Vireol plc will produce 300,000 tonnes of sustainable UK bioethanol each year, from two production sites in Immingham and Teesside. These facilities will provide “good biofuels” delivering carbon savings in excess of 50 per cent. Through its process of biorefining, Vireol will also provide 340,000 tonnes of high protein animal feed for use in the UK animal feed trade.

Vireol are on a mission to find a long term way to help replace the use of oil in transport fuels by making biofuels commercially, environmentally and socially sustainable.

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1 INTRODUCTION

Sustainable biofuels can help to reduce transport emissions and tackle climate change.

EU and UK policies must ensure that they can contribute to reducing transport emissions.

This paper explains why bioethanol produced from EU cereal crops such as wheat has a valuable role to play in meeting future road transport fuel demand for a low carbon, renewable and sustainable product.

The main reasons are as follows:

- Bioethanol produced from cereal crops such as wheat grown in the EU delivers significant savings of greenhouse gas emissions, up to around 70 per cent when compared to fossil fuels.
- Producing more bioethanol from wheat will not cause major increases in wheat prices between now and 2020.
- In Europe, large quantities of additional cereal crops can be grown for biofuels production without competing with food.
- Use, or causing displacement and indirect land-use change, even as global demand for cereals is increasing because more wheat can be produced from the same land; and good agricultural land that has been set aside can be brought back into production.
- Bioethanol from wheat can produce both food and fuel, thereby enhancing Europe's energy security and food security, with fewer land use requirements than other biofuels.

The paper discusses the extent to which current policy proposals will deliver a sustainable biofuels industry and then suggests ways in which EU and UK policies can promote the use of good biofuels.

2 BIOFUELS, TRANSPORT EMISSIONS AND CLIMATE CHANGE

Climate change is the greatest challenge that the world faces. If action is not taken to limit global warming, there will be massive environmental damage and some of the world's poorest people will face severe food and water shortages. Climate change is a major threat to our future prosperity.

The European Union has a strategic goal that the average increase in global temperature should be limited to no more than 2ºC above pre-industrial levels. The EU has also set a firm target for a 20 per cent reduction in the EU's greenhouse gas emissions by 2020. If these goals are to be achieved, emissions from all sectors will need to be reduced. A wide range of policy responses will be needed, including the delivery of a reliable carbon price, and encouraging people and businesses to change their behaviours. One of the key policy responses is promoting low carbon technologies.

Reducing emissions from road transport is a top priority. The sector now accounts for over one quarter of the UK's total greenhouse gas emissions and that figure is increasing.(1)

A number of measures are needed to create lower emissions from transport, including: encouraging greater use of public transport; demand management, promoting more efficient vehicles; efficient use of infrastructure; and increasing the use of renewable transport fuels. All of these steps must be taken urgently and, preferably, as elements of a coherent programme.

The key role of biofuels in tackling climate change

One of the EU's main policies to reduce greenhouse gas (GHG) emissions from transport is promoting the use of alternative transport fuels in the form of biofuels.

Biofuels are derived from crops or organic wastes. Crops such as wheat and rape seed oil capture the sun's energy and can then be converted into fuels like bioethanol and biodiesel. These fuels can then be blended with petrol (bioethanol) and diesel (biodiesel). The stored carbon is released by burning it in transport fuel, but is recaptured by growing more crops such as wheat. Biofuels replenish every year: they are a renewable energy resource. By contrast, oil is simply carbon that has been captured over many years and stored in the ground. Burning oil releases carbon into the atmosphere, one of the major factors in man-made climate change. Oil and, therefore, petrol are not renewable energy resources.

Where feedstock is grown without causing either direct or indirect land-use change, most biofuels deliver net greenhouse gas savings.

By 2020, biofuels have the potential to deliver annual global greenhouse gas savings of around 338 – 371 million tonnes CO_2e compared to a "without biofuels" scenario.(2)

Promoting the use of biofuels

Biofuels can be used in Europe's existing car fleet, in blends of petrol or diesel. At the moment the level of blending is set at 5 per cent by volume under the European Fuel Quality Standard. This is currently under review and bioethanol blending in petrol is expected to be raised to 10 per cent by 2010.

In 2003, the EU Renewable Fuels Directive called on Member States to convert 5.75 per cent by energy (or around 7 per cent by volume) of their transport fuel to biofuels by the end of 2010.

