

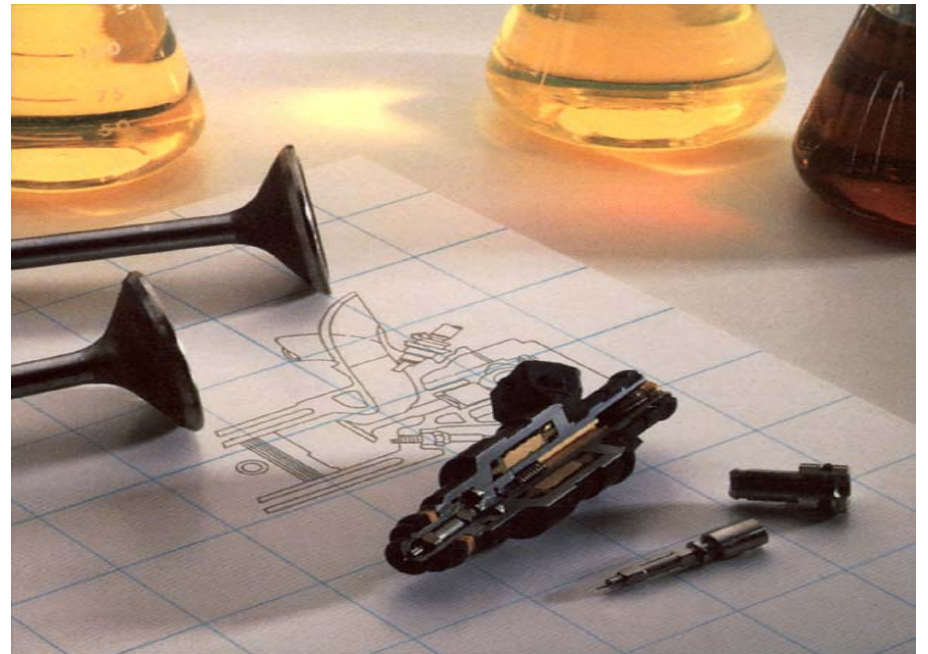


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The Future of the Fuel Additive Market

**ASPA Winter Meeting
December 4-5, 2007**

**Jeffrey M. Burns
Chevron Oronite Company LLC**



Overview

- Fuel Additives
- Market Drivers for Fuel Additives
- Industry Drivers for Fuel Additives
- Engine Technology Changes
 - Direct Injection Spark Ignition
 - Light Duty, High Speed Direct Injection Diesel
- Fuel Issues
 - Top Tier Gasoline
 - Ethanol
- Summary



Fuel Additives

- The most common fuel additives used today are deposit control detergents
 - Polyisobutylene amine (PBA) and Polyether amine (PEA) detergents are used in gasoline
 - Succinimides are the most common detergents used in gasoline.
- Some additives are used to provide other functional benefits such as corrosion inhibition, water separation, cold flow improvement or lubricity improvement
- Changes in fuel composition and in engine technologies may promote the use of improved and higher performing deposit control additive packages



