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Biofuels in the UK

- **Biofuels can play a part in reducing CO_2 emissions from road transport**
- **The oil industry is adding biofuels to road fuels under the Renewable Transport Fuel Obligation (RTFO) of 3.5% in 2010/11, 4% in 2011/12, 4.5% in 2012/13 and 5% in 2013/14**
- **The RTFO was amended in December 2011 to reflect the requirements of the Renewable Energy Directive (RED, 2009/28/EC). The RED came into force and requires that all biofuels crossing the duty point should meet the carbon and sustainability criteria as defined in the Directive.**
- **The main biofuels available in the UK are bioethanol and FAME (biodiesel); road fuel quality standards currently permit ethanol to be blended up to 5% by volume with petrol (E5) and biodiesel up to 7% by volume with diesel (B7). A European standard for E10 is currently under development.**

Background

Biomass can reduce UK emissions of carbon dioxide either by generating heat/power or by conversion into road fuels. Biofuels can be produced from a variety of sources in different countries.

Potential UK grown energy crops include

- rape seed which can be converted into bio-diesel
- wheat and sugar beet which can be used to produce ethanol by fermentation
- miscanthus and wood from short rotation coppicing, which can be burned to produce heat and power, or in the longer term converted to produce biodiesel.

These can be supplemented by bioethanol and biodiesel made from crops grown overseas, e.g. sugar cane, maize, palm oil and soy.

A number of waste products can also be converted into energy or fuels, e.g. used vegetable oil/tallow into bio-diesel, straw and forestry waste converted into heat and power, or in the future biofuels.

However, for UK production, the area of land available is a determining factor, with indications that about 1-2 million hectares could be given over to energy crops without affecting food production. In addition wheat, currently exported, and waste products, could supplement production.

Beyond this level, major change in land use would be required – for example permanent grassland or woodland cultivated for energy crops – which would adversely change the CO_2 balance.

UK Introduction of biofuels & RTFO

In October 2007, Parliament approved the Renewable Transport Fuel Obligation (RTFO), requiring suppliers of road fuels to incorporate a proportion of biofuel in petrol or diesel, or pay a penalty.

The Renewable Fuels Agency (RFA), established on 26th October 2007, had been responsible for monitoring the implementation of the RTFO by obligated companies until 1st April 2011, when the Department of Transport took over responsibility for the governance of the RTFO. Each year guidance notes are issued on how to report carbon saved and sustainability of biofuels.

The RTFO commenced on 15th April 2008 with a target of 2.5% biofuel content in road fuels in 2008/9. On 28th January 2009, the Renewable Transport Fuel Obligation was revised and new limits were announced. The yearly obligation level for fuel suppliers under the RTFO became: 3.25% for 15th April 2009/ 14th April 2010; 3.5% for 2010/11; 4% for 2011/12; 4.5% for 2012/13; 5% for 2013/14. The new levels are in line with the recommendations in the Gallagher Review of Biofuels in 2008, advising a slowing down in the rate of increase of biofuel content in road fuels to reach 5% in 2013/14. The original RTFO targets envisaged a biofuel content of 3.75% in 2009/10 rising to 5% in 2010/11.

At the 5% level, the Government estimates that around 1 million tonnes of carbon emissions per year would be avoided.

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On 1st April 2010, following the ending of the duty differential for biofuels for road use, the duty rates for biodiesel and bioethanol have been increased to the same rate as the main road fuels, with a current buy-out penalty for suppliers failing to meet the obligation of 30p per litre. Though, biodiesel made from waste cooking oil will continue to benefit from a 20p per litre duty differential until 31st March 2012.

The Industry has worked hard towards meeting the RTFO targets.
In 2011, UK sales of biofuels were 1,577 million litres, compared with approximately 44 billion litres of fossil petrol and diesel.

Biodiesel can be blended at the refinery using current quality controls and the existing fuel distribution system. On the other hand bioethanol's affinity to absorb water will require blending with petrol at terminals, - unless it is converted to ETBE at a refinery by reaction with isobutene, or replaced by biobutanol - because of the risk of transporting bioethanol blends in the UK's multi-product pipeline systems.

