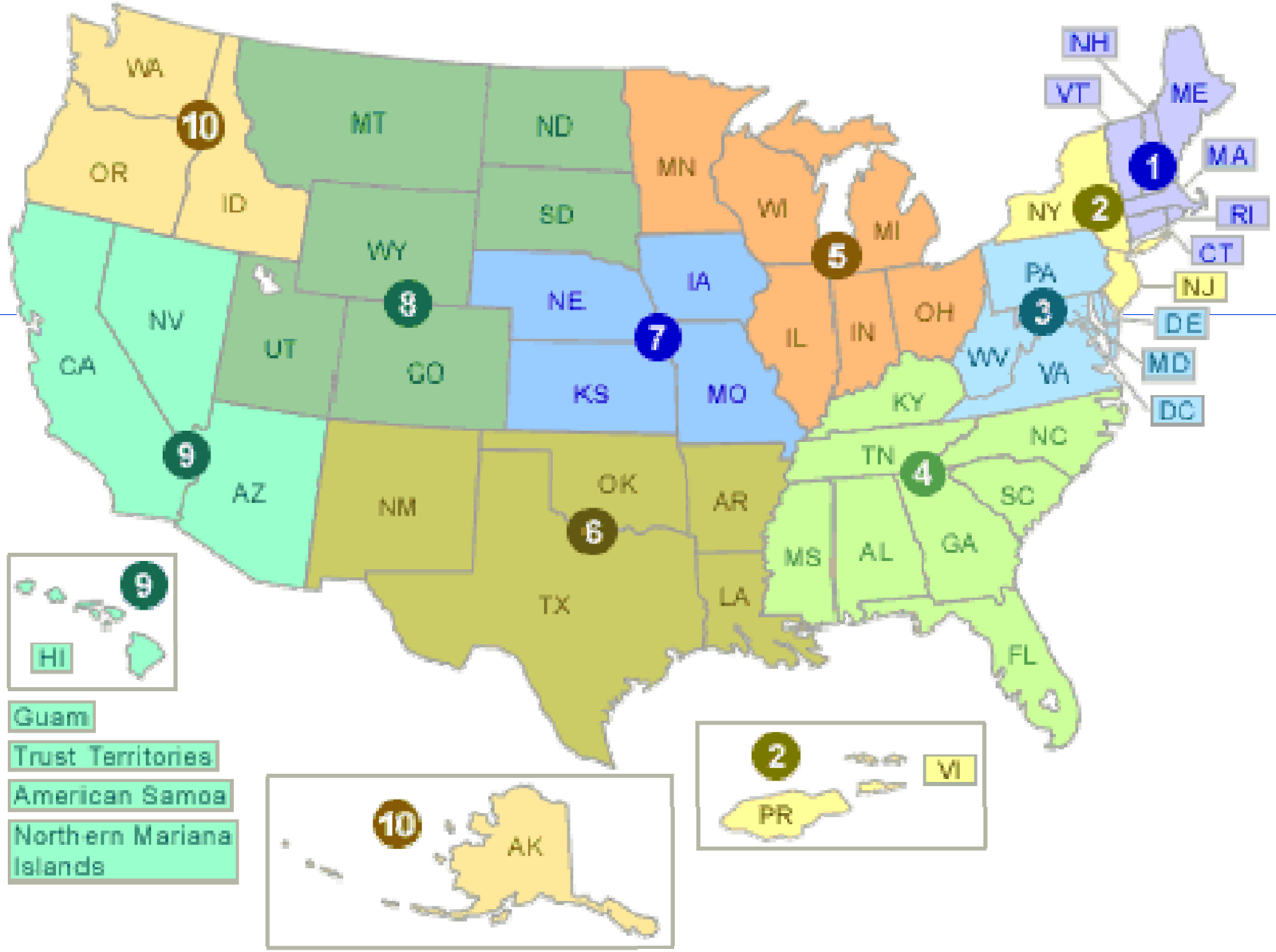
Federal Grants - EPA

- EPA Supplemental Environmental Projects (SEP) grants
  - Environmental polluter is given opportunity to partner with local NGO to “invest/support” environmental improvement project instead of paying fine, i.e. “Force-feed a carrot using a stick”
  - No formal solicitations – each SEP is unique; negotiated between DOJ, EPA and offending and benefitting entities
  - Work with your nearest Clean Cities Coalition and/or regional EPA office to learn more about potential opportunities within your area

