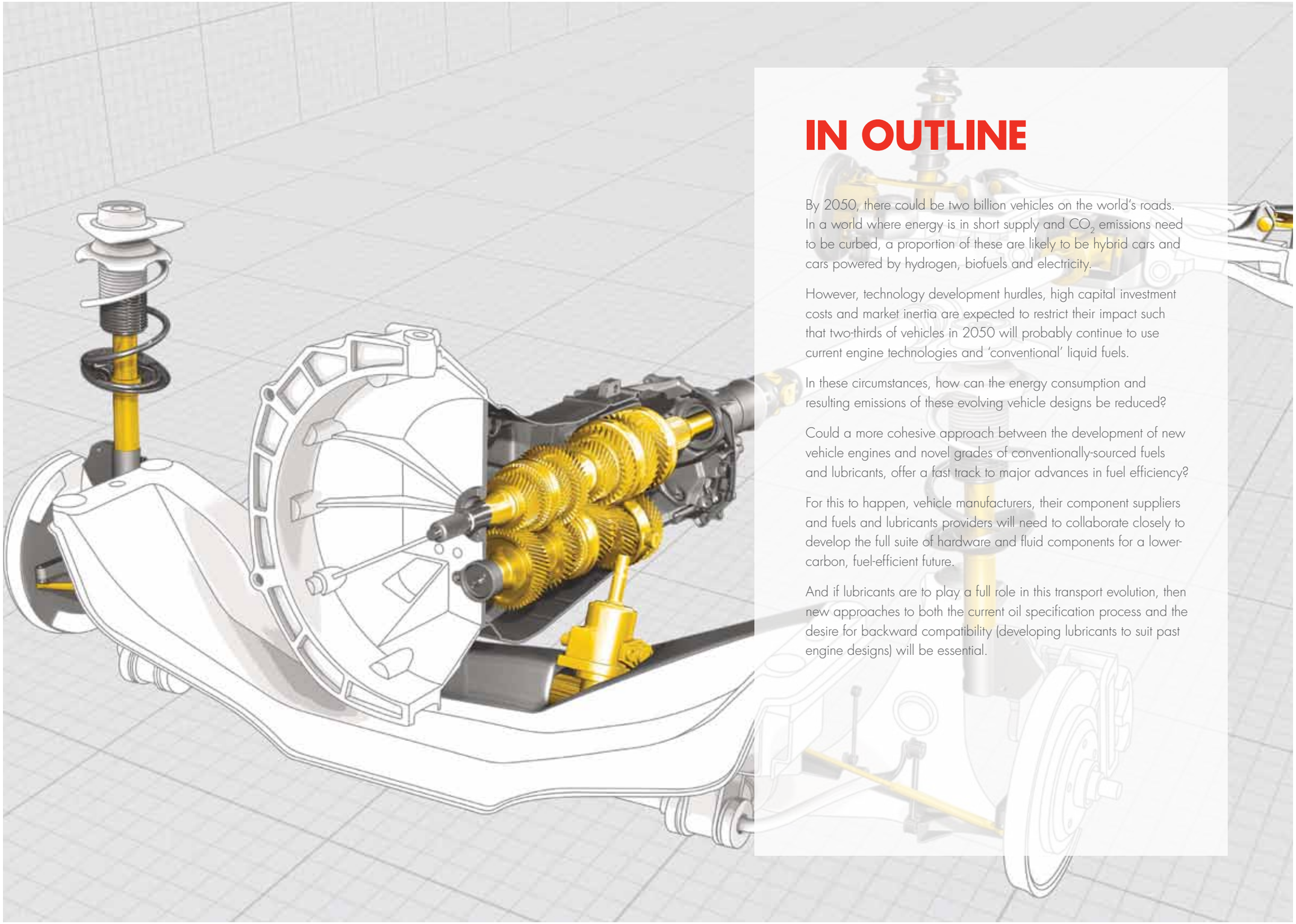
CARS, LUBRICANTS AND THE GLOBAL ENERGY CHALLENGE

Could a new approach to lubricants specifications and co-engineering help passenger cars use less energy? Shell Lubricants Technology Manager Robert Mainwaring explores the issues and options.

