LUBRICANTS

Drivers for change

The key drivers for change in the lubricants sector are demand for improved fuel efficiency, lower viscosity oils, regulatory moves towards lower emissions and new powertrain enablement. *Brian Davis* reports on the latest market analysis by the Kline Group and new developments from Total.

Car motor oils are the most dynamic lubricant product category in terms of innovation, with engine oil viscosity grades getting lower

Source: Total

Lubricant performance continues to improve, driven by regulations for fuel economy and emissions control, but the market has stayed flat. New quality specifications are being introduced for passenger cars and heavy-duty motor oils, as well as lighter viscosity grades. Meanwhile, lubricant basestock quality continues to improve and new suppliers are entering the market, providing innovative options for lubricant blenders.

According to a recent Kline report: 'The global basestock industry is witnessing sea changes. The rapid new supply creation has consistently outpaced demand growth, leading to a flood of new basestocks supply. Tightening emission and fuel economy regulations and original equipment manufacturers' (OEM) specification is driving the use of high quality and synthetic lubricants.'

It's a challenging picture. George Morvey, Industry Manager in the Kline Energy Practice, says: 'There is limited volumetric growth in the lubricants market, but a lot is going on in terms of development on the automotive and industrial side.'

Automotive lubricants

Car motor oils are the most dynamic product category in terms of innovation. Engine oil viscosity grades are getting lower, with a move from traditional 10W to 5W and 0W viscosity grades.* '0W-16 and 0W-20 are the preferred viscosity grades of Toyota and Honda today, while German luxury motor manufacturers BMW, Audi and Mercedes are increasingly specifying 0W-30 and 0W-40 – though not across the board for all powertrains,' says Morvey.

The primary driver is fuel economy, which global OEMs are under pressure to improve. Lower viscosity engine oils are being used in combination with new technologies, with smaller engines, turbo-charged gasoline direct injection engines, stop-start and exotic materials – all of which influence fuel economy requirements. 'The OEMs are seeking single digit, incremental gains in fuel economy with these technologies,' explains Morvey.

0W lubes are being formulated using better quality basestocks.** Traditionally an API Group II basestock would be used to formulate a product that meets OEM recommendations. Now there is a move towards API Group III+, like the Group III basestock oil which Shell is formulating at its gas-to-liquids plant in Qatar.

The move to higher quality basestocks, means that 0Ws are being formulated and positioned as full synthetics. 0W is primarily formulated from Group III or occasionally Group IV basestocks. One of the key benefits is that OEMs can move towards longer oil drain intervals.

Group III basestock is primarily coming out of Asia, South Korea and increasingly the Middle East. Typically, it is shipped to Europe and North America for blending, but there is also Group III blending and use in China.

One of the advantages to a formulator using a Group III basestock as opposed to Group IV PAO (polyalphaolefin), which has traditionally been the domain of majors like ExxonMobil with Mobil 1, is the price. The fully formulated product is claimed to be nearly identical and has lower flow and corepoint capability. 'The introduction of Group III basestock and global availability at competitive prices means many formulators have adopted this approach as opposed to the more expensive PAO approach,' says Morvey.

Furthermore, the OEMs are under pressure to reduce emissions. For example, India has improved fuel quality targeted at reducing vehicle emissions. China is doing the same, following the lead of OEMs in Europe (with recent changes to Euro 6 emission standards) and North America.

'A lot of what makes the difference in a lubricant is the additive component,' says Annie Jarquin, a Director at Kline. Detailed research is underway on lubricants and additives at oil major R&D facilities worldwide and by some of the independents, particularly in niche areas.

Industrial lubricants and synthetics

There is also a lot of focus on industrial lubricants because of changing automation demands. According to Jarquin: 'Though there is not much product innovation, there is a lot of behavioural change in terms of handling lubrication of automation and other new technology.'

Generally, industrial lubricants are 'fit for purpose'. The ability to substitute one product for another is limited. 'Having the correct lubricant is vital for good maintenance and equipment uptime,' says Morvey.

There is also a move from conventional lubes to synthetics. For example, switching from a conventional lubricant to a full synthetic for air compressors can extend run-time from 2,000–3,000 hours to 10,000 hours. 'It all comes down to economics, but the smart maintenance manager recognises the benefit of spending an extra $100 for a drum of synthetic which will improve operation rates and reduce unscheduled maintenance significantly,' Morvey says.

