

ALTERNATIVE-FUEL HEAVY-DUTY ENGINE PROJECTS

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Management District**



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SCAQMD Clean Fuels Program Technology Advancement

- ⌘ **Started in 1988**
- ⌘ **~\$8M / year project funds**
- ⌘ **Develop and Demonstrate New
Clean-Fuel & Electric Technologies**
- ⌘ **Requires Cost Share >50%**
- ⌘ **Contracts for \$100K-\$1M**
- ⌘ **Prefer OEM participation**

EVALUATION OF ALTERNATE DIESEL FUELS - II

- ⌘ Five 1988-95 Dodge, Ford, GM diesels**
- ⌘ Five Fuels**
 - CA-reformulated diesel**
 - ARCO EC-D**
 - Biodiesel (80% SoyGold-soy)**
 - Biodiesel (80% World Energy-soy)**
 - Biodiesel (80% OXyG B-60-yellow grease)**
- ⌘ Final report in 3 months**
- ⌘ Contractor: UC Riverside CE-CERT**
- ⌘ \$233k total / \$210k SCAQMD**

EVALUATION OF ALTERNATE DIESEL FUELS - I

⌘ Chassis dyno emission testing

⌘ Four 1988-96 Dodge & Ford diesel trucks

⌘ Four fuels

CA-reformed diesel (10% aromatics)

Fischer-Tropsch (Mossgas Ltd.)

Biodiesel (Envirodiesel)

Biodiesel blend (80%/20% CA diesel)

⌘	PM	NOx	THC	PAHs
F-T	+	o	-	o
B100	+	o	--	o
B80	+	o	-	o

⌘ \$259k SCAQMD Contractor: UC Riverside CE-CERT

HEAVY-DUTY DIESEL POLLUTION REDUCTION PROGRAM (2766)

- ⌘ Pays the incremental cost of new clean vehicles and fueling infrastructure**
- ⌘ FY99-00 Heavy-Duty CNG/LNG**
 - 398 Transit Buses (40')**
 - 89 Refuse Trucks**
 - 57 Misc. (dump, aerial, Class-8 tractors)**
 - 9 Cat D9 Crawlers (recalibration)**
 - 5 Fueling Stations (CNG/LNG/LPG)**
- ⌘ 240 tons/year NOx reduced**
- ⌘ \$19.4M**

CARL MOYER HDV BUY-DOWN PROGRAM

- ⌘ Increase use of low-emission HDVs**
- ⌘ FY99-00 381 Vehicles & Equipment**
 - 134 Refuse Trucks (CNG/LNG)**
 - 120 Transit & Shuttle Buses (CNG/LNG)**
 - 21 Street Sweepers (CNG)**
 - 12 Delivery Trucks (CNG)**
 - 26 Marine Engines (repower)**
 - 81 Misc. Veh & Equipt (LPG, Elec, Diesel)**
- ⌘ \$7.1M / \$3M CA / \$4M SCAQMD**
- ⌘ 645 tons/year NOx reduced**

REPOWER TUG BOAT WITH ULTRA-LOW-EMISSION ENGINE

- ⌘ Install two DDC12V149 DDECIII engines
Connolly-Pacific Harbor Tug**
- ⌘ On-road vehicle emission calibration**
- ⌘ Contractor: Port of Los Angeles
Subcontractor: OceanAirEnvironmental**
- ⌘ \$505k total / \$78k SCAQMD completed**
- ⌘ 81 tons/year NOx reduced!**

SCAQMD Clean Fuels Program Technology Advancement

⌘ **Unsolicited/Solicited Proposals**

⌘ **Clean Fuels**

**CNG, LNG, Electric, Fuel Cell, LPG,
Alcohols, Solar, Hydrogen**

⌘ **On-/Off-Road (80+ active projects)
C/LNG Trucks/Buses/Equipment**

⌘ **Recent/Current: 17 heavy-duty
alternative-fuel engine projects**

FAST-RESPONSE ON-BOARD NOx SENSOR FOR HDVs

- ⌘ Contractor: California Air Res. Brd**
Subcontractor: Southwest Res. Inst.
- ⌘ Evaluate NGK-Locke NOx Sensor for
diesel and natural-gas engines**
- ⌘ Final report by end of year**
- ⌘ \$350k total / \$125k SCAQMD**

