Program Objectives

- Customer satisfaction is the primary goal!
  - Optimal power & performance
  - Optimal maintenance schedule/cost and reduced downtime
  - Consistent engine operation over time

- Same message from Fuel Marketer **AND** Vehicle Manufacturer!

- Fuel quality plays very important role to meet the combined customer and regulatory requirements
Gasoline with the U.S. mandated minimum deposit control additive produced higher valve deposits than the same fuel containing no additive in ASTM D6201 Valve Deposit Tests.

100 hr. Keep Clean Cycle in ASTM D6201
(Ford 2.3L Dyno Engine Test)

Increasing Detergency Concentration
History of TOP TIER™

OEMs, working with Fuel Marketers, create a voluntary program to address global fuel detergency needs without mandatory regulation changes-

Program Start: April 2004
Nine auto company sponsors:

- GM
- Honda
- Toyota
- BMW
- FCA
- Mercedes-Benz
- Volkswagen
- Audi

EPA Treat Rate 100 hrs. ASTM D6201
TOP TIER gasoline 100 hrs. ASTM D6201
Development of TOP TIER™ Diesel Fuel
Findings: Diesel and Biodiesel Consumption by Equipment Type, North America: 2016-2025

- **Consumption of diesel & biodiesel expected to increase by 14% and 12% higher than 2016 levels** in the Base and Aggressive scenarios
- **Increase in consumption is expected to be driven primarily by gains made from heavy-duty class consumption**
3. Support for Additized Diesel Grows

TOP TIER detergency standards supported by several of the world's major automakers, soon will apply to diesel in addition to gasoline. Officials with the TOP TIER program are finalizing the performance standard and defining the process, according to the Center for Quality Assurance, of Midland, Mich., which administers the licensing process for TOP TIER. Two majors – ExxonMobil and Shell – already have been testing additized diesel.
Performance Standard Overview

#1. Injector Deposits

#2. Lubricity

#3. Fuel stability

#4. Water and particulate
Overview of TOP TIER™ Diesel Performance Standard

- Fuel must meet relevant country/regional standards (e.g., ASTM D975 or ASTM D7467) and these additional requirements:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidation Stability (Rancimat IP method)</td>
<td>EN15751 (Rancimat IP method)</td>
<td>&gt;8 hours for B100 as blend component OR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt;24 hours for up to B5 Biodiesel blend at retail OR</td>
</tr>
<tr>
<td></td>
<td>ASTM D7545 (PetroOxy Test)</td>
<td>&gt;20 hours on &gt; B5 the biodiesel blends at retail OR</td>
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<td></td>
<td></td>
<td>&gt; 60 minutes for B0 fuel</td>
</tr>
<tr>
<td>Lubricity</td>
<td>ASTM D6079</td>
<td>460 micron max</td>
</tr>
<tr>
<td>Detergency -Injector Cleanliness</td>
<td>DW-10B (CEC F-98-08 )</td>
<td>&lt; 2% power loss</td>
</tr>
<tr>
<td></td>
<td>DW-10C (CEC F-110-16 )</td>
<td>Rating of &gt; 9 on Demerits Scale</td>
</tr>
<tr>
<td></td>
<td>Place holder until approved by CEC</td>
<td>Results on the qualified test as approved by OEM sponsors</td>
</tr>
<tr>
<td></td>
<td>Qualified engine/vehicle test from</td>
<td></td>
</tr>
<tr>
<td></td>
<td>fuel marketer or additive company</td>
<td></td>
</tr>
<tr>
<td></td>
<td>to demonstrate performance to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>prevent IDID deposits</td>
<td></td>
</tr>
<tr>
<td>Refueling Station Housekeeping</td>
<td>Refueling Station Housekeeping</td>
<td>Water detection media filter or approved water detection process</td>
</tr>
<tr>
<td>Water</td>
<td>ASTM D6304</td>
<td>To be monitored during audits</td>
</tr>
<tr>
<td>Particulate Contamination, Size Distribution</td>
<td>Retailer dispenser filter</td>
<td>&lt; 10 microns absolute for low speed pumps</td>
</tr>
<tr>
<td></td>
<td>ISO 4406</td>
<td>(30 micron accepted for high flow)</td>
</tr>
</tbody>
</table>

NOTE: Additive package will have to pass ‘no-harms’ testing in addition to above performance requirements with fuel containing biodiesel at highest blend rate, lubricity, conductivity, stability additives tested with each deposit control additive. See official Performance Standard for full details regarding the TOP TIER™ Diesel requirements.
Implementing the program...

- The program technical requirements focus on quality improvements from additives use and dispenser filter media.
- Minimum detergent levels are based on “keep clean” levels.
- Fuel marketers can compare to “the minimum treat rate” in order to differentiate their diesel product offering.
- The program is not designed to sort base diesel or biodiesel fuels.
- Unlike the gasoline program, the diesel program allows the enrollment of site specific retail locations.
- All grades of diesel (No.2 and “additized diesel”) sold at the site must meet the TOP TIER™ Diesel Performance Standard.
- Audit testing will be done by the program.
- Enrolled fuel marketers may use TOP TIER™ logo for advertising.
The TOP TIER™ program is managed by:
The Center For Quality Assurance Inc. (CQA)
4800 James Savage Road │ Midland, Michigan 48642 │ USA
Phone: 989.496.2399

Program Information: TopTier@CenterForQA.com