Industrial lubes are mostly

Development and innovation

The two biggest drivers for change in the lubricants sector are climate change and new health and safety (H&S) legislation, says François Bénard, Development and Innovation Manager, Total Lubrifiants. 'As CO_2 targets for energy efficiency, emissions reduction and alternative fuels have now become enshrined in legislation, lubes have had to evolve to meet these challenges.'

Furthermore, lubricants need to maintain protective and durability features as well as helping improve energy efficiency. This has been achieved by developing lubes with the lowest possible viscosity and the use of friction modifiers. Lubricants also have had to be modified to ensure they can protect the latest engine types and perform with various types of fuels, including biofuels.

Legislative impact

On the safety side, REACH (Registration, Evaluation, Authorisation & Restriction of Chemicals) legislation has meant developing performance additives to replace components that do not meet REACH or other new H&S requirements. The biggest impact on lubricants comes from regulations or directives that are not actually directly related to the lubricants themselves. The change in 2017 from the New European Drive Cycle (NEDC) to the World Harmonised Light Vehicles Test Cycle (WLTC) and the planned introduction of the Real Driving Emission (RDE) cycle will have major impact on oil formulations. By 2025 or perhaps sooner, WLTC may be replaced with the World Harmonised Light Vehicles Test Procedure (WLTP). Under European directive Euro 6c, automotive lubricant formulations will have to be adapted to post-treatment evolution.

'Biofuel regulations will also have a significant impact, and are still not yet harmonised within European countries,' notes Bénard. Lubricants have to be adapted to neutralise products (like biofuel) that impact on fuel dilution and combustion gas. In addition, new regulations concerning Mineral Oil Saturated Hydrocarbons (MOSH) and Mineral Oil Aromatic Hydrocarbons (MOAH) measurement will affect formulation of all food-grade lubricants.

On the marine side, there have been major new regulations from the International Maritime Organization (IMO). New marine fuels are coming into play and there is an increase in Environmental Control Areas (ECAs) in Europe, the US and China. In the US, legislation specifically covers the use of environmentally acceptable lubricants (EALs) to allow a ship to trade in territorial waters and for a vessel general permit (VGP) to be issued. (See also pp30–31.)

Key developments

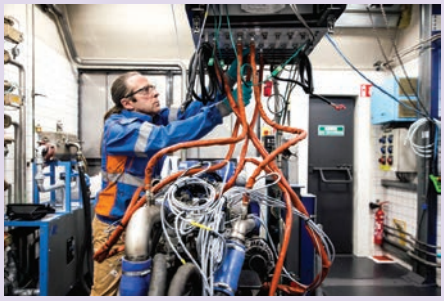
Total is working on a number of R&D initiatives in key areas of the lubricant sector.

Automotive – Total's main developments are focused on engine oils with very low viscosity for fuel efficiency. These products require specific base oils with high resistance to volatilisation to avoid oil consumption, and high resistance to thermo-oxidation for durability. Because viscosity is low, specific friction modifiers are needed to maintain fuel efficiency even at high load when the oil film is broken. Low viscosity requires a strong anti-wear additive system to maintain engine protection, and also needs to avoid particulate aggregation when oil film thickness is low.

Biofuels are being introduced in all European fuels. Oil formulators are seeking additives to minimise oil degredation by oxidation, sludge, etc.

Industrial (plant) – Developments are focused on improving the energy efficiency of lubricants. Depending on the application, improved efficiency may be achieved through viscosity decrease or friction reduction. For metal working fluids, developments are also HSE-oriented, with low VOC (volatile organic compounds), HAP (hazardous air pollutant)-free, chlorine paraffin replacements, etc.

Marine – Total has developed Talusia Optima to avoid the need for a lube change when fuel is changed on entering or exiting an Emissions Control Area (ECA). Total Lubmarine pioneered the single oil concept with the launch of Talusia Universal in 2007 and has now launched the second generation. Aurelia LNG product is designed for LNG powered four-stroke engines. Bioneptan is designed for stern tubes to meet the US' VGP requirements. 'Total has some of the widest bio-products ranges on the market,' says Bénard.



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Source: Total

Synthetics – Total is also developing synthetic lubes. For example, Group III base oils may have volatility characteristics which are too high for some engines, so new synthetic base oils are used to achieve the best viscosity/volatility compromise. There is also increasing interest in renewable base oils and bio-lubricants. 'The real challenge is to have the right thermal stability performance, the right viscosity at each temperature (rheology) and to stay economically acceptable. Compatibility with materials, such as seals, also needs to be optimised,' says Bénard.