The UK's Renewable Transport Fuels Obligation (RTFO), which came into force on 15th April 2008, was introduced to assist the UK in meeting its obligations under the EU Renewable Fuels Directive. The RTFO requires oil companies and fuel importers to deliver a percentage of their annual fossil fuel sales from biofuels. The volume level is currently set at 2.5 per cent initially, rising to 5 per cent by 2010/11.

The EU has now set a binding target that 20 per cent of EU energy consumption – in electricity generation, heat and transport– should come from renewable sources by 2020. In January 2008, the new renewable energy directive set out a package of measures to achieve this target. The package includes a binding minimum target for renewable fuels to have a 10 per cent share (by energy) of the transport fuels market by 2020.

A more cautious approach to biofuels?

There are, however, a number of questions about whether EU and UK policies should promote biofuels. Some have asked whether biofuels are an effective way of reducing greenhouse gas emissions and whether biofuels might impact on food security. It has been alleged that increasing demand for biofuels has caused prices for some food commodities to rise. Other issues around the wider economic, social and environmental impacts of biofuels need to be considered.

In July 2008, the UK government published *The Gallagher Review on the indirect effects of biofuels production.* This review examined the indirect effects of increasing demand for biofuels on food prices, food security for the poor and the displacement of agricultural production on to uncultivated areas, and the consequent impacts on biodiversity, greenhouse gas (GHG) savings and local land rights.

The Gallagher Review concluded that a more cautious and discerning approach is needed in the use of biofuels; nevertheless, they must be part of a low carbon transport future. The report also found there is probably enough land to meet demands for food, feed and fuel, on a sustainable basis.(3)

The Gallagher Review's recommendations aimed to ensure that the biofuels industry can be sustainable. A key proposal was the use of robust, comprehensive and mandatory sustainability standards in the EU Renewable Energy Directive, in order to address land use change. To provide sufficient time for such standards to be developed and implemented, The Gallagher Review recommended: a slowdown in the rollout of biofuel targets in the UK; reaching 5 per cent by volume in 2013, rather than by 2010, as previously envisaged.

The Gallagher Review proposed EU targets of between 5 and 8 per cent by 2020 for biofuel inclusion, so long as milestones in 2014 for sustainability and avoiding land use change are met. The review said that the EU targets could move to 10 per cent provided that global controls on land-use change and new evidence verifies that the effects on food prices are manageable.(4)

The Gallagher Review also suggested that biofuel feedstocks should be delivered through yield enhancement on existing arable land or targeting feedstocks grown on marginal or idle land, in order to avoid negative displacement effects.(5)

The UK government broadly accepted The Gallagher Review's conclusions and recommendations and is now consulting on proposals to:

- slow the rate of increase of the RTFO to 0.5% per annum, taking the level to 5 per cent in 2013-14 rather than in 2010-11 as is the case currently;
- add two new eligible fuels - biobutanol and hydrogenated renewable diesel – to the list of renewable fuels eligible under the RTFO;
- support the EU target of 10 per cent renewable transport fuels by 2020, conditional on evidence showing that it is being delivered sustainably and that the indirect effects of biofuel production are accounted for;
- press for the 10 percent target to be kept under regular review in the light of the emerging evidence; and
- support work to establish international standards and controls, which reflect the international nature of the biofuels industry.

The need to distinguish good biofuels and bad biofuels

There are good biofuels and bad biofuels, depending on how the feedstock is grown and the fuel is made. The Gallagher review described the ways of distinguishing "good" from "bad" biofuels. They include the extent to which biofuels can:

- save substantial amounts of carbon compared to petrol or diesel;
- avoid major impacts on food prices;
- be produced in ways that are complementary with needs for food, feed and fuel;
- avoid the environmental impacts of direct or indirect changes in land use; and
- demonstrate that they are sustainable.

A "good" biofuel should help enhance both energy security and food security.

A "good" biofuel should be a catalyst for positive change, helping to ensure that all feedstock, regardless of its end use, is produced in ways that are better for the environment.

Looking ahead, the challenge for sustainable biofuels policy is two-fold:

- recognising the good biofuels; and
- making sure that good biofuels, and not bad biofuels, are blended into UK transport fuels.

3 WHEAT-BASED BIOETHANOL - A GOOD BIOFUEL

Applying the standards set out above, bioethanol produced from EU cereal crops, such as wheat, is a good biofuel.

Saving carbon

A major benefit of using biofuels as a transport fuel is that they produce significantly lower greenhouse gas emissions than fossil fuels.