Federal Grants – EPA

- Diesel Emission Reduction Act (DERA) program grants
  In EPACT 2005, Congress rolled up different diesel emissions reduction grant programs into one broad DERA program.
  - Federal programs allocation (70% of funds)
    - Regional Diesel Collaborative process
    - SmartWay Finance Program (national)
    - Emerging Technologies Program (R&D)
  - State programs allocation (30% of funds)
    - States may narrow their focus to one or more technologies or markets as long as the programs follow EPA guidance
    - EPA sets aside 1/3 of funding as bonus for states that match base

EPA Diesel Emissions Reduction Collaboratives



Federal Grants: EPA DERA Program

- Qualifying entities
  - Local/state government and quasi-government agencies
  - Tribal nations
  - Non-profits with enviro/clean air/clean transportation mission
- On-highway and non-road medium- and heavy-duty applications (e.g., trucks, buses, shuttles, cargo handling equipment, airport GSE equipment, marine, locomotives, agricultural/construction equipment)
- Programmatic priorities:
  - Maximize public health benefit;
  - Diesel Emissions Quantifier (on web) evaluates/ranks cost-effectiveness
  - high-density pop. areas with disproportionate diesel emissions;
  - leverage funding;
  - demonstrated expertise and past performance

Federal Grants: EPA DERA Program

- Qualifying projects
  - **Repower: 75% of cost *(incl: CNG/LNG or LPG engine replacement for diesel).***
  - Retrofit (w DPFs, DOCs, etc)
  - Anti-idling technologies and programs
  - Clean fuel incremental cost: 100%
  - **Vehicle replacements: 25% of cost *(incl: CNG/LNG or LPG vehicles for diesel)***
  - Fueling infrastructure projects ***NOT*** allowed

- Grants fund early replacements - not normal fleet turnover, and no fleet expansions (old engine must be scrapped, rebuilt or disabled)

- Engine/vehicle replacement must be same duty-cycle and size as what it replaced

Other Federal Grants That May Be Applied to NGV (and other Alt Fuel) Transportation Projects

- **Federal Transit Administration (FTA)**
  - The ARRA Stimulus Bill of 2009 allocated additional $8.4 billion for transit agencies through FTA Capital Expenditure Grant (program provided 100% funding instead of the usual 80/20 match)
  - Additional funding that may be applied for AFV projects has recently been announced by FTA (e.g. TIGGER, TIGER and Next Steps Programs)
- **General Services Administration (GSA)**
  - ARRA allocated $300 million for fuel efficient vehicles and vehicles that reduce emissions.
- **DOE Energy Efficiency and Conservation Block Grants**
  - ARRA allocated $3.2 billion in new funding – although previously "authorized," this program was never funded; transportation programs that conserve energy, capture GHGs qualify under these block grants

Dollars and Sense

NGV Economics:
Components of CNG Cost,
Calculating Simple Payback
and
Life-Cycle Cost Savings

Components of CNG Cost

- Gas Bill:
  - Gas Commodity
  - Pipeline transportation to utility's city gate + Local gas distribution company service
- Compression
  - Electric motor KWH and KW …OR engine driven unit's natural gas use
- Station Maintenance
  - Normal PM, scheduled replacement of parts, compressor rebuilds
- Capital /equipment amortization
  - Actual cost of equipment or cost of capital factored into each GGE over life of station equipment

