ALTERNATIVE-FUEL
HEAVY-DUTY ENGINE
PROJECTS

Mike Bogdanoff

South Coast Air Quality
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)

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

Fred Minassian  (909) 396-2641
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

Larry Watkins (909) 396-3246
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 NOx 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 NOx & 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

Fred Minassian (909) 396-2641
ADVANCED SAFETY METHODS FOR CNG TANKS

ẑ Contractor: GTI
  Subcontractor: Battelle
ẑ Develop coating for composite CNG tanks which changes color with damage
ẑ Investigate and improve acoustic detection of damaged CNG tanks
ẑ $2.3M total / $325k SCAQMD
REMOTE SENSING OF HD DIESEL VEHICLES FOR NOx & PM

()], ) 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

Fred Minassian (909) 396-2641
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

Mike Bogdanoff (909) 396-3254
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

Mike Bogdanoff  (909) 396-3254
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

Mike Bogdanoff (909) 396-3254
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

Mike Bogdanoff (909) 396-3254
SCAQMD Clean Fuels Program
Technology Advancement

**SCAQMD Program Information**
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