Market Drivers for Fuel Additives

OEMs

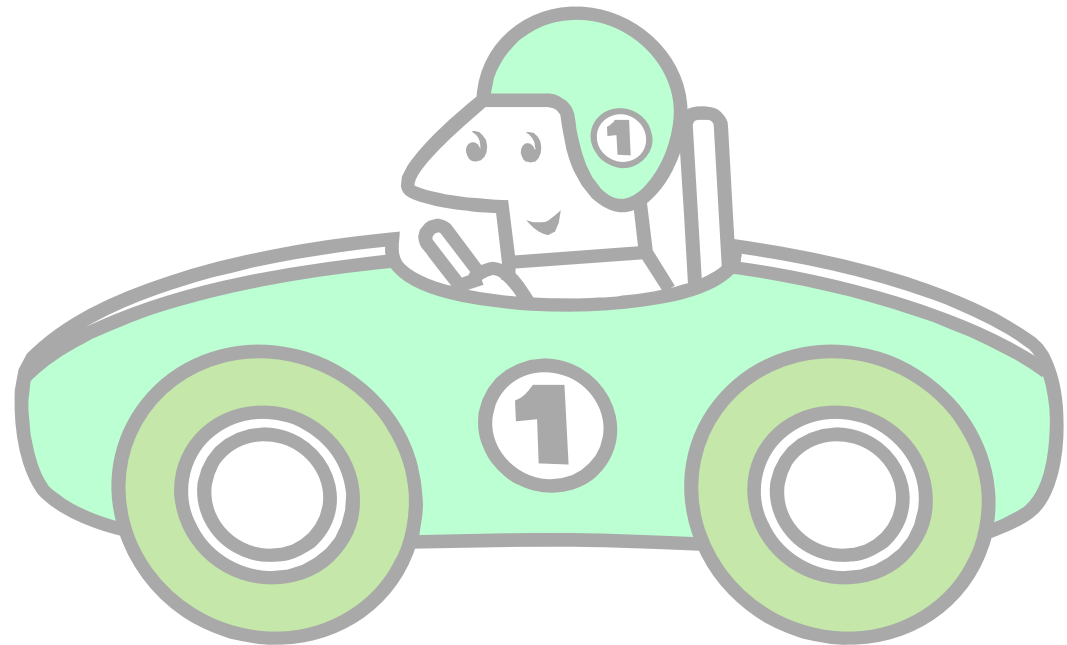
- Deposit-related performance
- Warranty liability
- New engine technology
- Emissions regulations
- Fuel consumption
- Energy conservation

Fuels

- Growth of Top Tier segment
- Changing fuel slate
- Renewable fuels / ethanol
- Growing interest in LD diesel

Fuel Marketers

- Cost Conscious
- Diverse requirements
- Drive for differentiation
- New claims



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Industry Drivers for Fuel Additives

- *Fuel-Related Challenges*
- *OEM Endorsement*
- *Improved OEM Warranty Repair Tracking*
- *Changing Lube Requirements*

Possible Impact

- Increasing Demand for higher performance deposit control additives
- Demand for Differentiation via Additives
- Increased Emphasis on Crankcase No-Harm



Engine Technology Changes

Future Market for Vehicle Technologies

- Advancements in Vehicles and Exhaust Aftertreatment Systems
- Advanced Conventional
 - Flexible Fuel Vehicles
 - VVT (Variable Valve Timing-intelligent system)
- Hybrids
 - MPI Hybrid
 - DISI Hybrid
 - HCCI Hybrid
- Direct Injection Spark Ignition (DISI)
 - DI homogeneous stoichiometric
 - Variable Valve Timing-camphaser
 - DI stratified lean
- Controlled Auto Ignition (CAI) or Homogeneous Charge Compression Ignition
- Light Duty Diesel
- Heavy Duty Diesel
- Electric Vehicles