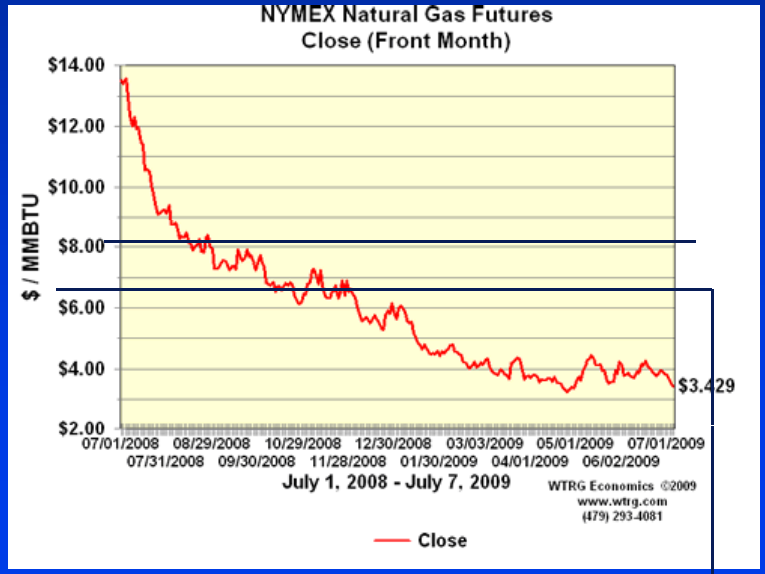
Components of CNG Cost

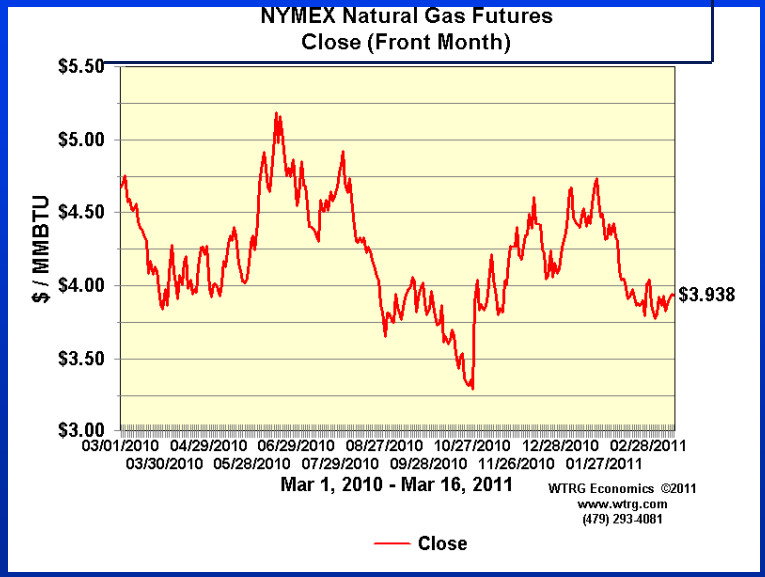
- Gas Bill:
  - Gas Commodity:

    Gas is drawn from wells, gathered/ pooled, stripped of impurities and “heavy” gases, then transported to “hubs” where it is available on the commodities market. Henry Hub (Louisiana) is used for NYMEX pricing.

    US DOE and industry long term price forecasts (prior to the economic collapse) pegged NYMEX natural gas at $6.50-8.00/MCF. Impact of shale gas is being reevaluated for next forecast.

    Future market projections for gas are still up in the air now that shale gas has changed the equation





Components of CNG Cost

Gas Bill - Gas Commodity:

- One cubic foot = ~1000 BTUs (Note: cf = volume, BTU = energy)
- One Mcf = 1000 cubic feet
- One Mcf = 1000x1000 = ~1,000,000 Btus (MMBtu or decatherm)
- US Gov't says 124,800Btu/GGE and 138,700Btu/DGE…therefore….
- **One MCF = roughly 8.0 GGE of (uncompressed) natural gas**
- **One MCF = roughly 7.2 DGE of (uncompressed) natural gas**.

