Unlocking Industry Innovation: Time to Change the Model?

Detroit Advisory Panel

April 19, 2016
Outline

• Global Drivers
• The Case for Changing the Industry Model
• Recommendations for Improvements
Key Global Lubricant Drivers
Global Vehicle Sales Will Grow

1. Vehicle sales growth
2. Improving efficiency
3. Powertrain enablement
4. Lower viscosity oils

Global diversification – Example China:
- In 2000, 700K cars sold
- In 2020, 24 million projected

Total vehicle fleet grows from 1.1B to 2B in 2030

Annual worldwide vehicle sales
(Light, medium and heavy duty vehicles)

Sources: IHS AutoInsight, McKinsey, KPMG, Lubrizol
www.greencarreports.com; www.Wikipedia.com

Demand grows for high performance lubricants and engineered solutions
Regulatory Impacts Are Not Incremental

PC sees substantial emission reductions

- New legislation leads to **efficiency improvements** in hardware and lubricants

- Tailpipe **emission reductions**
  - Beijing 6 standard in China
  - Phase in of Tier 3 in the US
  - BS VI in India by 2021
  - RDE\(^a\) and WLTP\(^b\) in the EU

- **CO\(_2\) emission reductions**
  - 95 g/km\(^c\) in the European Union by 2021
  - Phase III fuel economy legislation in China
  - 54.5 mpg in the US by 2025

This leads to lower viscosity lubricants and new additive technologies

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**Notes**
- RDE is an acronym for Read world Driving Efficiency, a test cycle for emissions performance which is conducted on the road
- WLTP is an acronym for Worldwide harmonized Light vehicle Test Procedure which is expected to replace the New European Drive Cycle (NEDC) in the EU
- Current limit based on the NEDC test cycle and this may be changed once the WLTP test cycle is adopted

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**Sources**
- ICCT, Dieselnet, China Ministry of Environmental protection
Modern Lubricants Demand Integrated Design

- Engine and transmission systems will be optimized to deliver power more efficiently
  - Higher power density, smaller engines
  - Downspeeding of engines
  - Increasing the number of gears
  - Shift to automatic transmissions
  - Continued use of diesel particulate filters
  - Introduction of gasoline particulate filters
  - Greater use of SCR\(^4\) systems on light duty diesel vehicles
  - Light weighting and many other options

Notes: 4. SCR is an acronym for Selective Catalytic Reduction, an advanced exhaust aftertreatment system for the reduction of NOx emissions.

The operating conditions get more severe and hardware more sophisticated
Enabling Efficiency Gains With Lubricants

- New specifications and OEM requirements indicate:
  - Lighter viscosity grades
  - Lower HTHS viscosity levels
  - More fuel economy overall
  - **Fuel economy durability** over the life of the drain **is critical**
  - Uncompromised durability

- Lubricants directly contribute to fuel economy and emissions reductions
- Lubricants further enable the durable operation of new hardware

*Durable, lower viscosity fluids represent a new frontier of lubricants*
## Trends Heavy Duty Truck

*More performance - less emissions*

<table>
<thead>
<tr>
<th>Year</th>
<th>Power (HP)</th>
<th>Fuel Economy</th>
<th>Emissions Levels</th>
<th>Aerodynamics (Cda)</th>
<th>Emissions equipment</th>
<th>Engine Lubricant</th>
<th>Gear Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>430</td>
<td>6.0</td>
<td>NOx 4.0, PM 0.11</td>
<td>0.8</td>
<td>Oxidation Catalyst</td>
<td>CF-4 15W-40</td>
<td>MIL-L-2105D</td>
</tr>
<tr>
<td>2015</td>
<td>600</td>
<td>6.4</td>
<td>NOx 0.2, PM 0.02</td>
<td>0.62</td>
<td>Oxidation catalyst SCR DPF Limp mode</td>
<td>CJ-4 10W-30</td>
<td>SAE J-2360 + OEM</td>
</tr>
</tbody>
</table>

- **Power**: 40% more power
- **Fuel Economy**: 6% improved fuel economy
- **Emissions Levels**: Over 90% reduction in emissions
- **Aerodynamics**: 22% improved aerodynamics
- **Emissions equipment**: More complex emissions systems
- **Engine Lubricant**: Low ash formulation
- **Gear Oil**: Higher performance

### Class 8 tractors are more powerful and less polluting – are we doing enough?
Industry Model: A Case for Change
How Do Industry Standards Come To Be?

