California Air Resources Board Alternative Diesel Fuels Symposium

Presentation of the

Engine Manufacturers Association

Sacramento, California

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- Domestic and foreign manufacturers of diesel, gasoline and alternatively-fueled internal combustion engines
- Principally, non-integrated manufacturers of loose engines
- Wide range of engine sizes, from 1 hp to 7000 + hp
- Wide range of industry applications

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EMA Membership Roster

Briggs & Stratton Corporation	Case New Holland	Caterpillar Inc.
Cummins Inc.	DaimlerChrysler Corporation	Deere & Company
Detroit Diesel Corporation	Deutz Corporation	Ford Motor Company
General Motors Corporation	Hino Motors, Ltd.	International Truck & Engine Corporation
Isuzu Motors America, Inc.	Kohler Company	Komatsu Ltd.
Kubota Engine America Corporation	Mitsubishi Engine North America, Inc.	Mitsubishi Fuso Truck of America, Inc.
Onan – Cummins Power Generation	PACCAR	Scania CV AB
Tecumseh Products Company	Volkswagen of America, Inc.	Volvo Powertrain Corporation
Waukesha Engine, Dresser, Inc.	Yamaha Motor Corporation	Yanmar Diesel America Corporation

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EMA Objectives

- Achieve air quality improvements through cost-effective, technologically feasible measures
- Promote/maintain global alignment of standards, programs, and procedures: design once, certify once, sell worldwide
- Maintain customer satisfaction and product acceptability

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Fuel Quality

- Fuels must meet established specifications
- High quality fuels are essential to:
  - achieve emission reduction goals
  - enable advanced aftertreatment technologies
  - provide expected engine performance
  - achieve expected efficiency
  - maintain engine durability
  - meet customer expectations consistently

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Rationale For Alternative Diesel Fuels

- Reduce energy dependency on petroleum-based fuels
- Potential to provide emission reductions
  - Direct emission advantages for current engines
  - Retrofit of older technology engines
- Boost domestic industries, (e.g. farming, fuel production facilities)

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Alternative Diesel Fuel Challenges

- Emission reduction trade-offs
- Fuel specifications, quality and consistency
- Performance
- Infrastructure and fuel availability
- Cost
- Impact on additive package/consistency
- Impact on engine components (compatibility)

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Alternative Diesel Fuels

- Water/diesel emulsion
- Ethanol/diesel fuel blends
- Gas to liquid (GTL) fuels
- Biodiesel fuels

Water/Diesel Emulsion

- Benefits
  - NOx emission decrease
  - PM emission decrease
- Concerns
  - Lack of industry-wide fuel specification
  - Need for special handling (self-contained fuel unit)
  - Special storage required to prevent water/fuel separation
  - Reduced energy content
  - Potential adverse interaction between emulsion and aftertreatment control technology
  - Increased separation/freezing potential in cold weather operation
  - Durability/corrosion effects

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Ethanol/Diesel Fuel Blends

- Benefits
  - PM emission decrease
- Concerns
  - Lack of industry-wide fuel specification
  - Flammability (dispensing, maintenance and storage)
  - Reduced energy content
  - Potential adverse interaction between ethanol and aftertreatment control technology
  - NOx emission levels are engine and/or application dependent

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Gas to Liquid (GTL) Fuels

- Benefits
  - NOx emission decrease possible
  - PM emission decrease possible
  - High cetane
  - No sulfur or aromatics
  - Good blending stock for diesel fuel
- Concerns
  - Lack of industry-wide fuel specification
  - Reduced energy content
  - Fuel flow impairment in cold weather operation

Biodiesel Fuels

- 100% biodiesel and various biodiesel blends
- Several feedstock options with varying benefits and concerns

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Conclusions

- Each alternative diesel fuel has unique characteristics
  - Decrease in engine-out emissions for some criteria pollutants
  - Increase or no change in other pollutants
  - Potential performance, durability, cost, and customer satisfaction concerns
- Infrastructure and availability issues must be resolved
  - Avoid "boutique" fuels
  - Fuel blending at the refinery for consistency
- Engines are designed to operate on specified fuels
- Significant time and resources are required to conduct performance/emission testing on a host of potentially feasible fuels and fuel formulations
- EMA is committed to working with other stakeholders in industry and government to develop a common understanding of the role of alternative diesel fuels in California's overall air quality strategy

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