

On-Road Heavy Duty Vehicle Overview



*Advanced Transportation
Technologies*

*Clean Transportation
Solutions* SM

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Trends & Drivers of Change

- **ENERGY SECURITY: FUEL SUPPLY AND COSTS** – Traditional fuel supplies/refining capacity barely meeting current demand
 - The need for biofuels is increasing but so are questions about their impacts/benefits
 - RFS2 rules at federal level – Biofuels grow as fuel blends; 2nd gen biofuels emerging
 - Rise of non-traditional hydrocarbons possible – but have serious impacts
 - Regional fuel variation and choice becoming more prevalent
 - Alternatives becoming economically competitive with petroleum but have own costs
- **GLOBAL WARMING** – Push to reduce GHGs intensifying and pushing fuel economy – focus and urgency increasing in 2009
 - EPA now says GHG is a health danger – can regulate under clean air act
 - *California CO2 tailpipe rules approved by new EPA*
 - *CAFÉ revised to match CA CO2 rules: CAFÉ for med & heavy trucks under study*
 - States/communities remain GHG leaders – Calif AB 32 increases momentum
 - Several climate change bills now in Congress (Summer 2009) – law in 2010?
 - Energy efficiency reduces GHG impact; Fuel switching and blending reduces GHG impact; Modal split (transit and rail) has long term role
- **EMISSIONS REDUCTIONS** – World population increasingly urban and world emission standards increasingly move to CA/Euro standards
 - EU and US may align in 2012-2015 timeline
 - Fine particulates (nano particles) will be of increasing concern from combustion
 - Diesel fuel still challenged in dirtiest regions (ports, Southern California)



Key Driver – 2010 Emissions

- New EPA Regulations for on-road diesels take effect in MY2010
- Dramatically decrease discharges of particulate matter (soot and ash) and nitrogen oxide (NOx)
- 0.2 gram per brake horsepower hour (g/bhp-hr) for NOx and 0.01 g/bhp-hr for particulates
- Requires use of ULSD diesel fuel
- Requires use of CJ-4 lubricating oils
- Particulate traps/filters and SCR/EGR systems to reduce conventional diesel engine pollutants
- Major motivator for alternative technologies



There is no “Silver Bullet”
– no single technical or
fuel solution that exists
today will fit every
situation