- Setting an Industry Standard requires several steps:
  - Establishing need
  - Test design, funding, and development
  - Spec acceptance
  - Formalization
  - Implementation
  - Licensing

Available on www.HDDEO.com
Specification Developments Need Fresh Approach

Consensus-driven lowest common denominator process

- Industry processes and committees are complex, slow and unbalanced
- Category development costs are prohibitive for commercializing innovative products
- Specifications mandate minimum lubricant quality levels
- Advertising rulings constrain marketers from selling performance and differentiation
- Consumers and society deserve more products that give more than minimum performance
- Our industry must take action to improve speed, flexibility, and unlock innovation

Our industry model locks out innovation and adaptability
Five Forces: Barriers Working Against Innovation

FORCE 1: Costs are accelerating
FORCE 2: “Dear Manufacturer”
FORCE 3: It takes too long
FORCE 4: A pass is a pass
FORCE 5: Performance convergence

These factors cumulatively are impacting all of us
The First Force - Costs Are Accelerating

Example: PC-11 Category Development (Lubrizol)

Pre-platform development $20 million

Market General Product $10 million

Field testing and customer programs $45 million

Capital expenses for new additive technology $75 million

$150 million category cost

The model and escalating costs make investments increasingly risky
The Second Force — “Dear Manufacturer”

Technology must be readily available and backward compatible

Sequence VID Results

- EPA sets “typical limits” for fuel economy that OEMs can use to certify and further requires these oils to be readily available.

- Industry committees set the minimum standards that everyone can meet.

- Creates hurdles for marketers to bring step out products to market.
This Costs Everyone

Examples: US fuel economy systemic losses and opportunities

PC: 0.5% More Lube FE

- FLEET
  - 685 MG saved
  - 6 MMT CO₂ saved
  - $1.5 billion in wasted fuel cost
  - = 1.2 million cars removed

HD: Regulate 10W-30 vs 15W-40
(1% FE savings for on-highway trucks)

- FLEET
  - 378 MG fuel saved
  - CO₂ – 1 MMT
  - $750 million in wasted fuel cost

HD: Use of Fuel Efficient Lubricants
(3% FE savings EPA SmartWay® Transport Partnership)

- FLEET
  - 2.4 billion gals total
  - CO₂ – 24.7 MMT
  - $5 billion in wasted fuel cost

- Per TRUCK
  - Diesel fuel – 485 gals
  - CO₂ – 4.93 MT
  - $1,680 fuel cost savings

These are things available NOW

- CO₂ calculations from EPA average Carbon Dioxide Emissions Resulting form Gasoline and Diesel
- EPA SmartWay Estimates of benefits
- EIA estimates of on highway distillates usages 2014
Innovations and step out products need faster routes to market

The Third Force – It Just Takes Too Long

GF-6: 6 organizations and 11 sub-committees involved

- 0W-20: 8 years between product launch and EPA certification testing
- 0W-16: 4 years for SAE J300 grade definition. EPA certification? 0W-8’s 10+ years?


TOYOTA: “It becomes obvious that the revision of engine oil specifications cannot keep up with the rapid change of engine hardware and engine oil technologies”

*Lubricant viscosity from Kline’s Lubesnet*
The Fourth Force – “A Pass Is A Pass”

- Government, OEMs and consumers desire performance
- BUT litigations have generally guided differentiation substantiation to:
  - Specifications
  - Pass / Fail testing
  - Field testing and testing applicable to customer experience (no torture tests)
- Synthetics, typically positioned as top tier and generally featuring the basestock type

How can marketers articulate meaningful consumer benefits?
The Fifth Force — Performance Convergence
The Basestock Squeeze

Are we heading for commoditization?
Today’s Passenger Car Product Categories Are Generally Based on Basestock Type

Sample PC Lubricant Product Architecture – North America

In a low viscosity world will basestocks still differentiate product categories?
Hard Passenger Car Claims Enable Separation of Product Categories

Sample PC Lubricant Product Architecture – Asia

Tiering based on claims provides a pathway to commercialize performance
So What Should We Do?
Lubrizol’s Proposal

Form a Stakeholders Group that aims to:

- **Streamline specification development** to improve speed and cost
- Identify a **fast track** for new **technology**
- Form and fund an **evergreen test development** organization
- **Engage regulatory agencies** to incent products that deliver societal benefits today
- **Build tiered specification** to give consumers performance-based differentiated options
- Define paths to **educate** consumers on lubricant performance

As an industry can do better and the time to act is now
Next Steps

Start the Conversation

– Exchange perspectives with oil companies, OEMs, Regulatory Agencies, Testing Organizations, Additive Companies and End User Representative Groups
– Form Stakeholder Committee and agree on scope and governance
– Focus on forthcoming Passenger Vehicle mid-term reviews for 2025 CAFE targets
– Refine and agree, plan, fund, and test
– Implement learning and improvement post GF-6 and PC-11 first licensing

Let’s work together and enable innovation for everyone
Working together, achieving great things

When your company and ours combine energies, great things can happen. You bring ideas, challenges and opportunities. We’ll bring powerful additive and market expertise, unmatched testing capabilities, integrated global supply and an independent approach to help you differentiate and succeed.