EXTRA MILE

Ask any fleet engineer where the opportunities are to improve fuel economy and they'll reel off a list that probably won't include the fuel itself. But they might well be missing a basic trick, warns Ian Norwell, from Hamburg

Squeezing the last kilometre out of every litre of diesel has become so complicated that it's almost akin to playing three dimensional snooker. Apart from correct maintenance, axle and wheel alignment, tyre pressures, appropriate lubes, a trained and intuitive driver, and the ruthless mining of telematics data, where else can fleet managers turn?

Well, according to Emma Wyatt, a fuel scientist at Shell's retail and automotive fuels technology group in Hamburg, Germany, there are secrets locked up in the fuel itself: the diesel. Wyatt is team leader for the Shell FuelSave Diesel development programme and she says diesel remains widely misunderstood.

You only need to dredge your 'O' level physics memory to recall the fractionating column that splits crude oil into its useful constituents, with LPG (liquefied petroleum gas) and petrol spilling over at the top, and bitumen and heavy lubricants seeping out at the bottom. Diesel lies about halfway up this hierarchy, but its molecular complexity puts petrol in the shade. Taking us deeper down the metaphorical well, Wyatt says: "Under a gas chromatograph, there are about 300 or so hydrocarbons present in petrol. By comparison, diesel has about 10,000."

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The average chemical formula for common diesel fuel is $C_{12}H_{23}$, but the key word here is 'average'. The latitude of the exact composition ranges from approximately $C_{10}H_{20}$, to $C_{15}H_{28}$. So, unlike most compounds that link elements in fixed proportions, there's some considerable elasticity here. These variations are the result of the original source of the crude oil itself, which varies considerably across the globe's oilfields, and it can also be significantly influenced by the refining process.

The point being made is that not all diesel fuel is the same. There are, of course, parameters of compliance that legislation dictates, and the OEMs are also very closely consulted on new developments. But the 'wiggle room' remains. The picture becomes even foggier when the vast range of potential additives are thrown into the melting pot. Indeed, it is with a mix of these additives that Shell claims its advantage, with Shell FuelSave Diesel.

Seasoning the fuel

Wyatt says that Shell's FuelSave diesel will give a fuel consumption saving of 3% over the life of a vehicle. It's a precisely couched definition, because taking any slice in a truck drivetrain's life will provide different figures. The basis of her claim is that the formulation of FuelSave Diesel is aimed squarely at maintaining excellent engine performance over the unit's entire working life.

So Shell is not claiming that two new trucks, one fuelled with its diesel and the second with another brand, would show this 3% variation. What the global oil giant is saying is that its product will ensure that injectors – the essential heart of an oil-based motor – remain working at peak efficiency at all times. That matters now more than ever.

The massively increased injection pressures at Euro 6 (2,500bar or above) have made cleanliness of the injectors even more critical. So, if a fuel can prevent unwanted deposits that might otherwise compromise the efficiency of nozzle spray formation, we have to assume it's a benefit.

Additives are at the centre of innovations here in Hamburg, with detergents designed to prevent the build-up of injector deposits being among key active ingredients. With other additives to prevent waxing at low temperatures and yet more to minimise foaming on fast-fill diesel pumps, I ask Wyatt just how much diesel there is in a litre at the pumps? "Don't worry, you're still getting a litre for your money," she says. "Additives are measured in ppm [parts per million]."

At Shell's technology centre, Rüdiger Heine takes me on a tour of the laboratories where fuels are assessed. A Mercedes-Benz Actros 1844 tractor unit, equipped with two separate fuel

tanks and fuelling systems, dutifully sits on a dynamometer. "This is where we evaluate the performance of different fuels by switching between tanks on programmed routes," he explains. There is also a Euro 5 DAF enslaved in a similar way, and although the Actros is a Euro 3 specimen, I am assured that the goal of direct comparability is achieved.

Alternative fuels

Jörg Spanke is Shell's technology manager for new commercial fuels and he's on the hunt for a diesel replacement. "Energy demand is predicted to double by 2050, and we would be negligent if we were not exploring a wide range of alternatives to diesel," he says. "The peak of oil production is currently expected to be with us between 2030 and 2040, but the forecasts for natural gas [methane] availability are a lot better."

With the three prime drivers of development being energy security, emissions and costs, Spanke predicts that the evolution of alternative fuels used in road transport will move towards a far greater variety by mid-century. "We are working with a simple fuel mosaic at the moment, relying on diesel for the vast majority of freight transport, with some biofuels and natural gas included. This must change," he insists.

He describes a "full mosaic" of fuel usage that will be in use by 2050, which draws in hydrogen, electricity, biofuels and natural gas in a much more balanced mix. Bringing the average haulier down off the dizzy high they've experienced from diesel (it is so flexible) will not be an easy process, however, and there will be some stick as well as carrot, he concedes. The secret will be in applying the use of specific fuel technology in the freight environment where it can be most effective.

Spanke agrees that today's alternative fuels suffer from issues such as storage, handling and infrastructure – that need to be overcome. If they didn't, you could simply delete the word 'alternative'. Legislation, primarily around exhaust and noise emissions, looks set to move in only one direction, though, and that will favour methane – one of Shell's primary areas of research. So why methane? "It's the first important step towards the de-carbonisation of road fuel," explains Spanke. And the second reason: its rapidly improving availability landscape.

The IEA (International Energy Agency) predicts plentiful availability of natural gas worldwide, which will not only calm energy security worries by redressing the imbalance of power created by the locations of today's oil reserves, but also promise a better longevity of supply. Shell's two favoured fuels to add to its future mosaic are GTL (gas to liquid) and LNG (liquefied natural gas). Shell believes that, compared to standard diesel, GTL-derived fuel cuts particulates by up to 33%, NOx by up to 37%, HC by 23% and CO by a maximum of 22%. No figures for CO_2 there, but impressive nonetheless.

It's apparent that the writing is on the wall for diesel, but it may not yet be in a language we can, or want to, understand. If Shell's men and women in white coats are right, $C_{12}H_{23}$ may still have a seat on the bus as this century passes its mid-point, but it won't be behind the wheel any more. TE