Who can't see the wood for the trees in the biofuels debate?

There is growing unease about the true impact on the environment of replacing fossil fuels with biofuels. So much so that the British government and European Commission appear to be having second thoughts. Fleet engineers meanwhile are preoccupied with practical problems cropping up as diesel gradually gives way to biodiesel. David Wilcox reports.

The British government's approach to the subject of biofuels is beginning to read like the script of a Brian Rix farce. Last month marked the start of a 12-month period in which suppliers are required to ensure that no less than 2.5 per cent of the road transport fuel they supply is "renewable", (in essence, biodiesel or ethanol). The requirement is spelled out in the Renewable Transport Fuel Obligations Order 2007 (RTFO Order), imposing an "obligation" on fuel suppliers to ensure that by 2010 renewable fuels make up five per cent of their UK road fuel sales. This is being achieved by incorporating modest amounts of biofuels in normal (sulphur-free) fuel (*Transport Engineer* October 2007). Suppliers are now required to report road fuel sales volumes to the newly-established Renewable Fuels Agency, set up under the RTFO Order, which is issuing "tradeable certificates" in return for the supply of renewable road fuel. The certificates can be used as evidence of having met the obligation, and suppliers without enough certificates at the end of the 12 months may fulfil their obligation by paying an amount specified in the Order, 15p per litre at present. Extraordinarily bureaucratic though all this may seem, it is not the farcical bit. That comes courtesy of one Professor Robert Watson who, only weeks before the RTFO Order kicked in last month, called for the entire scheme to be halted pending a thorough Department for Transport review of the pros and cons of biofuels. Who is Professor Watson? None other than chief scientific adviser at another government department, the Department of the Environment, Food and Rural Affairs (Defra).

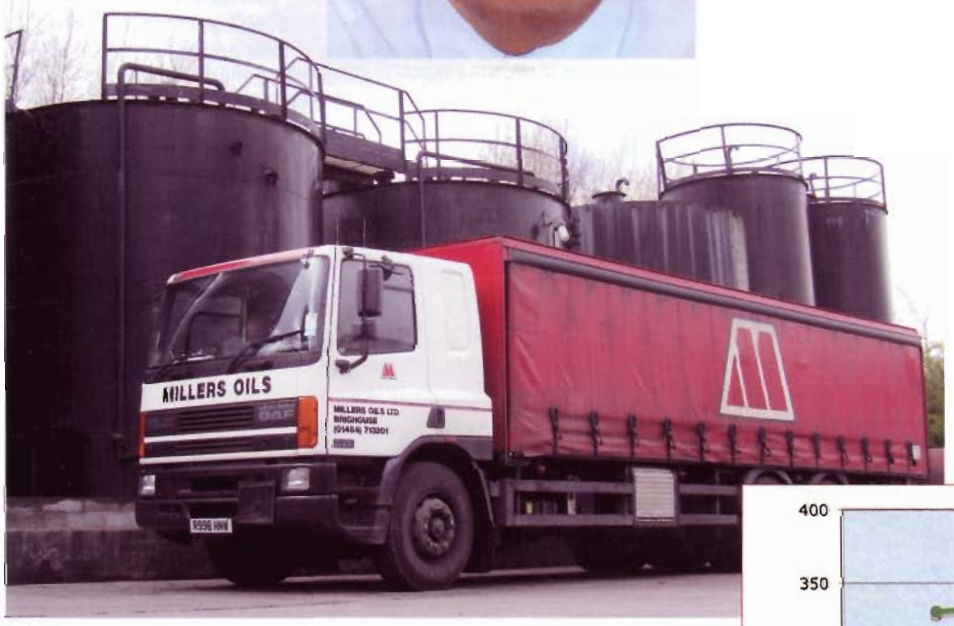
Biological warfare: this bacterial growth comes from a fuel filter, the result of biodiesel's hygroscopic inclinations.

And as if one government department seeking to kill off a scheme run by another is not daft enough, there is similar confusion over biofuels among the great and good of the European Union. The European Commission, which set the targets at which the DfT's RTFO Order is aimed, wants at least 10 per cent of road transport energy to come from biofuels in every European Union country by 2020. Yet only four months ago European transport commissioner Stavros Dimas accepted that this may be a mistake, admitting that the EU had moved too fast to embrace biofuels before all the science was fully proven. Environmental pressure groups such as Greenpeace and Friends of the Earth are also calling for the RTFO to be put on hold. The green credentials of biofuels have been called into question yet again by several recent reports. One study by a highly-regarded international team of scientists concluded that biodiesel

made from rapeseed oil generates substantially *more* greenhouse gases than conventional diesel, because it releases twice as much nitrous oxide (derived from nitrogen-rich fertilisers) than previously thought. Nitrous oxide (better known as laughing gas but no joke for the environment) is 300 times more powerful than CO_2 in terms of global-warming potential. Meanwhile other sources of biofuels, including biomass (using more of each plant to improve yield per acre) and even algae grown on ponds, are being explored. And with the price of wheat and rice spiralling as more and more land is given over to biofuel crops, Mr Dimas could hardly be accused of exaggeration when he says: "The social problems are bigger than we thought."