Shell Lubricants

DESIGNED TO MEET CHALLENGES



IN OUTLINE

By 2050, there could be two billion vehicles on the world's roads. In a world where energy is in short supply and CO_2 emissions need to be curbed, a proportion of these are likely to be hybrid cars and cars powered by hydrogen, biofuels and electricity.

However, technology development hurdles, high capital investment costs and market inertia are expected to restrict their impact such that two-thirds of vehicles in 2050 will probably continue to use current engine technologies and 'conventional' liquid fuels.

In these circumstances, how can the energy consumption and resulting emissions of these evolving vehicle designs be reduced?

Could a more cohesive approach between the development of new vehicle engines and novel grades of conventionally-sourced fuels and lubricants, offer a fast track to major advances in fuel efficiency?

For this to happen, vehicle manufacturers, their component suppliers and fuels and lubricants providers will need to collaborate closely to develop the full suite of hardware and fluid components for a lower-carbon, fuel-efficient future.

And if lubricants are to play a full role in this transport evolution, then new approaches to both the current oil specification process and the desire for backward compatibility (developing lubricants to suit past engine designs) will be essential.

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CAR DEVELOPMENT DRIVERS

Emissions legislation, fuel economy and performance

A body of new legislation led by the European Union will soon see car-makers facing financial penalties – per vehicle sold – if they fail to meet CO_2 emissions targets. In parallel, competition for energy is likely to push fuel prices higher, driving consumer demand for enhanced fuel economy: in other words, achieving more miles to the gallon.

In future, new types of vehicles such as hybrids and electric-powered vehicles are likely to secure increased market share. However, technology challenges and high capital investment costs, both in development and manufacturing, may also encourage carmakers to seek major advances in the fuel efficiency and emissions performance of 'conventional' vehicles.

Some of the ways they might do this include using lighter-weight parts and components, special surface coatings and new or upgraded power systems such as smaller, turbocharged engines.

LUBRICANTS

Key engine components

Lubricants also have their own contribution to make to fuel efficiency. They are in contact with, and critical to, the effective operation and longevity of almost all engine parts. Lubricant viscosity is linked to engine friction and lowering it is a reliable means of improving fuel economy, provided that the integrity of the engine's components is not compromised.

However, to realise the full potential of a lubricant to improve fuel economy and performance, a new approach to specifying oils and to tackling issues of backward compatibility will be necessary.

OIL SPECIFICATIONS AND BACKWARD COMPATIBILITY

Standards or Straightjackets?

Today, engine and transmission lubricants are formulated to meet industry-wide or Original Equipment Manufacturer (OEM) specifications. Industry specifications typically define base performance while OEM specifications address additional protection and performance required for branded hardware. As these specifications evolve they become more general to meet the needs of many additional and more challenging parameters. Inevitably, this limits lubricant formulation flexibility and imposes a straightjacket that potentially closes off some interesting opportunities to optimise performance.

An increased focus on reducing CO_2 emissions creates an incentive to break the specification mould and develop lubricants tailored to vehicles chasing strong fuel economy. For example, current specifications limit oil volatility and so preclude unusually low viscosity oils, which in all other respects are acceptable. Should these specifications include seal compatibility tests, which are widely viewed as outmoded, yet place a ceiling on the amount of dispersant an oil can contain? Recasting the specification mould would reduce the level of compromise.

Creative approaches

Until engine lubricants become 'fill-for-life' components, they need to be replaced at regular intervals. However, there is no guarantee that the refill lubricant will be the one defined by the OEM when the vehicle was new. The 'special' lubricant may not be readily available. A modern engine may be filled with an historic lubricant, which does not enable optimum efficiency, provide such good protection or allow trouble-free operation of the exhaust after-treatment system. An older engine may be filled – mistakenly or not – with an unsuitable 'special' lubricant. With these risks in mind, the safe option may be for a range of lubricants that are broadly interchangeable and backwardly compatible.

But could this tendency towards 'backward compatibility' – the safe option and a compromise – be hindering more creative approaches and the development of more innovative lubricants solutions? For example, should an engine's oil filler be designed so that oil can only be added through a special container equipped with a matching nozzle or an electronic interlock? By doing this, we could be certain that the engine would only be topped up with the most appropriate lubricant. What else could we be missing?