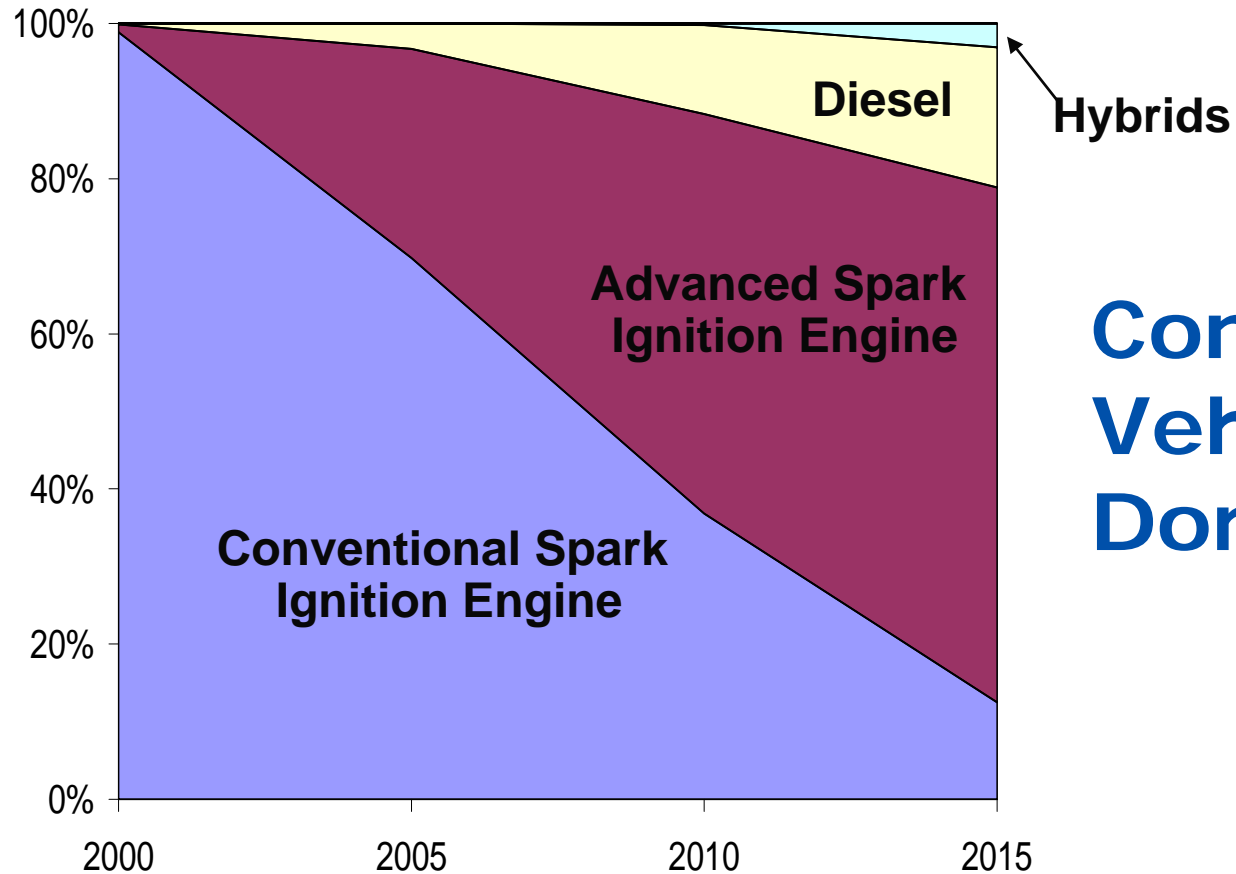
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Engine Technology Changes Future Market, U.S.

