COLIN MATTHEWS, HEAD OF TRANSPORT PROGRAMMES AT THE ENERGY SAVING TRUST, EXAMINES THE ALTERNATIVE FUELS THAT COULD POWER THE SUSTAINABLE FLEETS OF TOMORROW.

SUSTAINABLE COMBUSTION

THE ALTERNATIVE FUEL MARKET IS BOTH DYNAMIC AND INNOVATIVE WITH NEW APPROACHES AND TECHNOLOGIES COMING ON TO THE MARKET AS CONSUMERS' APPETITE FOR GREEN SOLUTIONS GROWS.

Alternative fuels come in many forms, from traditional fuel-based biodiesel, to fuels that aim to revolutionise the vehicles we drive today. They all help to reduce the world's dependency on oil as reserves begin to dwindle and cut carbon dioxide (CO_2) emissions from road transport, currently responsible for over a quarter of the total UK CO_2 emissions.

The Secretary of State for Transport, Alistair Darling, has recently announced new measures to make transport fuels greener under a Renewable Transport Fuels Obligation, thus making alternative fuels for use in public sector fleets a more viable proposition.

PLANT POWER

Biodiesel, as its name suggests, is a blend of diesel with a biological source, often derived from oil-based crops such as rapeseed, palm or nuts. It can also be produced from waste vegetable oil, used to fry food. However, they all require a 'transesterification' process to bring its specification closer to that of crude oil-based diesel.

There are tight specification guidelines for biodiesel blends to ensure the quality and percentage of the biological matter being used. European specification EN14214 relates to transesterified biodiesel. It can be blended at up to 5% by volume into existing diesel forecourt specification fuel (EN590). All motor manufacturers warrant their vehicles to run on EN590 but will not go above this 5% blend. Others will warrant between 10% and 30% (check with the manufacturer before using) provided the fuel is from a reputable supplier. One such example is Southwark Council which currently runs 70 vehicles on an 80/20% blend, and also successfully trialled a 70/30% blend for six months.

Matthew Trott, Transport Manager for Southwark Council said: *"Our decision to trial and later successfully run a number of our vehicles on a higher percentage blend of biodiesel demonstrates our commitment to delivering a cleaner and greener borough and a more sustainable future for all."*

Despite its name and reliance on traditional diesel, biodiesel boasts a 60% reduction in carbon dioxide emissions depending on the production method and source, which means a 3% CO_2 saving from a 5% blend.

Biodiesel is also becoming increasingly available on forecourts at the 5% blend, although it may not necessarily be labelled, given that it can be delivered through existing pumps. The biodiesel component currently receives a 20p/ltr reduction in duty on the rate of 47.2p/ltr (Oct 2005) and is generally priced at parity to traditional diesel or at 1p/ltr higher. Higher blends (or neat) can be obtained from processors and manufacturers such as Rix, Broadland fuels, Petroplus and Global commodities. Older vehicles (out of warranty) can be modified at minimal cost to run on these higher blends.

Pure Plant Oils (PPO) has a similar premise to biodiesel but with greater CO_2 savings, depending on production method and source and is again made from oil-based crops. Currently PPO is only readily available in Germany, however, as the UK market will not warrant vehicles to take the fuel.

Bioethanol is also made from crops, this time sugar beet, wheat and wood (cellulosics). It requires a chemical plant to convert it to alcohol (ethanol) in the same way as drinking alcohol is made.

Bioethanol is generally available on forecourts at a 5% blend in traditional petrol but is unknown to consumers. A higher 15% blend (E85) is being developed and car manufacturers are producing vehicles that can easily run on petrol, E85 or any blend in between. These vehicles cost very little extra to buy and the development of infrastructure for bioethanol has already begun in the UK.

Depending on the production method and source it is generally accepted that bioethanol gives a 70% CO_2 reduction which means 3.5% in a 5% blend or 50% in an E85 blend. Other emissions are lower than their petrol equivalents.

CAN THE FUTURE BE GAS?

Liquid Petroleum Gas (LPG) is produced from 'wet' natural gas fields or by oil refining and is made up of a mixture of propane and butane.

In road fuel LPG can be anything from 100% propane to 100% butane but is generally a mix of both to help with ignition and is held under light pressure to make it a liquid.

LPG is taxed at 9p/kg (effectively 6p/l on a diesel litre equivalency basis) for use as a transport fuel and is available at over 1200 refuelling points of which nearly 1000 are traditional forecourts. Traditional petrol engines will need a conversion in order to run on LPG.

It is generally accepted that LPG gives a 10-15% reduction in carbon dioxide (well to wheel) in comparison to petrol and is at parity with diesel whilst also delivering 80 per cent lower NOx emissions and zero particulate emissions.

Natural gas is mainly methane stored under pressure or as a liquid, hence the terms compressed natural gas (CNG) and liquefied natural gas (LNG). Natural gas

HM Revenue and Customs boasts the largest fleet of Toyota's hybrid – the 'Prius' – in the UK

vehicles either have a dedicated gas engine or they are dual-fuel, which means they can burn both diesel and natural gas simultaneously in the engine. This flexibility makes natural gas a strong contender for both van and heavy goods fleets, especially as the issues of air quality and carbon dioxide emissions are rapidly growing in importance for freight and commercial vehicles.

Natural gas tends to be available from refuelling stations linked to the HGV industry. Networks currently exist for both CNG and LNG throughout the UK but in limited numbers (please visit **www.est.org.uk/refuelling** for more information). Refuelling is as quick as with traditional fuels but a specially converted engine is required to run the fuel.