- When NYMEX Mcf was $12.00, commodity portion of CNG was $1.50/ GGE
- When NYMEX Mcf was $8.00, commodity portion of CNG was $1.00/GGE
- When NYMEX Mcf was 3.20, commodity portion of CNG was $.40/GGE
- Currently NYMEX Mcf is ~$4.00; commodity portion of CNG is $.50/GGE
- Your local gas company buys gas at various prices and uses weighted formula to pass along commodity at cost….purchased gas cost adjustment (this helps eliminate extreme swings in market price)

Components of CNG Cost

- Gas Bill:
  - Gas Commodity
  - Pipeline services/gas acquisition/marketer services to utility's city gate plus distribution/delivery service (regulated tariff)

    The LDC contracts with the producers and pipelines for short-term and long-term gas supplies, related storage and balancing services and delivery to the city gate. The LDC then delivers gas to you (customer) and charges regulated tariff for this service (pipe system investment and depreciation, maintenance, meter set, customer services, invoicing, etc). Varies quite a bit from one state to the next, one utility to the next

Components of CNG Cost

- Gas Bill: $.81-.89/GGE
  - Gas Commodity: ~$.61/GGE
    (based on estimated average purchase price of $4.88/MCF
    check with your utility representative for actual tariffs in effect)
  - Pipeline/gas acquisition/marketer services + local gas company city-gate-to-meter service : ~$0.20-.27/GGE

Components of CNG Cost

- Gas Bill: $.81-.89/GGE (based on avg Mcf cost of $4.88)
- Electric compression costs
  - Gas delivered to the customer has to be compressed.
  - Most stations use electric motors although many larger stations use natural gas engine-drive compressors (depends on local regs).
  - Be sure to factor in both KWH consumption and KW demand
  - Estimated @ 1 fully-loaded KWh/GGE – a bit less for larger stations and more for small stations
  - Varies significantly from one utility area to the next
  - Nat'l range:$.04 -.30/KWH – **Rates vary: ~$.10/GGE**

Components of CNG Cost

- Gas Bill: $.81-.89/GGE (based on avg Mcf cost of $4.88)
- Electric compression costs:$.10/GGE
- Maintenance/Repair/Service: $.30-.65/GGE.: **$.40/GGE***
- Like any compressor equipment, CNG stations require regular preventative maintenance/service and occasional rebuilds of compressors and replacement of other parts. Cost per GGE will vary based on total throughput (generally, larger throughput = less cost/GGE)
- ***Cost** /GGE range noted above assumes these services are provided using in-house capabilities . Assume higher cost/GGE when using PM service contractor. **Price**/GGE quoted by independent retailer providing fully-loaded **O&M** services will be higher as risk/liability is shifted to them and they should be compensated for on-call technician, parts inventory, 24-hr remote monitoring, emergency back-up provisions, etc. Est: $.40-.75/GGE

Components of CNG Cost

- Gas Bill: $.81-.89/GGE (based on avg Mcf cost of $4.88)
- Electric compression costs: $.10/GGE
- Maintenance/Repair/Service: Assume average of $.40/GGE
- **Capital amortization of equipment: $.35-.65/GGE (simple calc)**
  - Station cost divided by total GGE over life of equipment
  - Depreciation term will affect this cost (10 yrs; 7 yrs; 5 yrs)
  - Utilization factor is important (how much of the capacity of the station is actually utilized)
  - Ex: 20 veh. x 15 GGE/day x 5 days/wk = 1500 GGE/wk =~80,000 GGE/yr
  - 80,000 GGE/year x 10 yrs = 800,000 GGE
  - If station cost is $400K, then $.50/GGE

Components of CNG Cost

- Gas Bill: $.81-.89/GGE (based on avg Mcf cost of $4.88)
- Electric compression costs: $.10/GGE
- Maintenance/Repair/Service: $.40/GGE
- Capital amortization of equipment: $.35-.65/GGE

SUB-TOTAL: $1.66 – 2.04

- **SUBTRACT federal motor fuels excise tax net credit**
  - Tax exempt fuel sales reap full benefit of $.50/GGE
  - Taxable fuel sales: Pay $.183 fed tax, apply $.50/GGE credit; net $.317/GGE credit

