# Abstracts

## Session 3 – Diesel Engine Policy at the State, National, and International Level

# GLOBAL CLIMATE CHANGE AND THE UNIQUE (?) CHALLENGES POSED BY THE TRANSPORTATION SECTOR

**James J. Dooley**
Joint Global Change Research Institute

This presentation will describe findings from the first phase of the Global Energy Technology Strategy Project (GTSP). The GTSP is a unique international, public/private collaboration designed to address the role that technology can play in addressing the long-term risks of climate change. The program began in 1998, and Phase I of GTSP culminated in the publication of a document summarizing key findings, which were presented at the sixth meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change as well as in testimony before the U.S. Senate and in numerous other policy and scientific venues. This work has laid the foundation for developing a long-term technological response to climate change in the United States. The presentation will also include early highlights from ongoing research in Phase II of the GTSP (which was initiated in the spring of 2002) that is specifically focused on the challenge associated with decarbonizing the transportation sector. The sponsors of the GTSP include the Battelle Memorial Institute, BP, Electric Power Research Institute, ExxonMobil, General Motors, Kansai Electric Power, National Institute for Environmental Studies (Japan), New Energy and Industrial Development Organization (Japan), North American Free Trade Agreement -- Commission for Environmental Cooperation, PEMEX (Mexico), Tokyo Electric Power, Toyota Motor Company, and the U.S. Department of Energy.

# MEETING THE $CO_2$ CHALLENGE

**Douglas Graham**
Ricardo, Inc.

With a new California $CO_2$ law now passed, it is time to think about this soon-to-be regulated greenhouse gas. Adding to the challenge is the fact that many $NO_x$-PM emissions reduction strategies cause an increase in $CO_2$ emissions. This presentation outlines a strategy for reducing $CO_2$ emissions by the use of advanced direct injection diesel engines. Specific methods discussed are increasing diesel engine penetration in the fleet, downsizing the diesel engine, using advanced boosting systems, increasing the specific output of the engines, controlling $P_{max}$, using light engine structures, and applying diesel engines in hybrid vehicles. The $CO_2$ reduction using this strategy can reach 50 percent in city driving cycles. The technology involved will be generally available within the next few years. The remaining challenges are in cost and customer value.

# EPA'S PERSPECTIVE ON THE 2007 HEAVY-DUTY TRUCK DIESEL ENGINE EMISSIONS COMPLIANCE

**Byron Bunker**
U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) has completed a comprehensive technology review of the progress that industry is making toward meeting the requirements of the 2007 Highway Heavy-Duty Clean Diesel Program. This Program will help achieve public health benefits through the introduction of new emission standards that will result in significant reductions in particulate matter (PM) and oxides of nitrogen ($NO_x$) from diesel trucks and buses. The report, "Highway Diesel Progress Review," provides EPA's review of the progress of manufacturers of diesel engines and emissions control systems in developing technology to reduce engine exhaust pollutants. In particular, the report documents progress to develop the $NO_x$ adsorber technology and the catalyzed diesel particulate filter technology. The Agency found that the industry has made significant progress to develop and commercialize the technologies needed to comply with the Program's requirements.

# THE U.S. NAVY'S CONCERNS FOR DIESEL ENGINE EMISSIONS AND ASSOCIATED TECHNOLOGIES

**Michael Osborne**
NAVSEA

Development of environmental technologies for diesel engines is a U.S. Navy priority, but declining budgets have constrained Navy investment in recent years. Emerging environmental regulations for marine engines have established clear trends toward more stringent standards in the future. Unique Navy operational requirements, the marine environment, and distinct marine engine models render the operating mechanisms of some land application technology concepts ineffective and enhance the viability of other technology concepts. Some of the attractive technologies may not be suitable for global operations and the varied missions of national security. Marine operation, Navy constraints, and appropriate technology investments will be reviewed.