Additives – New additive developments are also underway. Polymer optimisation is being used for very low viscosity base oils. Additives may also have an impact on viscosity and friction, so there is a lot of work to minimise both. Research on friction modifiers is also very active. Although molybdenum components are widely used, new types of additives are under investigation. ●

formulated with API Group I and in some cases API Group II basestock plus an additive package. On the synthetic side, formulators tend to use Group IV or Group V esters, polyolesters and phosphate esters.

Bio-basestocks

New entrants and some existing lube suppliers are manufacturing basestocks from bio-sources, such as sugar cane and soya bean oils. Companies like Novvi and Biosynthetic Technogy in the US convert sugar cane and soya oil respectively, to a Group III basestock with biodegradable capabilities. However, there is little or no regulatory pressure to use bio-lubes.

'Unlike the marine sector, where growing legislation is forcing the end-user to use more environmentally compliant products, in the absence of government or regulatory push, there is unlikely to be a significant switch to bio-based lubricants in the short to medium-term,' comments Morvey. US legislation (pre-Trump) requires that 25% of lubricants supplied to government contracts should be bio-based, and the paper and pulp industries have also expressed interest in bio-based lubricants.

'The economics of bio-basestock is also a challenge if they are not sold at a competitive price,' says Jarquin. 'A lot of this innovation started when the oil price was much higher.'

Nevertheless, Chevron made an equity investment in Novvi in December 2016 for development of high performance bio-based lubricants. BP Ventures and Monsanto back Biosynthetic Technologies, which has developed a new class of bio-based synthetic oils (from soya beans) that are

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claimed to match or exceed the performance of high-quality petroleum-based oils. BP launched a bio-based version of the Castrol Magnatec brand as a passenger car motor oil (PCMO) product that is biodegradable. 'But I think it will be a tough sell. The majors may be hedging their bets and don't want to be blind-sided if bio-products take off,' remarks Morvey.

Heavy truck engine oils

There is also a shift in the type of engine oil products being used by heavy trucks. Traditionally, an over-the-road diesel engine used a 15W-40 engine oil. But engine OEMs are under pressure to reduce emissions and improve fuel economy and are moving towards lower viscosity grade engine oils, like 10W-30 which offers field economy gains. OEMs are also recommending a move to factory fill and service fill of 10W-30 and 5W grades, where in the past they may have used 15W-40.

On the engine oil side, there is still a preference for API Group II category. Kline forecasts that other lubricants such as driveline fluids, gear oils and transmission fluids are likely to adopt synthetics in Group IV formulations. 'Driveline manufacturers will be able to offer longer oil drain intervals and extended warranties if the service fill lubricant is synthetic. But heavy duty vehicles aren't moving as quickly or innovatively as the consumer car space,' reflects Morvey.

Route to market

'We are starting to see new action in channels – "how" and "who's responsible" for getting those products to market via distributors,' says Jarquin. In China, for example, many people are buying lubricant online from Ali Baba or Amazon rather than using a conventional dealer.

In developing markets like China and India there is also a lot of consolidation in the lubricants distribution market, following similar moves in Europe and the US.

Morvey recognises that volumes are not what they were five to 10 years ago. 'Now the focus is more on efficiency, distribution, understanding segments and how to capitalise on them. There is product innovation but the market isn't growing volumetrically. Lubricant suppliers are looking internally to see what they can improve, how to cut costs and secure the position they already have. There's a rethink about the supply chain, and in the US there has been a rash of acquisitions and mergers of lubricant distributors using private equity.'

'Private equity is actually getting involved across the whole value chain, not just distribution,' notes Jarquin. For example, Brenntag, a global market leader in chemical distribution, bought two of the leading US lubricant distributors – JAM Distributing Company and GH Berlin-Windward – last November.

Generally, the lubricant market is shifting gear rather than changing direction dramatically. ●

*The viscosity grade of a lube oil is determined by the Society of Automotive Engineers (SAE). Multigrade oils' viscosity grade consists of two numbers, for example 10W-40: 10W refers to the low-temperature viscosity ('winter'), 40 refers to the high-temperature viscosity ('summer').

**The American Petroleum Institute (API) has categorised base oils into five categories. The first three groups are refined from crude oil, while Group IV base oils are full synthetic (polyalphaolefin) oils. Group V is for all other base oils not included in Groups I through IV.