Some biofuels save more emissions than others. The level of carbon savings from a particular biofuel depends on: how the crops are grown and harvested; whether the production of biofuel feedstock causes direct or indirect land use change; how the crops are dried and stored; the source of energy used in converting crops to biofuels; and how the co-products are used.

EU manufactured bioethanol from EU cereal crops delivers significant savings of greenhouse gas emissions compared to fossil fuels. **Wheat bioethanol delivers default greenhouse gas emissions savings of between 45 per cent and 70 per cent, compared to the fossil fuel equivalent.**(6)

Lower impact on food prices

The Gallagher Review found that rising prices for commodities have been caused by many factors. Higher demand for biofuels is just one of them. The review noted, however, that the scale of individual effects varies widely between different feedstocks.(7)

The review used a model to project price rises resulting from biofuels policies, up to the year 2020. For most crops, the forecast price rises are rarely more than 5 per cent. For wheat, they ranged from a drop in price of 2.6 per cent in the EU to a price increase of just 0.2 per cent in southern Africa and Brazil. The review concluded that biofuels policies have much less impact on prices for EU cereals than for other feedstocks. By contrast, oilseeds are the worst affected, with projected price increases of up to 72 per cent.(8)

Producing food as well as fuel

Each tonne of wheat grown and used to produce bioethanol creates two important products. First, the starch is extracted and turned into bioethanol for transport fuel.

Second, through bio-refining in manufacturing the bioethanol, wheat can be upgraded to the valuable co-product, Dried Distillers Grains and Solubles (DDGS). DDGS has a high protein content and can be used in animal feed.

Protein rich crops usually require a relatively large amount of land to produce a given output, compared with cereal crops. One of the important findings of The Gallagher Review was that co-products like DDGS can reduce the amount of land that is required to produce high protein crops specifically used for animal food. The resulting benefits include more efficient land use and greater savings of carbon emissions.(9)

Typically, each hectare of wheat grown in the UK can deliver an additional 2.6 tonnes of DDGS per hectare, as well as 2.3 tonnes of bioethanol.(10)
In other words, an additional tonne of high protein animal feed is created for each tonne of bioethanol produced from wheat. This means that food AND fuel needs can be met.

Fewer major land use changes

If biofuels are to play a bigger part in reducing emissions from road transport, demand for wheat will have to increase. So will demand for other cereal crops, such as maize and barley, which can also be used as feedstock for bioethanol production in the EU.

The Gallagher review concluded that increased demand for cereal crops for bioethanol production may be met at the expense of food production, causing land use change which can, in turn, lead to increased carbon emissions. To avoid this, the review recommended the adoption of policies that will promote the increased use of idle and marginal land. The review also noted that increased yield from existing arable land could also play a valuable role.(11)

In fact, within the EU, it is improved yield – producing more cereal from the same land - that offers the greatest potential to meet increased demand for cereal crops, on a sustainable basis.

The ADAS study, for The Gallagher Review, showed that "business as usual" yields between now and 2020, will deliver sufficient cereal crops to enable the EU to meet the increased demand for food and animal feed, and to match the current surplus food available for export. [see chart 1]

However, the ADAS study also recognised that the 27 EU member countries have the potential to produce significantly more cereals by 2020 to assist in meeting their biofuels targets. Crucially, this can be done without competing with food use or making changes that will result in harmful indirect land-use.(12) The increased demand resulting from greater EU bioethanol production can be met in three ways.