But none of this uncertainty is stopping a growing number of truck and bus operators from turning to biodiesel as they seek to do what they can to minimise the environmental impact of their operations. This has not gone unnoticed in Brighouse, West Yorkshire, home of Millers Oils, a family-owned lubricants company. "In the last quarter we have seen a definite increase in the number of biodiesel-related issues," reports Millers' sales and marketing director Steve Woollven. It is showing up in oil analysis samples, where there is more and more evidence of fuel dilution caused by blends of biodiesel well above the five per cent maximum (B5) allowed under the current European specification for mineral diesel , EN 590.

Millers Oils technical director Martyn Mann: advocating oil analysis to determine the extent of fuel dilution.

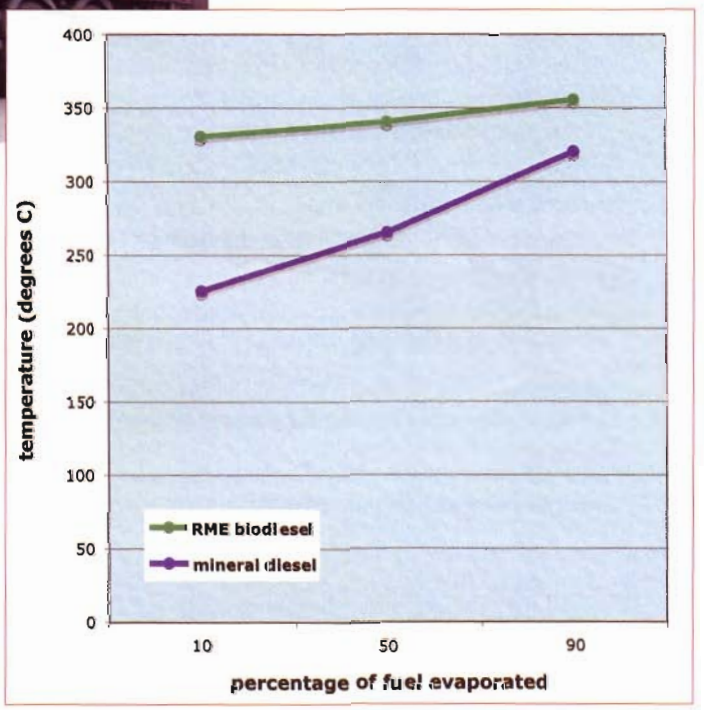


Millers technical director Martyn Mann explains why engines are more likely to suffer from fuel dilution when running on biodiesel. "Firstly, it's to do with droplet size," he says. "Biodiesel droplets are larger than those of normal diesel. This is not so good when it comes to atomising fuel spray at the injectors." More ends up running down the cylinder walls. The problem is compounded by biodiesel's lower volatility, making unburnt droplets less likely to evaporate than those of mineral diesel. Mineral diesel starts to boil off at around 225 degrees Celsius, and by 265 degrees about 50 per cent would have evaporated, points out Mr Mann. But typical rapeseed methyl-ester (RME) biodiesel has a boiling point around 350 degrees Celsius, so there is more likelihood of unburnt droplets getting past piston rings and entering the engine oil. A chemical reaction between the sump-oil and unsaturated fatty acids in the biodiesel causes the oil to thicken. The thicker the oil the more slowly it circulates, so the implications for engine wear are plain. Unchecked oil-thickening caused by biodiesel creates gelatinous lumps that can block filters and oil passageways. This explains why many engine and vehicle manufacturers demand that oil-drain intervals are halved on engines running on biodiesel blends above B5. This may be overkill, according to Millers' Martyn Mann who reckons that fuel dilution is unlikely to be a real-world problem with biodiesel blends of B20 or less, unless an engine suffers from high oil consumption anyway, "The sensible approach is to use oil sampling and analysis to refine the drain interval for each individual engine," says Mr Mann. Millers has its own analysis laboratory, charging £12 to £15 per analysis.

