eMobility: Not the end of the road

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eMobility is the harbinger of change, not obsolescence, for the automotive lubricant market. An agile lubricant industry can exploit emerging opportunities and create value with broader coverage oils and higher performance fluids differentiated to meet the specialised needs of this growing sector.

Despite Covid-19 depressing new vehicle retail, the demand for electrified vehicles accelerated in Europe during 2020, particularly in Q4, fuelled by EU emissions regulations, OEM sales campaigns and government incentives.

Conversely, consumer gravitation towards shared mobility slowed during the pandemic; much OEM investment in this area has stalled or been diverted. Early evidence suggests that fear of infection from shared transport could have a lasting impact on millennials, who may now suddenly desire private vehicle ownership over mobility.

Whatever the next normal looks like, the number of internal combustion engine (ICE) vehicles in the global car parc is forecast to continue growing until 2040. Opportunities therefore abound for lubricant suppliers within the automotive sector, with growth coming from engine oils, transmission fluids and coolants targeted to the specific needs of ICE, hybrid and battery electric vehicles.

Growth of electrification

ACEA data shows that electrically chargeable vehicles, which includes both battery (BEV) and plug-in hybrid (PHEV) vehicles, leapt threefold from 3% of EU new vehicle sales in 2019 to 10% by the end of 2020.[1] This figure is forecast to rise again to 15% of new vehicle sales in 2021. Meantime, hybrid electric vehicles have doubled to nearly 12% of new vehicle sales.

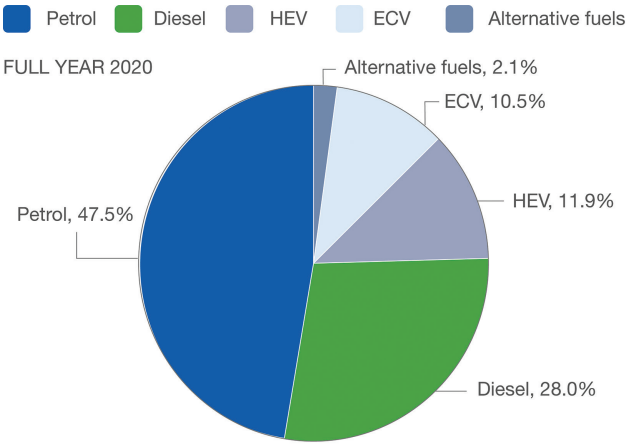


***Figure 1:** EU new vehicle sales 2020* Source: ACEA 2020

This sudden jump in EV sales, especially in Q4, was prompted by the introduction of the 20/21 EU emissions targets, suggests Transport & Environment.[2] Prior to this, average new car CO_2 emissions had been rising steadily from 118.1g/km in 2016 to 122.4g/km in 2019. This CO_2 increase comes from sales of heavier and more polluting SUVs and high-performance cars, as consumer preferences have shifted and OEMs sought to maximise profitability before 2020 CO_2 targets and penalties were phased in.

A further milestone – parity in cost of ownership between BEVs and ICEs – now predicted to be reached in Europe during 2022[3], will also encourage BEV growth; although the greatest impact is still likely to come from government incentives.

The opportunities that EV growth brings for lubricants depend on the different strategies that OEMs employ to balance consumer preferences with the challenges of legislation.

OEM strategies

Today's eMobility growth is coming mainly from hybrid (HEV) and plug-in hybrid (PHEV) sales, with

OEMs offering at least 50% more hybrid models than battery electric cars (BEV) during 2019 and 2020. More BEV options are coming for 2021, although PHEV choice will remain greater.

According to T&E, this is because OEMs are using a range of different compliance strategies to meet their average EU CO_2 emissions targets. Volvo, Toyota, BMW, JLR, Daimler and Ford have placed more focus on ICE efficiencies and /or hybrid solutions to date; Tesla-FCA, Nissan and Renault have opted to focus more on BEV solutions. VW, the current EV sales leader in Europe by volume, has maintained a broad offering of PHEV and BEV models but plans to focus primarily on BEV in future.

This diversity of approach leaves the window of opportunity wide open for broader coverage lubricants, as well as more specialist fluids. As PHEVs become more prominent, and the balance of propulsion relies less on the ICE and shift to the electrical system, their operation will diverge further and exert a stronger influence on lubricant requirements.