In general, biofuels are more expensive than conventional fuels preventing their widespread use in the past. However, the rise in crude oil and refined product prices over the last two years has narrowed this gap slightly, although higher oil costs also feed into the cost loop for biofuel production.

Product quality & technical issues

Under current European Motor Fuel Standards, the maximum limit for blending of bioethanol with fossil petrol is 5% and biodiesel with diesel is 7% by volume. Vehicles require no modification to use this level of blend. A European standard for E10 is currently under development.

The oil industry has been working with other organisations within the European Standards Organisation, CEN, to examine if the current limits on biofuel composition of road fuels can safely be increased to 10% for biodiesel and bioethanol, taking account of the operational impact upon the current and future vehicle fleet.

Use of vegetable oils in diesel engined vehicles

Modern diesel engines are built to very high standards with close tolerances to give the performance, lower emissions and reliability wanted by vehicle owners.

The automotive and oil industries, along with bio fuels' producers, have developed a British/European standard for biodiesel derived from vegetable oil, BS EN 14214, based on their European experience. The biodiesel standard ensures that biodiesel meets the requirements of modern diesel engines.

Where high biodiesel blend is used, modifications to the seals of existing vehicles may be necessary to avoid leaks, unless the vehicle has been specifically designed for such use.

The use of unprocessed vegetable oil is not recommended and will invalidate engine warranties. Their use over time can give rise to a range of problems, including the build-up of sticky deposits; damage to the diesel injector pump; malfunction of the fuel shut-off valve so that the engine will either not start or if running not stop; along with fouling of fuel injectors or blockages in fuel filters. Additionally, unprocessed vegetable oil has poor cold flow properties, which may lead to starting and operating problems during cold weather.

Bioethanol

Bioethanol is mainly produced by fermentation of sugar derived from crops such as sugar beet, sugar cane, wheat and corn/maize. Ethanol is a high-octane clear, colourless liquid that can be blended with conventional petrol but increases the vapour pressure of the fuel. It has a tendency to pick up water so cannot safely be blended at a refinery and distributed in multi-product pipelines. For this reason, blending with petrol will be during road tanker loading at terminals.

In order to avoid the problem of water absorption in storage tanks at service stations, some extra 'housekeeping' may be required. Guidance for operators will be issued in due course.

Ethanol can, however, be converted to ETBE by reaction with isobutene thus overcoming the problem of water absorption, or biobutanol can be produced, which has a vapour pressure similar to petrol.

The European/British Standard for petrol, EN 15376, permits a maximum of 5% by volume of ethanol (or 15% ETBE). Ethanol/petrol fuel blends to a higher proportion are sold in some countries, for example the United States, Brazil, and Sweden. The most common blend is 10% ethanol and 90% petrol (E10). Only flexible fuel vehicles can run on an 85% ethanol/15% petrol blend (E85). The range of 'flex-fuel' vehicles available in the UK is limited at present, as is the fuel distribution network for E85. Although the CO_2 reduction potential is higher than with lower proportion ethanol/petrol blends, the likely overall impact on reducing CO_2 from the road transport sector will be less than that associated with the move to 5% ethanol/petrol blend under the RTFO due to the limited number of E85 vehicles. The lower energy content of bioethanol is likely to be more evident with E85 blend, with up to 30% more fuel consumption compared with petrol.

Future biofuels

Second generation or advanced bio fuels are under development, utilising processes that turn cellulose

into fuel components either through enzyme fermentation or gasification followed by FischerTropsch synthesis. Biomass sources containing cellulose, such as plant and agricultural waste, organic household waste and non-food crops such as wood can be used.

Aside from not diverting land from food production, the utilisation of such material has cost benefits and requires less energy intensive inputs during the growing and production cycle. Furthermore, second generation fuels have the potential for superior CO_2 reduction benefits in comparison with conventional biofuels. However currently there is a cost penalty.

February 2012