BEST DESIGN PRACTICES FOR NATURAL GAS TRUCKS

**⌘ Develop SAE standard practices
J2343-LNG Trucks incl methane
detection**

J2406-CNG Trucks

⌘ Contractors: GRI & USA Pro

⌘ \$1M total / \$233k SCAQMD

VERY-LOW NO_x HD NATURAL-GAS ENGINE DEVELOPMENT

**⌘ Contractor: Cummins Engine Company
with Westport Innovations**

**⌘ Develop ISX with pilot-diesel to certify to
0.5 g/bhp-hr NO_x & 0.1 g/bhp-hr PM**

⌘ 400 HP / 1400 ft-lb

⌘ \$2.5M total / \$1M DOE/NREL

VERY-LOW NOx HD NATURAL-GAS ENGINE DEVELOPMENT

- ⌘ Contractor: Detroit Diesel Corporation**
- ⌘ Develop Series 50G to certify to
0.5 g/bhp-hr NOx & 0.1 g/bhp-hr PM**
- ⌘ Advanced fuel control & improved
combustion**
- ⌘ Developed technology will apply to
Series 60**
- ⌘ \$2.8M total / \$831k SCAQMD / \$550k CEC**

HCCI ENGINE DEVELOPMENT

- ⌘ Homogenous Charge Combustion Ignition (HCCI)**
- ⌘ Contractor: UC Berkeley, R. Dibble**
Subcontractor: LLNL
- ⌘ Develop natural-gas HCCI Cat 3401 generator set**
- ⌘ Demo in hybrid-electric vehicle**
- ⌘ \$666k total / \$300k SCAQMD**

DIESEL SCHOOL BUS RETROFIT PM-TRAP DEMO

⌘ Los Angeles Area: 8600 school buses

**⌘ Retrofit 39-45 school buses
6 engine models 1977-2000**

**⌘ Engelhard DPX
Johnson-Matthey CRT**

⌘ Emission test 6 buses

⌘ \$500k total / \$300k SCAQMD

ADVANCED SAFETY METHODS FOR CNG TANKS

⌘ Contractor: GTI

Subcontractor: Battelle

⌘ Develop coating for composite CNG tanks which changes color with damage

⌘ Investigate and improve acoustic detection of damaged CNG tanks

⌘ \$2.3M total / \$325k SCAQMD

REMOTE SENSING OF HD DIESEL VEHICLES FOR NOx & PM

- ⌘ Contractor: CRC (E-55/56)**
- ⌘ Measure exhaust plume of HDDVs &
correlate with chassis dyno emission data**
- ⌘ Two proposals being evaluated:
University of Denver - Opacity
Desert Research Inst. - Backscatter &
Instinction**
- ⌘ Selection by end of year**
- ⌘ \$400k total / \$100k SCAQMD**

DEVELOP ENHANCED ELECTRONICS CUMMINS C8.3G ENGINE

- ⌘ Develop next-generation electronic controls**
- ⌘ C8.3G natural-gas engine**
- ⌘ Certify to <2.0 g/bhp-hr NOx**
- ⌘ Demonstrate prototype engine at SunLine Transit**
- ⌘ \$603k total / \$265k SCAQMD**

DEVELOP & DEMO MACK 400 HP NATURAL GAS ENGINE

- ⌘ Improve fuel efficiency of E7G engine, increase HP, certify to 2.5 g/bhp-hr NOx**
- ⌘ Recalibrate/modify fueling, combustion chamber, piston crown, valve timing, turbo charging & ignition systems**
- ⌘ Five LNG truck demonstration**
- ⌘ Contractor: GTI sub: Mack Truck**
- ⌘ \$4M total / \$400k SCAQMD**

ENHANCED NATURAL-GAS HD ENGINE EFFICIENCY

⌘ Contractor: GRI

Subcontractors: Cummins Engine Co.

Deere Power Systems

Mack Truck

⌘ Advance fuel efficiency of HD NG engines

**⌘ Knock detection, Miller Cycle, Swirl ratios, EGR,
turbo & wastegate improvements, port fuel
injection, variable valve timing, humidity sensor**

⌘ \$1.2M total / \$325k SCAQMD completed

EVALUATE DIESEL PARTICULATE SAMPLING

- ⌘ Contractor: Coordinating Research Council (E-43)
Subcontractors: Univ. of Minnesota
Univ. of West Virginia
- ⌘ Actual particle size distribution & particle number concentration in HDD exhaust plumes
- ⌘ Compare with FTP data
- ⌘ Examine particle transformation during dispersion
- ⌘ Characterize bulk PM chemical and surface properties
- ⌘ \$1.2M total / \$100k SCAQMD Summer 2001

SCAQMD Clean Fuels Program Technology Advancement

**⌘ SCAQMD Program Information
www.aqmd.gov**

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