ALTERNATIVE FUELS COME IN MANY FORMS, FROM TRADITIONAL FUEL-BASED BIODIESEL, TO FUELS THAT AIM TO REVOLUTIONISE THE VEHICLES WE DRIVE TODAY

There is currently a three-year freeze on the duty for natural gas at only 9p/kg (4.5p/l diesel litre equivalent). Vehicles over 3.5 tonnes qualify for a Reduced Pollution Certificate and a subsequent reduction of up to £500 in annual road tax. This makes a strong financial case for switching to natural gas.

There is also a strong environmental case for natural gas. Compared to diesel a typical natural gas engine delivers a 95% reduction in particulates, 10-15% less CO_2 (in well to wheels analysis) and between 75% and 85% less NOx. Additionally, natural gas engines are far quieter than diesel engines, making these vehicles suitable for overnight deliveries in noise-sensitive locations.

Biogas is made from either rotting municipal waste, food waste or from sewage (animal or human). A digester controls the anaerobic conversion, it is then dried and adjusted for calorific value before being introduced into the natural gas pipelines (mains gas) that run throughout most of the mainland of Great Britain (along with natural gas).

Biogas is taxed at 9p/kg (effectively 4.5p/ltr on a diesel litre equivalency basis) for use as a transport fuel and will become increasingly available over the next five years, again predominantly at refuelling stations linked to the HGV industry.

It is generally accepted that biogas gives a 95-100% CO_2 reduction (well to wheel) in comparison to diesel whilst also delivering NOx emissions and particulate emissions as per natural gas.

It can be argued that biogas has greater than 100% carbon reduction as its source material would otherwise put methane, which is 21 times more damaging to the environment than CO_2, into the atmosphere. Investing in the development of this fuel would also reduce the need for landfill and reduce gas release at sewage works. ▶

In Summary...

- The Secretary of State for Transport, Alistair Darling, has recently announced new measures to make transport fuels greener under a Renewable Transport Fuels Obligation, making alternative fuels for use in public sector fleets a more viable proposition
- Current alternative fuels range from biodiesels and natural gas to electricity and hydrogen
- The Energy Saving Trust is to launch an Infrastructure Programme to increase the infrastructure of alternative refuelling stations for road vehicles

Further Information...

For more information please visit:

W: www.est.org.uk/fleet

▸ We've got the power

Electricity is probably the most accessible of all alternative fuels given that it has been used in the home as a source of light and heat since the 19th century. However, as a fuel for transport is has had a rough ride – in the past electric vehicles have tended to be slow, have a limited range and be considered bulky and ugly in design.

Electricity has zero carbon dioxide emissions at the 'tailpipe' but 'well to wheel' emissions levels depend on the source of electricity production (renewable or not).

There has recently been a surge in popularity for petrol or diesel electric hybrid vehicles such as the Toyota Prius which are part electric and part petrol or diesel powered. Although they currently rely upon petroleum-based fuel, hybrids can also be made to run on LPG or biodiesel.

Finally, there is hydrogen, the fuel hailed as the future for sustainable transport and transport infrastructure. But how realistic is it as a fuel and, importantly, how clean?

Hydrogen was first used as a transport fuel back in the early 20th century by German engineer Rudolf Erren, who converted the internal combustion engines of trucks and other vehicles to use hydrogen or hydrogen mixtures. Hydrogen is an energy carrier (like electricity) rather than a fuel.

Currently hydrogen use as a transport fuel is very limited and restricted to demonstration projects such as the fuel cell buses currently being trialled in London. This is because it not only requires specialist filling equipment but vehicles with hydrogen fuel cells are some 10-20 times more expensive than their petrol or diesel equivalents.

There are also problems in terms of hydrogen's green credentials. Like electricity, hydrogen produces zero carbon dioxide emissions at the tailpipe. However, unless it is made from renewable energy sources such as crops, solar cells, or wind power, then the overall well to wheel carbon dioxide emissions are likely to be worse than traditional petrol or diesel.

While there are some clear environmental incentives to using these fuels, there are also financial implications for anyone looking to make the switch

Supporting alternative infrastructure

In July 2005 the Department for Transport (DfT) received confirmation from the European Commission that the Energy Saving Trust's Infrastructure Programme is to have State Aid approval.

The aim of the programme is to increase the infrastructure of alternative refuelling stations for road vehicles. The provision of improved infrastructure for cleaner, alternatively fuelled vehicles is intended to encourage the uptake of clean, lower carbon road transport vehicles in the context of the UK Climate Change Programme and of the UK Air Quality Strategy.

The Infrastructure programme will offer grants of between 30% and 50% of eligible costs for the installation of an alternative fuel refuelling point within the UK.

It is expected that these alternative fuels will include natural gas, biogas, bioethanol, hydrogen and electric recharging points. Other non-traditional fuels, for which limited refuelling networks exist, will also be considered if a case can be made for them. A requirement of the programme will be that vehicles should be available which run on the fuel intended and that these vehicles have demonstrated emissions savings over equivalent petrol and/or diesel fuelled vehicles. Additionally, the fuel should be available for third party use in order to maximise the reach of each refuelling station.

The multitude of alternatives listed here are available for anyone looking to move away from the more traditional fuels. While there are some clear environmental incentives to using these fuels, there are also financial implications for anyone looking to make the switch. It is therefore vital that the market for alternative fuels is supported in terms of fiscal incentives from government, by the buying power of purchasers and by manufacturers producing more vehicles to actually run on them.

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