

# European Engine Oils

## Heavy Duty Diesel Market Overview



### Market Drivers

The Western European on-road heavy duty diesel engine oil market continues to undergo a period of dramatic change as the result of three factors:



#### Emissions

Changing European Union (EU) emissions legislation, designed to reduce potentially harmful vehicle exhaust emissions, is resulting in new engine designs and aftertreatment systems being introduced by OEMs. Euro IV resulted in the use of selective catalytic reduction (SCR) and exhaust gas recirculation (EGR) to reduce oxides of nitrogen (NOx) emissions. Particulate emissions were reduced by the use of diesel particulate filters (DPF), leading to “lower SAPS” engine oils being developed. Moving through Euro V and looking forward to Euro VI there is likely to be greater use of DPFs, SCR and EGR.

#### Fuel Economy

The drive to increase the fuel efficiency of heavy duty vehicles is to lower the cost of operating a vehicle. This is leading to a shift in the viscosity grades, from 15W-40 and higher to 10W-40 and 5W-30. However, there is no standard test for the evaluation of heavy duty diesel engine oil fuel economy improvement. Therefore, it is essential that any claims of fuel economy improvement are carefully evaluated to ensure that they will be measurable in the field. Although current legislation does not consider the reduction of carbon dioxide (CO<sub>2</sub>) emissions it is likely that this will be a future requirement.

#### Durability

The introduction of new engine designs, aftertreatment systems and fuels are making the environment in which the engine oil operates increasingly severe. As a result, engine oil durability must be increased to ensure that engine oils continue to perform as required.

These three factors continue to result in the need for new engine oil technology, designed to operate in vehicles with the latest aftertreatment systems, while delivering ever greater durability and fuel economy improvement.

### Market Structure

The Western European on-road heavy duty diesel engine oil market may be segmented by many factors including performance, specifications, viscosity grade, base oils, elemental limits and aftertreatment system compatibility.

Figure 1 illustrates Lubrizol’s segmentation of this market into three broad market tiers, each with distinct performance and value characteristics.

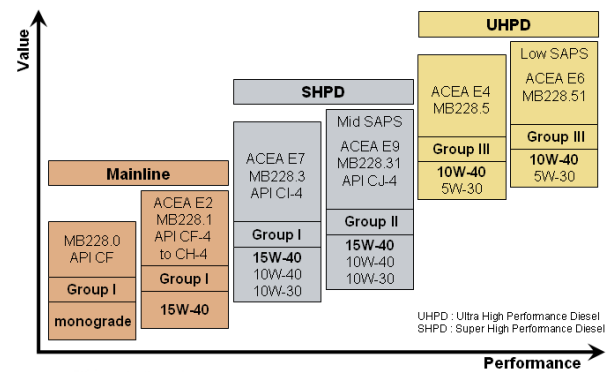


Figure 1 – Heavy Duty Diesel Engine Oil Market Structure

#### Ultra High Performance Diesel (UHPD)

This premium market tier represents the highest levels of engine oil performance seen in the European heavy duty diesel market. Predominantly 10W-40, formulated with API Group III base oils, the UHPD tier is split into two distinct segments by the differing requirements of ACEA E6-08 and ACEA E4-08. Both provide the highest levels of engine oil durability and are intended for use under severe operating conditions. However, ACEA E6-08 engine oils are formulated to a lower SAPS level in order to be suitable for use in vehicles fitted with advanced aftertreatment systems, particularly DPFs. Demand for ACEA E6-08 engine oils is expected to grow with the increased use of DPFs to meet the expected Euro VI emissions standards.

#### Super High Performance Diesel (SHPD)

A premium performance market tier that represents the main oil quality levels required for use in medium severity applications. This tier is also split into two distinct segments by the differing performance and SAPS requirements of ACEA E7-08 and ACEA E9-08. Engine oils meeting ACEA E7-08 are typically 15W-40s formulated with API Group I base oils. Since ACEA E2-08

is no longer in the 2008 Oil Sequences the minimum ACEA performance level for heavy duty diesel applications has become ACEA E7-08 resulting in a growing demand for this tier.