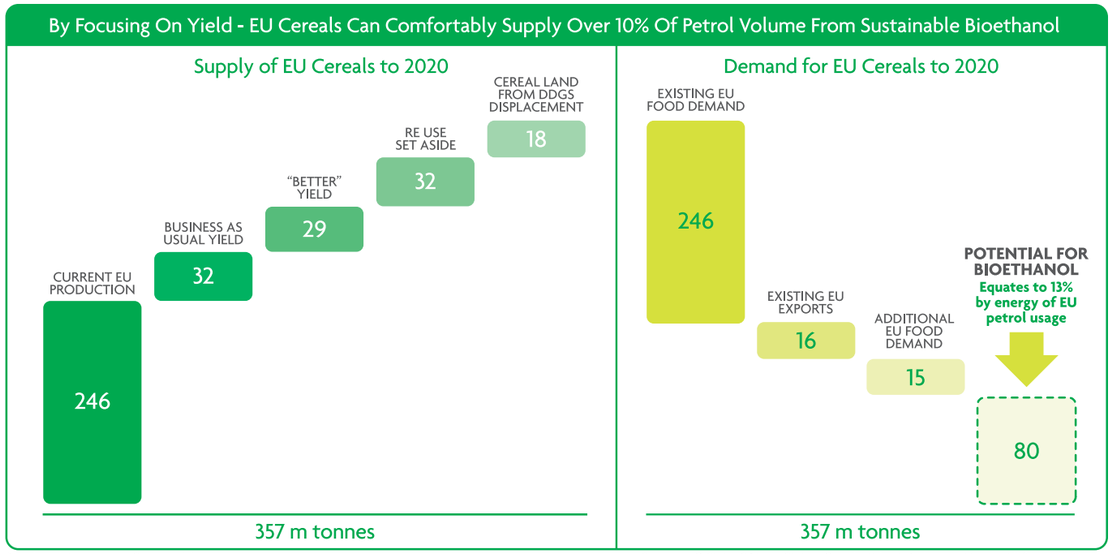
The first is by significantly improving crop yields ahead of the "business as usual" case. There is one simple way that such a result could be achieved. Cereal crops yields in the 12 countries that have joined the EU since 2004 are 36 per cent lower than those in the EU15.(13) The EU12 could, therefore, develop their yields, to reach the levels already seen in the original 15 member states.

Second, the EU can continue to use arable land that was previously set aside for crop production. This was achieved in 2008.

Third, the production of co-products, such as DDGS, will mean that less land is needed for cereal production to provide traditional animal feedstocks. Therefore the only additional land usage needed would be the limited use of rotational set aside land brought back into production.

This way, increased demand for cereal crops will not cause direct or indirect land use change that could lead to increased carbon emissions. At the same time, the 27 EU member countries can supply the crops that are needed for food.

Chart 1

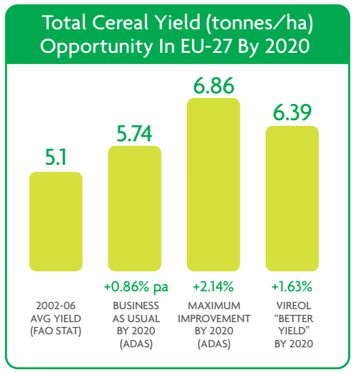


Based on data in Annex. (See page 15)

Source: FAO Stat, USDA, EU Stats Cereal = Wheat, Barley and Maize All figures m tonnes

It is worth noting that the yield growth in chart 2 is markedly lower than the opportunity level identified by ADAS in the study conducted for The Gallagher Review. In other words, the analysis above is somewhat conservative.

Chart 2



In contrast to other crops, increases in demand for wheat over the past thirty years have been met largely through a growth in yields, rather than changes in land use. Between 1961 and 2007, wheat production in Europe more than doubled but the land area used fell by 37 per cent.(14) Moreover, the Gallagher review noted that yield improvements can reduce pressure on the total amount of land required for agriculture.(15)

Achieving yield improvements – getting the most from the EU's arable land – should be an important priority for biofuels policies. The EU and the UK government must ensure that the market receives a strong signal for investment in crop yield, so that the potential for delivering food as well as fuel achieved. ADAS concluded that there are no serious technical constraints to increasing yields of most crops across most regions. However, it noted that "the yield improvements required are unlikely to be met without significant investments in agricultural research and development and breeding and without a shift in political and economic measures in many countries".(16)

Proving that biofuel production is sustainable

As well as delivering substantial carbon savings, a good biofuel will be produced on a sustainable basis. One way of being confident that a biofuel's environmental credentials are sound is to conduct an audit of its full supply chain. This is not always possible, however. Bioethanol made from EU cereal crops can be audited by existing food safety standards, such as the Assured Combinable Crops Scheme (ACCS). This will help to ensure that the biofuel is sustainable and can be demonstrated as such.

Enhancing energy and food security

Bioethanol can make a significant positive contribution to enhancing Europe's energy security. The bioethanol produced within the EU can be used for transport fuel in place of petrol. This wlll help to reduce the need for oil imports which are on course to account for more than 90 per cent of EU demand by 2030.(17) The 27 EU member countries by 2020 could alone produce sufficient bioethanol to meet 13.4 per cent of their projected demand for petrol.(18) This is before any benefits from imported bioethanol are considered.