# MARITIME ENERGY AND EMISSIONS PROGRAM: BACKGROUND, STATUS, AND LESSONS LEARNED

**Dan Gore**
U.S. Maritime Administration

The *Los Angeles Times* recently published an article entitled "Finally Tackling L.A.'s Worst Air Polluter" concerning the city's twin ports. Officials in Texas briefly considered shutting down the Port of Houston for 12 hours every day as one method of reducing area $NO_x$ emissions. Efforts to dredge the channels at Port of New York/New Jersey are delayed by Clean Air Act-induced red tape. The EPA is currently considering applying new proposed marine engine regulations to foreign vessels entering U.S. territorial waters. Considering that U.S. ports and waterways handle more than 2 billion tons of cargo every year, the need to squarely address maritime-related air pollution issues is becoming clear.

The U.S. Maritime Administration (MARAD) foresaw the probability that air-quality pressures and regulations would carry over into the marine industry and created the Maritime Energy and Emissions Program. The primary objective of the Program is to foster the demonstration of marine engine technologies that maintain efficiency while significantly reducing air emissions. Components of the Program include technology selection, systems installation, performance testing, formation of public-private partnerships, policy analysis, and information dissemination.

The presentation will describe the nature of the Program, provide a status of activities, and discuss lessons learned. A numerical description of the maritime industry in terms of vessels, engines, power, and fuel consumption will be provided. Demonstration technologies covered will include diesel auxiliaries, alternative fuels, and fuel cells. Finally, future goals and plans will be outlined.

# 2007-2009 EMISSION SOLUTIONS FOR HEAVY-DUTY DIESEL ENGINES

**Jeffrey A. Leet**
Southwest Research Institute

Manufacturers of heavy-duty diesel engines for sale in the United States face achieving an unprecedented reduction in emissions in 2007 and in 2010. A 90- percent reduction in PM must be achieved by 2007, and a full 90-percent reduction in $NO_x$ must be implemented by 2010 across 100 percent of the on-highway product line.

This presentation will focus on the technology solutions possible for engine makers for the interim 2007-2009 timeframe as well as discuss the additional $NO_x$ reduction strategies for a 2010-compliant engine. The ability to achieve the interim 2007-2009 $NO_x$ fleet average standard of 1.18 g/hp-hr via in-cylinder control methods, including diluent control, modified combustion, variable valve actuation, and model-based control strategies, will be presented. The possible means of achieving a larger portion of the required emissions reduction through in-cylinder control rather than by exhaust treatment will be discussed. The issues of oil consumption and closed crankcase ventilation systems and how they impact PM-control technologies will be discussed.

# REDUCING CALIFORNIA VEHICLE FUEL CONSUMPTION WITH INCREASED USE OF HIGH-EFFICIENCY CLEAN DIESEL TECHNOLOGY

**Richard McCann and Eric Cutter**

M.Cubed

California is assessing various options to reduce petroleum consumption over the next several decades. Increased use of diesel vehicles is one such option. Light-duty diesel vehicles use on average about 38 percent less fuel per mile than a comparable gasoline vehicle. However, these vehicles have not been able to meet current California emission standards and do not represent a significant share of the California car market. On the other hand, light-duty diesel vehicles compose up over 40 percent of the current market in Western Europe. These cars comply with European emission standards, which tend to focus on a different set of pollutants, including carbon dioxide. The introduction of ultra low-sulfur diesel fuel in the U.S. market and new emission control technologies may make diesel automobiles a competitive option to reduce fuel use in California by 2007. The potential success of diesel cars may depend on some policy choices related to means of complying with future emission standards.

Under a market scenario allowing for a 25-percent market penetration rate in diesel automobiles, California could save over 530 million gallons of gasoline-equivalent fuel per year by 2030. If diesel automobile and light truck penetration reaches 32 percent, a level akin to that seen today in Europe, then California could save up over 930 million gallons per year by 2030. Given the state's exposure to market risks with the shift from MTBE to ethanol as the oxygenate additive for reformulated gasoline, diesel delivers an even larger benefit in reducing gasoline consumption directly. Under the price-driven scenario, diesel light-duty vehicles could reduce gasoline consumption by 70 million gallons as early as 2010. With early introduction and rapid adoption under the European scenario, savings could rise to 110 million gallons by 2010.