ACEA E9-08 is a new mid SAPS requirement and contains many elements of API CJ-4 and is intended for use in vehicles fitted with DPFs together with EGR and/or SCR. ACEA E9-08 oils are expected to be 15W-40s based on API Group II base oils and demand for them is forecast to grow as the use of DPFs increases. ACEA E9-08 is also likely to become the minimum performance level for heavy duty diesel applications for Euro VI.

### Mainline

Mainly used in older vehicles this lower performance tier includes basic quality engine oils meeting older ACEA Oil Sequences or API categories.

## Market Demand

The change in engine oil demand by market tier, viscosity grade and base oil type has changed considerably in the last few years. The introduction of new engine oil requirements for aftertreatment compatibility, greater durability and fuel economy improvement have resulted in a change in the types of engine oil used in Europe.

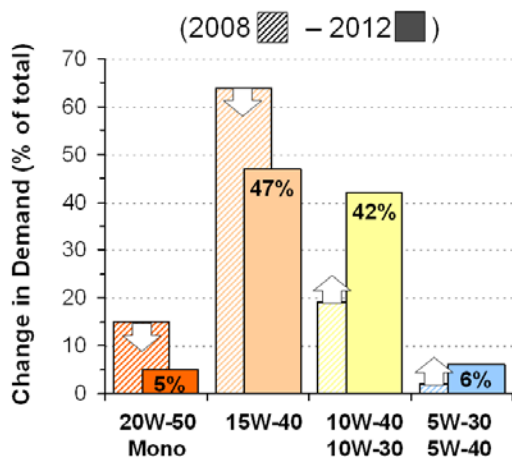


Figure 2 – Change in demand by viscosity grade

Figure 2 illustrates the relative change in demand by viscosity grade that Lubrizol expects to see over the next 5 year period from 2008 to 2012. As demand for lower SAPS engine oils continues to increase in both the UHPD and SHPD market tiers, demand for the lighter viscosity

grades (10W-40 and 5W-30) will continue to increase at the expense of the heavier grades (20W-50 and monogrades).

This change in demand will impact the types of base oil required as illustrated in figure 3. Increased usage of 10W-40 and 5W-30 will result in greater demand for API

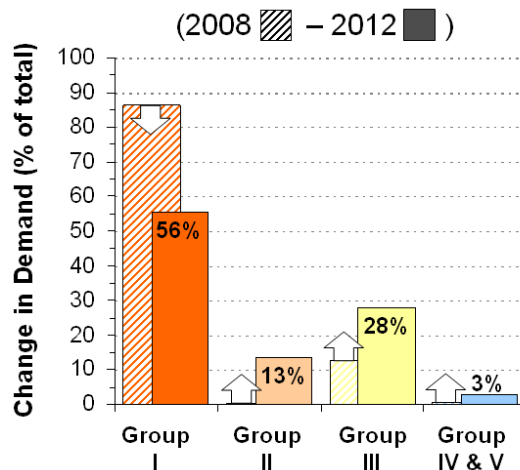


Figure 3 – Change in demand by API Base Oil Group

Group III base oils. Demand for ACEA E9-08 15W-40s is likely to result in a growth in demand for API Group II base oils. The obsolescence of E2, E3 and E5, combined with the changes in vehicle parc, will result in a fall in demand for older 15W-40, 20W-50 and monograde engine oils; reducing demand for API Group I base oils.

## Market Outlook

The heavy duty diesel engine oil market will continue to change over the next 4 years. Emissions, durability & fuel economy requirements will continue to drive demand for higher value engine oils with lighter viscosity grades, higher quality base oils and new innovative additive chemistry.

In the short term, as DPF usage increases in heavy duty applications the demand for lower SAPS engine oils meeting ACEA E6-08 and ACEA E9-08 will continue to increase rapidly and is forecast to represent over a third of all engine oil demand by 2013.

For further information on changes in heavy duty diesel engine oils see [www.lubrizol.com/ACEA2008](http://www.lubrizol.com/ACEA2008)

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