

2003 Diesel Issues Forum

Diesel: Today and Tomorrow

Marty Lassen
Johnson Matthey

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Diesel: Today and Tomorrow

Why Control Diesel Emissions?

- Diesel PM toxicity and health effects
- Ozone Non-Attainment (both HC and NOx)
- It's the right thing to do

Regulations Are Stimulating Technology Advances

- EPA Voluntary Retrofit Program
- ARB's Diesel Risk Reduction Program
- EPA OE emissions standards for 2002-3/4, 2004 & 2007
- EU / Japan / Other Areas – Environmental Zones, Regulations

Technology

- DOC, DPF, EGRT, SCRT, Other- Proven & Commercial
- Increasing Availability of ULSD
- ULSD enables the lowest emissions and ensures reliability
- Proven durability and successful application

Funding for Retrofit

- Increasingly available



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Progression of Retrofit Programs

- Sweden – Environmental Zones
- Scandinavia, Germany, Great Britain
- Taiwan, Hong Kong
- Mexico
- United States
 - New York City Transit
 - California – ARCO
- France, Switzerland
- United States
 - California
 - Seattle
 - Texas
 - NE, SE, SW, NW
- Japan
- Korea



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Worldwide Diesel Experience

■ On-Road

Light-Duty Diesel

- ≡ DOC – 50 million Class 1 & 2 Cars - OE
- ≡ DOC – 3 million Class 3 & 4 Pickups (LHD) - OE
- ≡ DPF – 700,000 Class 1 & 2 Cars (PSA) - OE

Heavy-Duty Diesel

- ≡ DOC – 100,000 Trucks & Buses – Retrofit
- ≡ DOC – 300,000 Trucks & Buses – OE
- ≡ DPF – 150,000 Trucks & Buses – Retrofit
- ≡ DPF – 10,000 Trucks & Buses – OE (1st Fit / Option Fit)

■ Off-Road - Construction, Mining, Materials Handling

- ≡ DOC – 250,000, Retrofit and OE
- ≡ Filters – 50,000 Passive and Active, Retrofit and OE



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Retrofit Challenges

- Engineering Intensive
 - ▮ Thousands of engine/vehicle combinations
 - ▮ Anticipated economies of scale not there
- Duty Cycles
 - ▮ Low temperatures limit application
 - ▮ Active temperature management is needed
- Verification
 - ▮ Required for SIP credits and funding
 - ▮ Complex and expensive
- Funding
 - ▮ Becoming more available but still small
 - ▮ Spending limits being set that don't reflect actual costs
- NOx Reduction
 - ▮ Technologies only now becoming commercial
 - ▮ Requires control systems / injection systems
 - ▮ Expensive



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Solutions for Broadening Retrofit

- Public outreach and education
- Availability of ULSD
- Cooperative efforts
 - ▮ DOE / Engine OE / Technology Suppliers / Fuel Suppliers
 - ▮ Engine OE / Technology Supplier / Exhaust System Packager
 - ▮ Regulators / Technology Suppliers / Users / Funding Sources
- Optimization / Consolidation of Design
- Active Regeneration
- Simplify Verification
- Increased Funding Sources
 - ▮ Federal , State, Local budgets
 - ▮ Philanthropic Sources
 - ▮ Incentives
 - ▮ Creative “out-of-the-box” funding
- Focus on Commercializing Combined NOx / PM Systems



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OE Challenges

- PM and NOx Emission Standard Levels
 - ≧ PM: 0.01 g/bhp-hr – Filter Forcing?
 - ≧ NOx: 2007 = 1.18 g/bhp-hr Average → Aggressive EGR, NAC, Other?
2010 = 0.02 → NAC, SCR
- Engine Development
 - ≧ Aggressive EGR
 - ≧ High Pressure Fuel Injection
 - ≧ Calibrations
- Fuel and Lube Oil Considerations
 - ≧ ULSD
 - ≧ Low Ash, Low Sulfur Lube Oil
- Timing
 - ≧ Technology Decisions for 2007 / 2010



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OE Solutions

- OE's are Well on the Way
- Integration of Engine with Emission Control with ULSD
- 2007 Compliant Engines



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Economic Impact of Diesel

- ~ 325 manufacturing plants in U.S. supporting diesel
 - ≡ Vehicle
 - ≡ Engine
 - ≡ Auxiliaries
 - ≡ Emission Control
- Many States and Congressional Districts Impacted
- \$\$\$ Impact - Billions
 - ≡ Jobs
 - ≡ Tax Base
 - ≡ \$\$\$ into the Economy
- Emission Control Companies in US will spend > \$3 billion for 2007 Rule
- Refining Industry will spend > \$6 billion for 2007 Rule
- Engine OE's will spend\$\$\$\$?



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Benefits of Clean Diesel

- Retrofit - Immediate reductions in emissions inventory from today's long-lived diesel fleet
- Retrofit - Build knowledge for use in 2007 / 2010 OE offering
- OE – Emission compliant engines with all the positive attributes
- Significant reduction of diesel exhaust emissions
- Continued use of diesel engine with all its positive attributes
- Significant impact on job creation, on expansion of tax base, and on \$\$\$ into the economy



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