Total U.S. Light Duty Sector



**Conventional
Vehicles
Dominate**

Source: Arthur D Little

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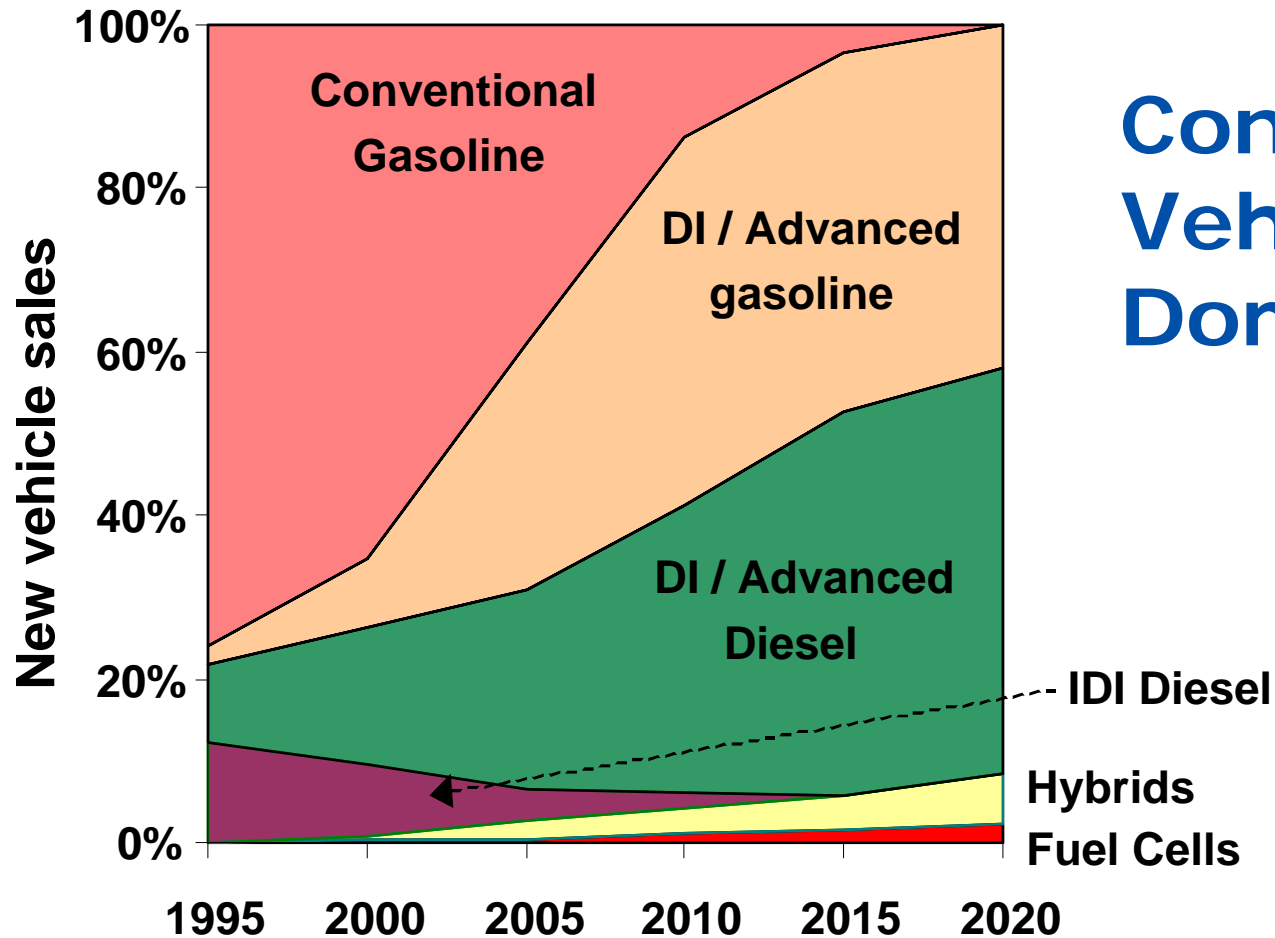


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Engine Technology Changes

Future Market, Europe

Total European Light Duty Sector



Conventional Vehicles Dominate

Source: EUCAR

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Engine Technology Changes

Direct Injection Spark Ignition

- DISI technology is penetrating the global market
 - Used in Japan & Europe; Introducing to U.S.
 - 10% penetration in 5-10 years (mature markets)
 - 6-10% improvement in FE (additional benefits with lean burn engines)
- Stoichiometric Versions Available in U.S. Today
- Isuzu Introducing DISI into Popular Price Market
- FSI being introduced in the U.S.



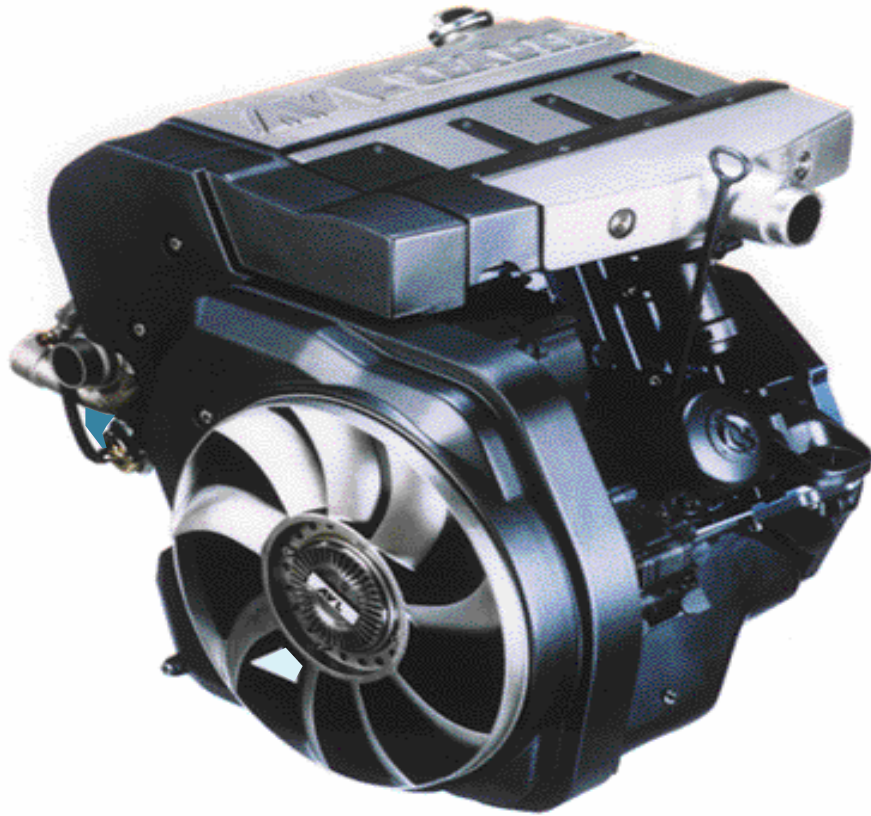
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Engine Technology Changes