PUSHING INNOVATION TO NEW LEVELS

Lubricants innovation spans a wide range of possibilities and opportunities. At the lowest level it may include the replacement of an existing formulation component by an equally effective, but less costly, alternative.

At an intermediate level, it might allow the development of a new diesel engine oil formulation which meets new chemical limits on sulphated ash, phosphorus and sulphur (low SAPS oils).

At a more extreme level, lubricants innovation could include systems which allow fluid viscosities to remain constant across the entire operating envelope. Or fluids which are capable of both lubricating the engine and cooling high energy density battery systems without risk of electrical breakdown. Or even fluids with distinctive chemical – or odour-based tracers to help avoid fraud. There are a wide range of options which would be most readily explored through strong partnerships between the OEM and lubricant developer.

"LUBRICANTS INNOVATION SPANS A WIDE RANGE OF POSSIBILITIES AND OPPORTUNITIES."

"GMD RECENTLY DEVELOPED A RADICAL LIGHTWEIGHT CITY CAR TO HELP MEET THE FUEL EFFICIENCY CHALLENGE."

PARTNERSHIPS

For progress in fuel economy and performance

Our experience shows that the stronger the relationship between the OEM and the lubricant supplier, the better the results.

- At a basic partnership level, an OEM may choose a lubricant from an oil company's current product range as the best match for the target engine.
- At another level, the oil company may develop a bespoke lubricant for the OEM against a fixed hardware design but perhaps with some influence over the detail of the oil specification.
- At the highest level, what we call 'co-engineering', the OEM and oil company enjoy a sustained and very close technical relationship throughout the development lifetime of the engine and the lubricant. Both are developed in parallel, with each party committed to the oil/engine combination that provides class-leading performance in terms of economy and durability.

The timescales and personnel commitment increase from level to level, but so does the benefit.

One example of successful collaboration is the work Shell has carried out with Gordon Murray Design (GMD). GMD recently developed a radical lightweight city car to help meet the fuel efficiency challenge. The vehicle is powered by a small, 660cc, low-friction engine. Working closely with GMD, Shell developed a concept lubricant outside current industry oil specifications. The resulting 0W-10 lubricant enabled fuel savings of 6.5% to be achieved (compared to a conventional 10W-30 oil widely used in European markets) on an urban cycle designed to mimic city driving.

Although in the concept stage, this represents a major advancement in lubricants technology and the lessons learned will be fed into future Shell product development.

OPENING A NEW CHAPTER

In tough economic times it is easy to be distracted by immediate tasks and to be disheartened by the scale of the challenge that we are faced with. In the case of vehicle fuel economy and CO_2 emissions reduction, the challenge is both significant and long term.

We have opened a new chapter in the vehicle emissions story and it is not clear how that story will unfold. However, technology, innovation, partnership and persistence will all yield huge benefits.

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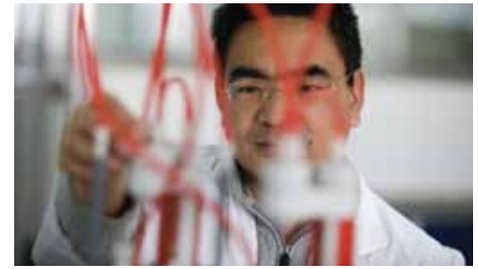

Robert Mainwaring is Shell Lubricants Technology Manager – Industry Liaison and OEMs. Bob joined Shell in 1988 after gaining experience in the nuclear and engine industries. From first taking responsibility for lubricants specification and research testing within the engine laboratory at Shell's Thornton research centre, his career has spanned running lubricant performance mechanisms projects to industry liaison management for crankcase lubricants and other products. A mechanical engineering graduate of Loughborough University, Bob is also a member of the Institute of Mechanical Engineers.

Shell is the number one global lubricants supplier for the fourth consecutive year (source: Kline & Company). This has been achieved by placing innovation, the application of our products and technology partnerships at the heart of everything we do. It enables us to develop world-class technology that helps our customers to lower operating costs, improve productivity and ultimately increase their profits. For more information about Shell Lubricants, visit www.shell.com/lubricants