Find Combination Strategies

We must find solutions that address all three competing needs

Air Quality

There is no one "Silver Bullet" solution

Integrated Solutions Needed

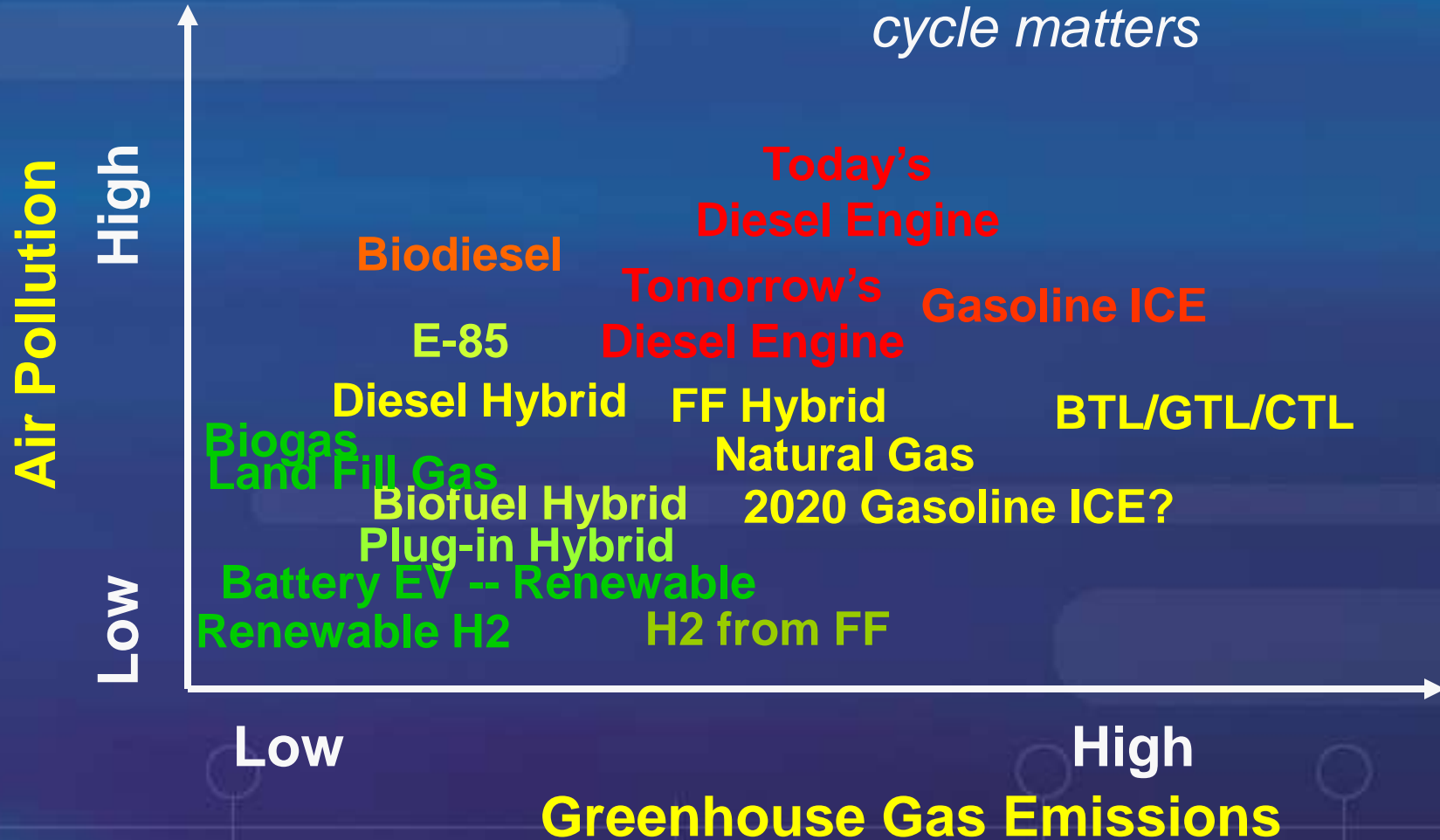
Energy Security

Climate Change



Mono to Poly-Fuel/Tech Future: Starting to Gain Traction

BUT: feedstock and fuel cycle matters





Hybrid Truck Users Forum (HTUF)



- Successful CALSTART program with U.S. Army, DOE, fleet users, truck makers and industry partners *has spurred rapid, early demonstration and production of truck hybrids*
- User driven process involving > 80 fleets with > 1 million trucks
- Other Public-Private initiatives:
 - California Fuel Cell Partnership
 - California Natural Gas Vehicle Partnership

All Major Truck Makers and System Suppliers involved (partial list)





Hybrid Truck Technology

- *Perfect storm for hybrids? Incremental cost in cars dropping as fuel price rises*
- *First products NOW entering market for medium- and heavy-duty vehicles*
 - *Hybrid electric, hybrid hydraulic, PHET*
- *First focus is urban work trucks: Class 4-8 refuse, utility, delivery*
- *Class 8 drayage, line-haul and construction equipment are in prototype or near preproduction*
- *Hybrids can multiply benefits when combined with low carbon fuels (biofuels, NG, electricity, plug-in)*



Hybrid Medium Duty Trucks Expand to Both New & Heavier Applications

- Freightliner – Eaton and Posi Plus (Canada) shows a new tandem axle hybrid utility truck (based on M2 chassis)
- GVWR range up to 40,000 lbs
- First use of hybrid systems in tandem axle operation – showcases the expansion of hybrid into additional Class 8 applications
- Vehicles bound for Canadian and US fleets
- Opens door for tandem axle tractors





Hybrid Truck & Bus Voucher Incentive Program (HVIP)

Table IV-1: Staff Recommended Hybrid Vehicle Incentive Amounts

Vehicle Weight	Base Vehicle Incentive ¹	Additional Incentive for ARB Vehicle Certification
10,001 – 14,000 lbs.	\$10,000	\$5,000
14,001 – 26,000 lbs.	\$20,000	
26,001 – 33,000 lbs.	\$25,000	
> 33,000 lbs.	\$35,000	

¹The first HVIP-eligible hybrid truck or bus purchased by any fleet would be eligible for an additional \$5,000 voucher.

- CARB staff worked to craft extremely simple program – incentive targets half the incremental cost of today's hybrids
- If successful, plans are for multi-year program but incentive may drop in future years
- **CARB Board approved April 24**



Bill to Restart Natural Gas R&D at DOE

- US House passes (HR 1622) to restart NGV research, development program at DOE
- Five year program of R&D at DOE; work with industry, EPA to streamline NGV conversion systems to federal certification and in-use standards
- Other key provisions:
 - Develop, improve safety codes for NGVs and their components
 - Improve reliability, efficiency of NGV fuel station infrastructure, certification to national standards
 - Develop new NG fuel storage materials
 - Certify on-board fuel storage systems to nationally-recognized, industry safety standards
 - Work toward NG engines in hybrid vehicles



**Photo: Cummins Westport
5.9L natural gas engine
Credit: westport.com**



Major OEMs producing NG trucks

- Freightliner and Mack with standard offerings
- Will use Cummins Westport ISL G 11 liter engine, will support LNG and CNG variants
- Will also support LNG and CNG variants
- Freightliner says will support natural gas across 90% of truck applications by year's end





Biomethane Overview

- Generated from biological breakdown of organic matter in the absence of oxygen
- Considered an renewable source of energy and the advantages of using biomass energy are three fold:
 - Is a domestic energy resource
 - Can be obtained at little or (in case of waste) no cost
 - Is considered a carbon-neutral resource (because CO₂ released during its utilization is captured from the atmosphere during biomass growth)
- Technology is available and in use by US fleets





Hydrogen / Fuel Cell Vehicles

- **Still very much a longer term technology development effort**
- **A few hundred vehicles worldwide for technical assessment to date**
- **Original launch dates (2010) no longer on table**
- **Will likely see in transit buses before passenger cars**
- **Costs still extremely high, though significant technical advancement has occurred**
- **Debate within congress on Hydrogen funding**



AC Transit Hyroad

- Support from CALSTART and FTA's National Fuel Cell Bus Program (NFCBP)
- Leverages the largest United States investment in fuel cell buses to date and the most comprehensive fuel cell bus program in the country.
- Provides accelerated fuel cell, fuel cell system data with buses that are on the road today so as to accelerate the development
- Over 180,000 miles of service on the three fuel cell buses, operating seven days a week
- Fuel cell durability continues to improve



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