Light Duty, High Speed Direct Injection Diesel



Source: AVL

- Direct Injection
- Common Rail
- Unit Injectors
- High Injection Pressures
- Smaller Orifices
- Shaping/Multiple Injections
- Turbocharged
- Charge Cooling
- EGR
- Exhaust Aftertreatment
- Computer Control

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Engine Technology Changes

Diesel Fuel Issues

CRC Diesel Performance Work Group Has Initiated An Effort To Define Emerging Light Duty Diesel Fuel Standard For U.S.

Objective is to Determine Minimum Properties to Enable LDD

- Cleanliness (Water & Sediment)
- Lubricity Requirements
- Density Range
- Cetane Number; Cetane Index
- Injector Detergency
- Conductivity
- Low Temperature Operability
- Filling Issues: Odor, Foam, ...

Can New Light Duty Diesel Vehicles Benefit From Newer Fuel Types: Water Emulsion, Biodiesel, Gas To Liquids, Ethanol-in-Diesel?



Fuel Issues

Top Tier Gasoline

Summary of Top Tier Detergent Gasoline

- A voluntary program to increase gasoline detergency

- Creates a winning situation for sponsors, fuel marketers, and consumers
 - Improved gasoline detergency
 - Product differentiation in the marketplace
 - Increased customer satisfaction

- Currently sponsors are BMW, GM, Honda, Toyota, VW and Audi

Source: OEM Presentations and www.toptiergas.com

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Fuel Issues

Top Tier Gasoline

Why Top Tier Detergent Gasoline?

- A logical next step for gasoline to help vehicles maintain optimum performance
 - Deposits impact on in-use emissions and customer satisfaction
 - Federal and California emission standards afford no margin for error
 - New engine technologies are sensitive to fuel quality.
 - Top Tier Detergent Gasoline will help prevent degradation of driveability and emission performance.

- Reverse the decline in additive treat rates
 - Create a movement away from LAC

- Provides oil companies an incentive to advertise performance
 - Gasoline meets a higher standard

Source: OEM Presentations and www.toptiergas.com

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Fuel Issues

Top Tier Gasoline

TOP TIER Detergent Gasoline Retailers

QuikTrip
Chevron
Conoco
Phillips
76
Shell
Entec Stations
MFA Oil Company
Kwik Trip/Kwik Star

The Somerset Refinery, Inc.
Chevron-Canada
Aloha Petroleum
Tri-Par Oil Company
Shell-Canada
Texaco
Petro-Canada
Sunoco-Canada