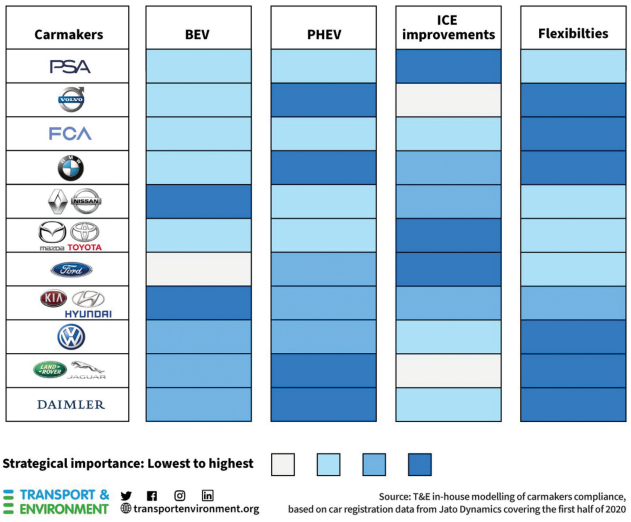


Figure 2: *Carmakers compliance stratergy for 2020*

Hybrid ICE fluids

Downsized ICEs in hybrid vehicles may experience very different stresses than ICEs in standard vehicles. For example, in hybrids used for frequent short journeys the ICE could suffer from condensation that rarely boils off because higher temperatures are rarely reached, increasing the risk of corrosion. Whereas for a hybrid driver typically making longer journeys the ICE might kick in at high speed or load, making wear more likely in the cold engine. Hybrids used as urban taxis or shared vehicles will experience longer operating periods at higher temperatures, exposing fluids to greater thermal and oxidative stress. At the opposite extreme are series hybrids: these ICEs operate under relatively constant conditions, acting as a generator to charge the onboard battery.

Both factory fill and service fill fluids will need to deliver excellent performance regardless of driving cycle. Differentiated hybrid engine oils that offer improved engine protection, with greater fluid longevity under diverse conditions, present a further opportunity.

Transmissions and eMotors

Hybrid transmission fluids need to meet traditional performance demands, including wear protection, friction characteristics and oxidative stability, across transmission types ranging from conventional AT, CVT and DCT hardware through to dedicated hybrid designs.

The transmission fluid may also be used to cool the eMotor. eMotors operate at high temperatures and direct cooling, which involves applying lubricating oil directly to the motor, is becoming increasingly popular with OEMs because of its greater efficiency.

Ricardo[4] modelling work for Afton shows that direct-cooled eMotors can benefit from 2-3% greater efficiency, helping to offset hardware costs or extend driving range. Ricardo's modelling scenarios also show that direct-cooled 2- and 3-speed transmissions can offer 2-4% better efficiency than single-speed transmissions.

In hybrids using the same fluid for both transmission and eMotor might make sense, but is a necessity with eAxles due to the compact packaging of multiple components.

hATF and ETF

Oils that come into direct contact with electrical components require a host of additional properties, including low electrical conductivity and the ability to minimise electrical charge build-up to prevent arcing and subsequent component damage. Fluids must also be compatible with sensitive components, such as wire coatings and copper in the eMotor and power electronics, to ensure maximum reliability.

Fluids designed and optimised for hybrid transmissions (hDCT, hCVT, hAT) are now required for first-fill OEM business. As this hardware takes a larger part of the parc, these fluids are beginning to differentiate themselves in the aftermarket too.

The eAxles in BEVs require even greater focus on the electrical systems. Not all the required properties are optimised within commercially available transmission fluids, so a new generation of lubricants has been developed: ETF – electrified transmission fluid.

ETF more effectively balances competing needs and increases the breadth of performance so eAxles benefit from an optimised blend of electrical, friction, antiwear, cooling and compatibility characteristics that supports reliable operation over the long term. Afton has developed proprietary screening tests, such as copper compatibility in the lubricant vapour phase as well as liquid phase, to better predict real world performance.

Dedicated ETF enables lubricant marketers to serve OEMs across a wide range of hardware including multispeed eAxles as well as offering a glimpse of the future service fill market.

BEV eMotor efficiency

OEM collaboration at pre-production stage has enabled Afton to validate the importance of fluid thermal conductivity and stability, ensuring that the all-round performance of ETF can be maintained even after prolonged exposure to high eMotor temperatures.

