

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT ALTERNATIVE FUEL HEAVY DUTY VEHICLE PROJECTS

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Heavy duty trucks account for 4 percent of the vehicle population in California, but contribute nearly 50 percent of the oxides of nitrogen (NO_x) and over 70 percent of the on-road particulate matter (PM). The majority of these trucks are powered by diesel fuel. Diesel exhaust is considered a potential or probable human carcinogen by several health agencies, including the National Institute of Occupational Safety and Health and the International Agency for Research on Cancer. The California Office of Environmental Health and Hazard Assessment (OEHHA) and the Air Resources Board (ARB) have initiated the process of identifying diesel exhaust as a Toxic Air Contaminant,

Alternative fuel heavy duty engines currently produce one-half or less the NO_x of their diesel counterparts. The South Coast Air Quality Management District's Technology Advancement Office manages projects for the development and demonstration of alternative fuels in heavy duty engines. Fuels and technologies demonstrated include methanol, natural gas, propane, hybrid-electric, and fuel cells.

This presentation provides an overview of alternative fuel heavy duty vehicle demonstration programs completed or underway, in addition to a discussion of planned activities with other local and State agencies in California.

WHY EMPHASIZE HEAVY DUTY VEHICLES

- NO_x and particulate emissions from heavy duty vehicles are a concern both from an air quality and health impact aspects

NO_x EMISSIONS

- Although heavy duty vehicles do not account for the largest contribution to the NO_x emissions inventory; their contribution is very high for the vehicle population

CARS VS. TRUCKS

- In other words one truck has the NO_x emissions of 15 cars.

SIP MEASURES

- Recognizing the challenging of meeting Federal standards for NO_x, the State has incorporated several measures into the State Implementation Plan directed specifically at heavy duty vehicles. The AQMD has incorporated these measures into its Air Quality Management Plan. These measures do not specifically require the use of alternative fuels.

- Measure M4 - Early Introduction of 2.0 gram NO_x engines

This measure projects a 5% sales penetration of 2.0 gram engines between 1996 and 1999; and 10% between 2000-2002.

- Measure M5 - Additional NO_x Reductions in 2002

Although directed to attainment in Sacramento and Ventura, this measure is certainly supported by the AQMD as a NO_x reduction strategy for the Basin. The measure proposes adoption by the ARB of a 2.0 gram NO_x emission standard for new engines sold in California beginning in 2002.

- Measure M6 - 2.0 gram NO_x Federal Standard in 2004. Many heavy duty trucks travel into California from other States. Without a national emission standard, the emissions impact of California regulations will be limited.

AQMD FUNDING PROGRAMS

- Technology Advancement
- Discretionary Funds
- Air Quality Investment Program

TECHNOLOGY ADVANCEMENT

- Established by AQMD in 1988

- Funded by \$1 fee on vehicles registered in Basin
- Clean fuel development and demonstration projects

DISCRETIONARY FUNDS

\$4/Vehicle/Year--Divided:

- 30% to SCAQMD
- 40% to Local Governments
- 30% to Discretionary Fund
- Focus on Near-term Emission Benefits

AIR QUALITY INVESTMENT PROGRAM

- Voluntary Program
- Evaluation Criteria relies heavily on cost-effectiveness
- Not easy for vehicle implementation programs to meet cost-effectiveness criteria

NATURAL GAS ENGINE TECHNOLOGY

AQMD has co-funded a number of demonstrations of natural gas engine technology; host sites include Wal-Mart and Unocal.

LA TIMES TRUCK

We are continuing a demonstration of the DDC Series 60 natural gas engine with the LA Times. The initial demonstration utilized CNG. Future plans are to convert the engine to LNG operation and continue demonstration and further engine refinement.

PIMA GRO TRUCK

Technology Advancement is funding the demonstration of the Caterpillar pilot ignition technology. The application is a long-haul truck, hauling bio-solids from the Orange County Sanitation District to a site near Bakersfield. The project uses the 3406 engine in a CNG configuration.