Source: www.toptiergas.com

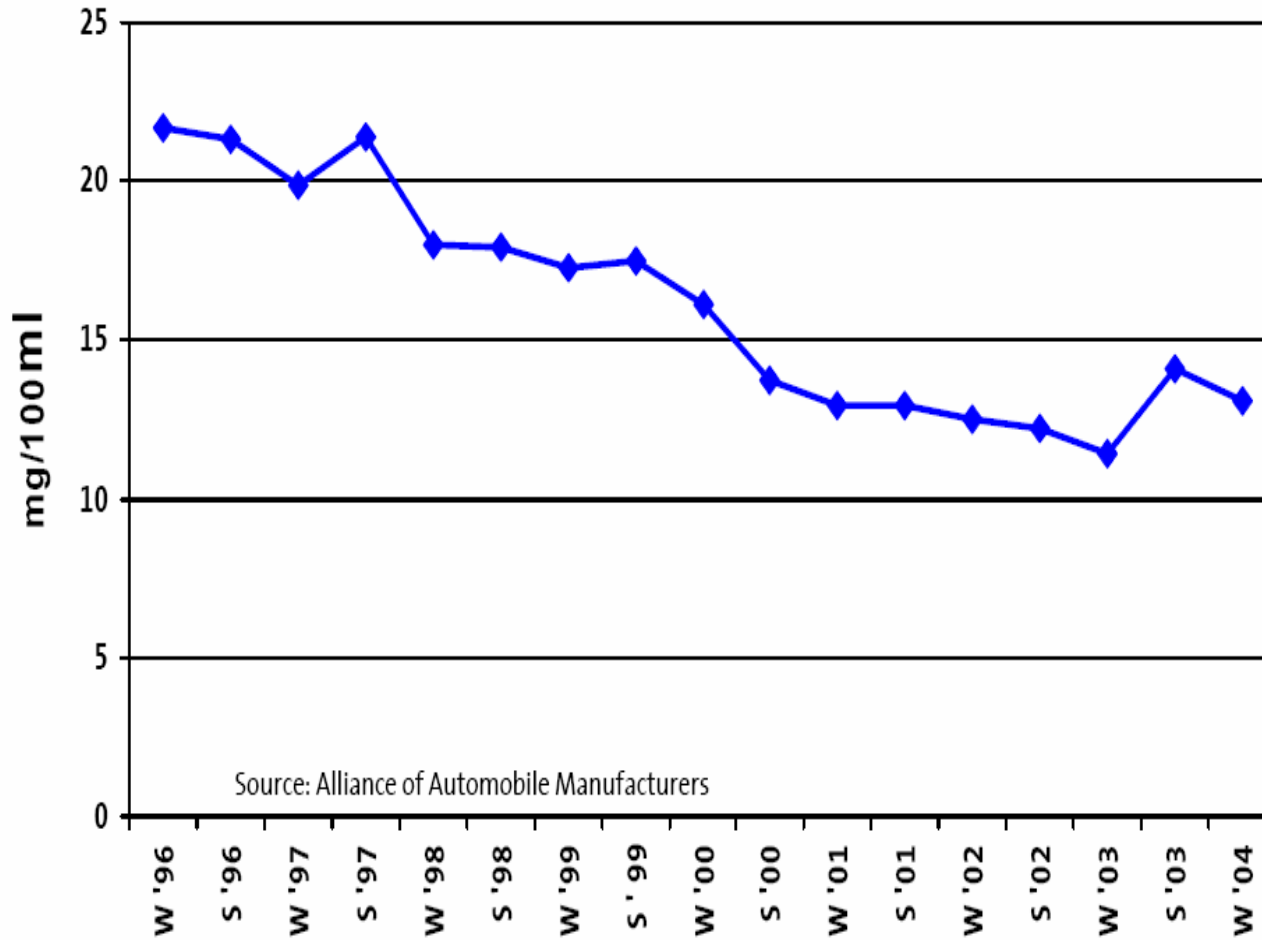
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Fuel Issues

Top Tier Gasoline



Gasoline Additive Usage Levels Are Increasing

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Fuel Issues

Ethanol

Use Expanding Worldwide

- Many major oil consuming or agricultural exporting countries including countries in Asia either have or are considering public policies to introduce ethanol as a blending component into their gasoline supplies.

Issues

- Water Tolerance
- Metal Corrosion
- Fuel Permeation
- Material Compatibility
- Increased Volatility
- Driveability, Fuel Economy
- Fuel Filter Plugging Problems – Service Stations



Summary

- Changes in fuel composition and in engine technologies may promote the use of improved and higher performing deposit control additive packages
 - Current additive treat rates are barely acceptable for the current fleet and changes to engine technology will drive the market toward higher performing additive packages
 - Changes in fuel composition may drive the market toward improved additive chemistries