European Union transport commissioner Stavros Dimas: "The social problems (of biofuel) are bigger than we thought."

Dispensing sound advice: suppliers of bulk fuel tanks are seeking ways of keeping moisture out of biodiesel installations.

Hot topic: biodiesel evaporates at a higher temperature than mineral diesel, increasing the risk of unburnt fuel ending up in the sump oil.



Cliff Lea, product manager at Fuchs Lubricants UK, is another enthusiastic advocate of oil analysis for any fleet engineer concerned about fuel dilution. Engine-oil gelling is temperature-dependent, he emphasises. "The chemical reaction between the fuel and the oil thrives on heat," explains Mr Lea. "For every extra 10 degrees of sump temperature you get roughly double the chemical reaction. So, for a given level of biodiesel fuel dilution, gelling may not be a problem in an unstressed engine like an agricultural tractor's where sump oil temperature may be only 70 or 80 degrees C. But the same dilution in a hard-working heavy-truck engine with a sump temperature of around 110 degrees will lead to far more gelling." Fuchs is running field trials of an engine-oil with base oil and additive chemistry designed to break down and disperse the gel. "But it's early days yet and we are still at the information-gathering stage," says Mr Lea.

> ***"Biodiesel is hygroscopic, absorbing water from condensation and moisture in the air, and this is turning out to be more serious than first thought.***

The EN 14214 standard for B100 fatty acid methyl ester (FAME) biodiesel limits water content at the production stage but obviously can have no influence over the amount of water getting in when fuel is stored in bulk tanks or on vehicles, points out Messrs Mann and Woollven of Millers Oils. Biodiesel is hygroscopic, absorbing water from condensation and moisture in the air, and this is turning out to be more serious than they first thought. Water gathers at the bottom of a storage tank and becomes a breeding ground for bacteria. Large, fungus-like structures can develop between the water and fuel. In a vehicle's fuel system this material can block fuel filters and even pipes linking tanks.

Ledbury Welding & Engineering of Ledbury, Herefordshire and JA Envirotanks of Birmingham are two of the UK's biggest suppliers of bulk diesel storage tank suppliers. Accumulation of water in biodiesel blends is a hot topic for both firms at present, and both are looking into adding filters with desiccant such as silica to tank vent pipes. Establishing filter life and finding a safe way of changing filters on a tank vent likely to be several metres off the ground are two unresolved problems at present.

Millers meanwhile is adding an anti-bacterial biocide to its latest fuel additive. Seasoned fleet engineers tend to be sceptical about any fuel additives but Millers points them to the positive results achieved in tests at Millbrook Proving Ground in Bedfordshire. Millers' Diesel Power Sport 4 additive for cars contains a cetane improver, lubricity additive and detergents to keep pistons and injectors clean. Now an additive for heavy-duty diesel engines is being introduced. It is called Eclipse. Millbrook tests of a Daf with a Euro-4 12.9-litre MX engine are said to have shown a 16 per cent cut in particulates emissions after 350 miles of running with Eclipse. Mr Mann reckons this particulates cut points to more efficient combustion, so he is expecting improved fuel economy to be reported by the 30 operators currently trying Eclipse. A recommended fuel treatment rate of 1:1,000 means Eclipse will add just under one per cent to fuel bills, so only modest economy gains are needed to make it sound business sense as well as environmentally worthy, argues Mr Woollven.

Eclipse Powercide Plus, incorporating biocide, costs about 20 per cent more but its anti-bacterial properties should be of interest to biodiesel users. "Once there is bacteria in the system it is difficult to remove," warns Mr Woollven, explaining that Millers is introducing a highly concentrated biocide called Eclipse Shock Dose to tackle established bacteria. "Whereas the Eclipse Powercide Plus is an on-going additive to improve fuel quality and prevent bacteria, Shock Dose is a one-off treatment to blitz a system bunged-up with bacterial growth," he explains. "It's a more expensive animal but it will get the vehicle moving again."

As for the bigger picture and future British government policy on biofuels, much would seem to depend on the content of that DfT review due to land on the desks of transport secretary Ruth Kelly and environment secretary Hilary Benn at the end of next month. This is expected to shape UK negotiations with Brussels about EU biofuels ambitions and will be instrumental in determining whether or not the Renewable Transport Fuels Obligation Order gets quietly forgotten.

Remember how the government once was terribly enthusiastic about liquefied petroleum gas (LPG), only to wind-back an LPG fuel-duty concession after reaching the conclusion that the fuel's environmental benefits were no great shakes after all? Perhaps we are about to see a *volte-face* on an even grander scale over biodiesel. ❑