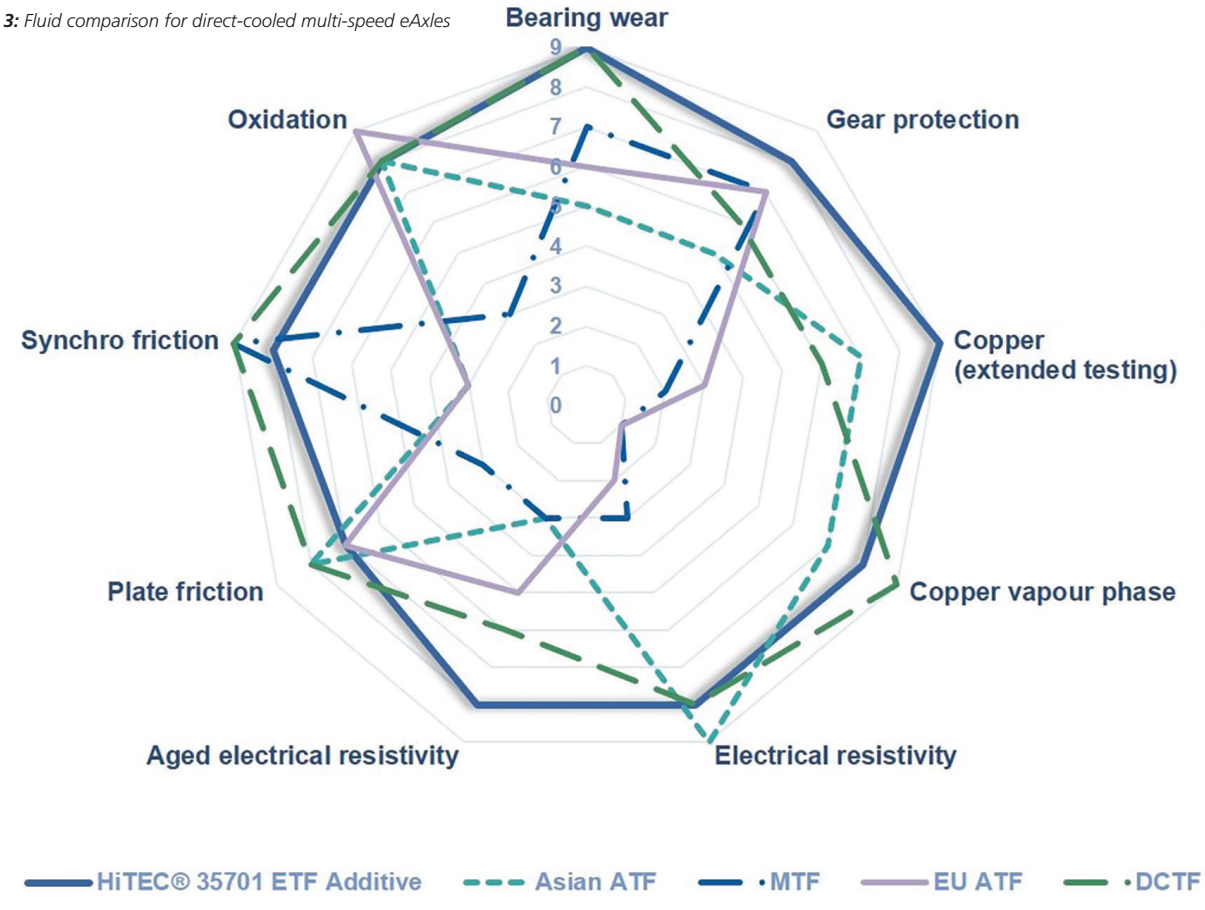
A bespoke eMotor test rig designed and built by Afton demonstrated that retaining excellent fluid performance over time does not have to come at the expense of material compatibility or electrical properties.

Equivalent in severity to two fluid lifetimes, the optimised test fluid delivered a 2-3% increase in eMotor peak torque efficiency.[5]

Commercial vehicles and electrification

For commercial vehicles (CVs) the future pattern of electrification is expected to be similar to that of passenger cars but with mass adoption lagging behind, as will fluid specifications. CV OEMs are currently setting their technology to meet the future challenge of step changes in EU emissions legislation being introduced in 2025 and 2030.

Figure 3: *Fluid comparison for direct-cooled multi-speed eAxles*



Factory fill lubricant choices are being made today for early fleets of electrified CVs, for which there will be many possible drivetrain configurations. Early OEM partnerships will enable the synergistic development of hardware and lubricants, helping to bring optimised solutions to market faster.

Fresh opportunities for coolants

Coolant solutions are at different stages of maturity. Direct cooling of eMotors and eAxles is already becoming commonplace, while direct cooling of EV batteries is still an emerging technology.

There is indication of potential for significant efficiency improvements from using immersion battery cooling. Modelling indicates that efficiency savings could boost battery life by an estimated 10% and support 20-25% faster charging. New formulations targeting this specialist area represent a further development opportunity.

eMobility going forwards

However vehicle electrification may progress, there are opportunities to drive lubricant growth and profitability through differentiated engine and transmission oils for hybrids and ETF for BEVs that offer long-lasting performance and protection.

The wider EV supply chain will also drive fluid market growth. Whether for the mining equipment that extracts minerals for battery production, the wind turbines that generate sustainable energy to recharge them, or the fast-charging infrastructure that keeps EVs on the road – lubricants are set to remain in demand as both enablers and performance enhancers.

References:

1 *ACEA - European Automobile Manufacturers Association (Q4 2020). New passenger car registrations by fuel type in the European Union.*

2 *Transport & Environment (2020). Mission (almost) accomplished.*

3 *Deloitte LLP (2020). Electric Vehicles: setting a course for 2030.*

4 *Ricardo (2020). BEV Technology Efficiency Estimates - for Afton Chemical.*

5 *Lehman, R., Petuchow, A., et al (2020), MDPI. Fluid Choice Based on Thermal Model and Performance Testing for Direct Cooled Electric Drive.*

LINKS
www.AftonChemical.com