ARROWHEAD WATER TRUCK

There are several other demonstrations of the Caterpillar/Clean Air Partners/Power Systems natural gas technology in both CNG and LNG configurations. Applications include delivery trucks such as this and refuse transfer trucks operating in various locations in the Basin

ATA PROGRAM

- AQMD has entered into a partnership with DOE and GRI to fund natural gas engine

efficiency projects

- Initial Funding is \$1.2 million; \$400,000 from each partner; it is anticipated that further funding will be available in the future
- Program Administrator is the American Trucking Associations
- Initially, John Deere, Cummins, and Mack will receive awards

PROPANE

OCTA

- AQMD is currently funding development and demonstration of a DDC Series 50 propane engine for transit applications. The project is currently in the early demonstration stage. The objective is to certify the engine for transit applications.

CITY OF PASADENA

- Technology Advancement is funding the development and demonstration of a Cummins B Series propane engine. The engine is operating in two City of Pasadena shuttle buses. The engine is expected to be certified to ARB medium duty ULEV standards.

ELECTRIC AND HYBRID TECHNOLOGIES

Although we do not traditionally think of electric vehicle technology having application in the trucking sector, there may be several niche applications. TAO is funding several projects in this area

ELECTRIC CONVERSION OF USPS LONG-LIFE VEHICLES (LLV)

- Contractor: TransMotive Technologies, Santa Rosa
- Vehicles have 24 year life; overhaul gasoline engines after 12 yrs
- Developing electric drive train conversion with US Electricar
- 80 HP (peak) AC Induction motor/controller from Systronics
- 336 V DC nominal 28 Optima sealed lead-acid batteries
- Minimum Electric LLV range of 40 miles

HYBRID-ELECTRIC TRUCK

- ISE was initially funded through the Discretionary Funds Program to perform a research study on the feasibility of electric hybrid technology in trucking applications. This project, fielded by TAO, applies that study in a practical application.
- Demonstrated in a commercial refuse hauling application
- Kenworth T-800 Class-8 Truck/Tractor
 - New 386 HP (peak) AC-Induction Motor/Controller
 - 105 HP (continuous) Clean Air Partners/GM CNG APU (4.3L)
 - 672 VDC nominal 2x56 sealed lead-acid battery pack (VRLA)

Status: APU CNG tanks installed in chassis and functional

Differential assembly being modified

Motor/controller under development in cooperation with United Defense LP and Siemens

ELECTRIC WATER DELIVERY TRUCK

McKesson Water Products - Delivers Sparkettes Bottled Water

Up to 200 engine start-stops per day

Class 7 FWD cab~chassis

312 hp (peak) ISE Research AC induction motor/controller

Sealed lead-acid battery pack

Expected range 70 miles

Status:

Cab-chassis complete

Hackney Bros. water body to be installed

Propulsion system under development

Truck operational 1/98

FUEL CELL TECHNOLOGY

BALLARD FUEL CELL ENGINE

The 250 kW (275 hp) Ballard proton exchange membrane (PEM) fuel cell engine fits within a normal transit bus engine compartment

The engine can provide comparable performance, with reduced range AQMD has been a strong supporter of fuel cells - contributed \$1 million to development of the technology. This 40 ft. bus is the most advanced fuel cell bus in the world.

Chicago Transit will be receiving 3 advanced technology Ballard buses in late 1997.

Ballard's agreement with Daimler-Benz will mean aggressive commercialization of PEMFC: buses and automobiles.

Biggest Remaining Issues:

- fuel logistics (reform HC such as MeOH, or use pure H₂?)
- Availability and cost of fuel
- Need volume production of stacks to reduce cost

GAS RAIL USA - 16 CYLINDER TEST ENGINE

Development of LNG combustion technology at SWRI

Development of pilot diesel ingestion for LNG

Achieved a 75% reduction in NO_x

Also has low PM without an increase in CO and HC

The EMD F59PH locomotive is being converted to LNG

To be demonstrated in LA passenger rail application in 1998