# A SUMMARY OF THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT INCENTIVE PROGRAMS

**Fred Minassian**
South Coast Air Quality Management District

The South Coast Air Quality Management District's (AQMD) Technology Advancement Office is responsible for the implementation of the agency's incentive programs. Funding for these programs mostly come from the State of California, in addition to local matching funds provided by the South Coast AQMD from its Clean Fuels Fund. The current incentive programs are:

- Lower Emission School Bus Program
- Carl Moyer Program
- $NO_x$ and PM Reduction Programs
- Rule 2202 Air Quality Investment Program
- ZEV Incentive Program
- Infrastructure Program.

The implementation of the above-mentioned programs is targeted to reducing criteria pollutant emissions from the on- and off-road fleet with a preference for alternative fuel technologies.

# THE POSSIBLE ROLE FOR DIESELS IN CALIFORNIA

**James Boyd**
California Energy Commission

The Energy Commission is the State's primary energy policy agency that is responsible for addressing the energy challenges facing California. With a strong economy and growing population, the California Energy Commission is faced with a daunting task of ensuring that California has a reliable supply of energy and transportation fuels that are clean and affordable.

Through an AB 2076 legislation directive, we are examining the potential benefits from various options and future technologies. Through this rigorous analytical effort the Energy Commission, jointly with the Air Resources Board, will be recommending policies and strategies that ensure energy and environmental objectives are balanced. One strategy that may help to meet our near-term energy needs is increased use of light-, medium-, and heavy-duty diesel vehicles. We remain committed to seeking ways that government can help to expand the use of more efficient fuels and vehicle technologies while maintaining our commitment to meeting clean environmental standards.

# $NO_x$ CREDIT AND SCR

**Daniel Sloan**
Emission Credit Brokers

The U.S. Environmental Protection Agency (EPA) has mandated emissions levels that no polluting sources can exceed without penalties. When a company voluntarily spends money to reduce pollution below those mandated levels, emission credits are given as incentives. The emission credits are nearly equal to the amount of pollution abated. For example, if a company reduced 80 tons per year at one of its facilities, the company would receive approximately, in all probability, 64 tons of emission credits. Normally, 20 percent is retired for the benefit of the environment. Emission credits, other than greenhouse gases, can only be bought and sold in the same Air Resources Board (ARB) Region in which they were created.

The amount of money the emission credit is worth depends on supply and demand. As an example, in the height of the California energy crisis, $NO_x$ reclaim credits were trading at $110,000 a ton. By creating emission credits, a company can offset the cost of applying technology, and sometimes profit, to lower pollution below mandated levels, while the environment benefits from the 20 to 30 percent of the pollution that is retired.

One source of emission credits is through retrofitting diesel engines. To date, however, it has been particularly prohibitive due to the cost of the technology. Using natural gas vehicles and dual-fuel vehicles as an alternative is expensive and has enormous obstacles to overcome in order to truly be effective.
Conversely, by utilizing aftermarket devices such as selective catalytic reduction (SCR) systems, companies can retrofit their on-road and off-road diesel fleets or stationary generators early, create emission credits, and profit.

New technologies such as SCR systems are incredibly cost effective and will now allow companies to retrofit their mobile and smaller stationary sources at a much lower cost and, with market-based incentives like emission credits, actually be able to profit. Retrofit devices can also be purchased using emission credits. For example, by implementing an emission reduction device, using an SCR system, as an example the following steps would be taken:

1. Company determines purchase price from vendor.
2. Emission Credit Brokers (ECB) negotiates with local ARB.
3. Retrofit provider installs SCR device.
4. ECB sets up monitoring.
5. ECB pays vendor for device.
6. After first year, ECB starts receiving compensation from EPA for $NO_x$ reduction from installed device.