Components of CNG Cost

- Gas Bill: $.81-.89/GGE
- Electric compression costs: $.10/GGE
- Maintenance/Repair/Service: $.40/GGE
- Capital amortization of equipment: $.35 -.65/GGE
- Net federal excise tax credit of either $.317 or $.50/GGE

- **Tax exempt makes and uses their own fuel for net $1.16-1.54/GGE**

- **Taxable entity makes and uses fuel for net $1.35-1.72**
  - Includes $.183 fed excise tax but no state excise tax

Caveat Regarding CNG Component Costs

- GGE costs presented here include following assumptions:
  - No grants for equipment
  - 10 year depreciation of equipment
  - No embedded cost of capital
  - Station is developed, owned and operated by the end-user and therefore assumes all risks/responsibilities associated monitoring station performance, maintenance, parts inventory, training staff.
- An independent retailer's price will be higher because:
  - Retailer carries risk/responsibility/liability for down-time
  - Shorter depreciation period (likely 5-7 years max)
  - Operations fee (e.g., 24-hr real-time remote monitoring, on-call technician for PM and emergencies, maintaining parts inventory)
  - Cost of capital
  - Profit margin

Components of CNG Cost

- **What would impact be if NYMEX Mcf cost rose to $9.60? (this is equivalent to when oil is in excess of $145/bbl based on models)**

- **Gas Bill: $1.47/GGE**
- Electric compression costs: $.10/GGE
- Maintenance/Repair/Service: $.40/GGE
- Capital amortization of equipment: $.35-.65/GGE
- Net federal excise tax credit of either $.317 or $.50/GGE

- **Tax exempt makes/uses their own CNG for net: ~$1.82-2.12/GGE**

- **Taxable CNG fuel sales: $2.00–2.30 (GGE) or $2.21-2.54 (DGE) as compared to $3.85+ for gasoline and 4.25+ for diesel**

Passenger van for Limo

- Ford E-350 passenger van, Chevy/GMC 3500 passenger van
- MPG: 13/15 City/Hwy, 75-90K miles/year
- Fuel Use: 16-19 GGE/day; 4700-5800gge/yr
- CNG Premium: $15,000
- Grant: $ 7500
- Remaining premium: $7500
- Simple Payback: 1.0-1.25yrs
- Life-cycle cost advantage: $16.2K – 22K
  (based on 4yr life and $ 1.25/GGE savings at “retail” station)
- Without grant, simple payback 2.0 – 2.5 years

Medical Lab Courier Service

- Honda Civic GX
- MPG: 19/30 City/Hwy, 30K miles/year
- Fuel Use: 4-6 GGE/day; 1000-1575GGE/yr
- CNG Premium: $6500
- Grant: $4000
- Remaining premium: $2500
- Simple Payback: 1.3 - 2.0 yrs
  (based on $1.25/GGE savings at retail station)
- Life-cycle cost advantage: $3750 – $7250
  (based on 5yr life)
- Without grant, simple payback = 3.3 – 5.1 years

Step Van

- Sample Applications (e.g., a laundry/uniform rental service using a Workhorse W42 or W62)
- MPG: 5.0 – 6.5, 75-90mpd x6 dys/wk, 26-28K/yr
- Fuel Use: 13-16DGE/day; 4200-5000GGE/yr
- CNG Premium: $29,000
- Grant: $20,000
- Remaining premium: $9000
- Simple Payback: 1.2 - 1.4 yrs
- Life-cycle cost savings: $54-66K !!!
  (based on 10 yr life and 1.50 savings/DGE at O&O station)
- Without grant, simple payback = 3.8 - 4.6 years

School Bus

- Blue Bird All American RE or Thomas Built Saf-T-Liner HDX
- MPG: 6.0.- 7.0 / DGE (avg 18,000 miles per year)
- Fuel Use: 2650DGE/yr
- CNG Premium: $37,000
- Grant: $25,000
- Remaining premium: $12,000
- Simple Payback: 3.0 yrs
- Life-cycle savings: $39,750
  (based on 13 yr life @ 1.50/DGE savings)
- Without grant, simple payback = 9 years

Refuse Truck

- 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; 8500-10,000dge/yr
- CNG/LNG Premium: $35-40,000
- Grant $20,000
- Simple Payback: 1.3 - 1.6 years
  (based on 1.50 savings /DGE)
- Life-cycle cost savings: $81,600 - $100,000
- (based on 8-year life)
- If no grant, payback is 2.6 – 3.2 years.

Implementation: How do we transition?

- Communicate benefits to your staff to get their "buy in" and to create feedback mechanisms that keep your program on track. Tell your customers; show environmental stewardship.

- Identify your internal champion, assemble stakeholders and resources; learn from others' successes, don't repeat mistakes… Use the resources of your Clean Cities Coalition

- Maximize use of OPM while it is available. Investigate other creative financing/leasing and station operation options. Learn how to purchase gas to lower fuel costs.

Specific Next Steps

- **Join your local Clean Cities Coalition, get connected to your EPA Regional Collaborative and your state environmental and energy offices**
  - Get on their mailing/news list to stay informed about upcoming grant solicitations, learn about the application process, receive grant writing guidance, learn of other successful grant applications and why.
  - Collaborate with other fleets with similar interest in pursuing alternative fuels and alternative vehicle technologies. There may be shared synergies.

Specific Next Steps

- Join your local Clean Cities Coalition, get connected to your EPA Regional Collaborative and state environmental and energy offices

- **Prepare fleet inventory and replacement spreadsheet**
  - Identify vehicles for which there are NGV options (light-,medium-and heavy-duty vehicles) and the CNG usage/petroleum replacement potential.
  - Aggregate projected CNG fuel use per year for next 3 years; add 20-25% to 3rd year total; use this as basis for station sizing plan
  - For current diesel fleet (which average at least 10+ year life), look at vehicles with higher fuel use and calculate break-even for potential early replacement or repower

Specific Next Steps

- Join your local Clean Cities Coalition, get connected to your EPA Regional Collaborative and your state environmental and energy offices
- Prepare fleet inventory and replacement spreadsheet

- **Ask your current vehicle vendors about natural gas options**
  - Do not accept “business as usual.” Your business is valuable – make them investigate options. Bring them into the loop so they can be informed and ready to respond to your RFP.
  - Contact the OEM regional sales representatives, if necessary; they have a mutual interest in educating their dealers about their natural gas product lines and can bring in additional resources.

Specific Next Steps

- Join your local Clean Cities Coalition, get connected to your EPA Regional Collaborative and state environmental and energy offices
- Prepare fleet inventory and replacement spreadsheet
- Ask your current vehicle vendors about natural gas options

- **Start communicating with your LDC, station developers and equipment vendors about their products and services**
  - NGV program development is a collaborative process. Your needs are specific and your learning curve will be steep. No one option is “best” - different equipment and service vendors offer different advantages.
  - Take the opportunity to visit existing sites when possible.
  - This is unfamiliar territory to most fleet operators - Don’t avoid asking questions of vendors.…they understand that this is new to most clients.

Specific Next Steps

- Join your local Clean Cities Coalition, get connected to your EPA Regional Collaborative and state environmental and energy offices
- Prepare fleet inventory and replacement spreadsheet
- Ask your vehicle vendors about natural gas options
- Start communicating with your LDC, station developers and equipment vendors about their products and services

- **Don’t “study it to death” – take action!**
  - Communicate the consequences of “taking no action” and your goals with your management and your staff. Don’t be caught flat footed again when petroleum fuel prices escalate faster than you can respond!

Specific Next Steps

- **Join your local Clean Cities Coalition, get connected to your EPA Regional Collaborative and state environmental and energy offices**
- **Prepare fleet inventory and replacement spreadsheet**
- **Ask your vehicle vendors about natural gas options**
- **Start communicating with your LDC, station developers and equipment vendors about their products and services**
- **Don’t “study it to death” – take action!**

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