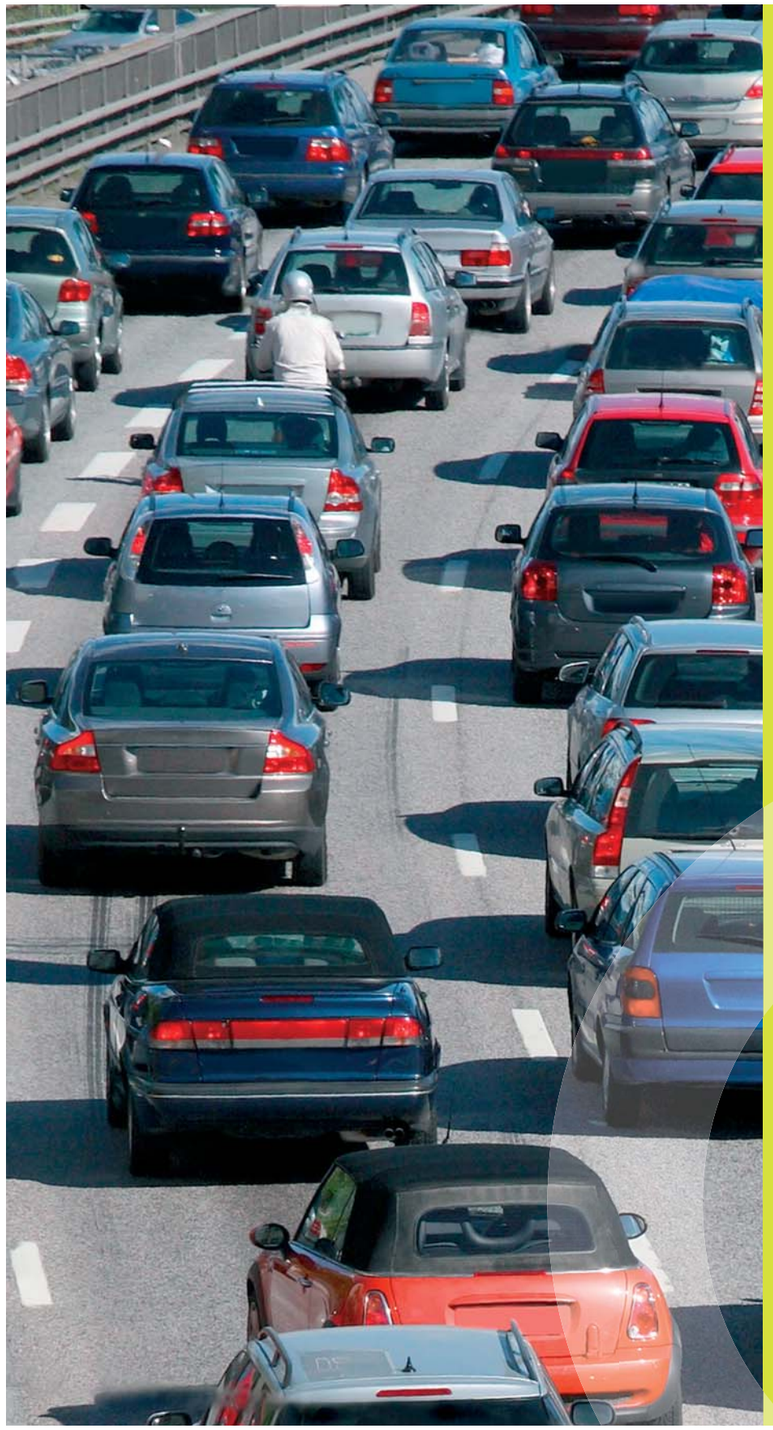
In addition the EU imports a significant amount of high-protein animal feed. With growing global meat consumption, meat production is becoming more intensive and therefore reliant on high-protein animal feed. The best way to provide high protein animal feed is to add protein concentrates, usually soy bean meal, to an energy source. The EU has a deficit in animal feed protein and consequently, imports around 30 million tonnes of soy bean meal per annum, mainly from countries such as Brazil.(19)

The growth in demand for soy production from these countries means that soy is being planted on additional land, either grassland or rainforest. Consequently, carbon stocks are released and there are major risks to sensitive eco-systems.

The DDGS produced from EU bioethanol production has major environmental benefits. First, the need to import significant quantities of soy meal for animal feed from South American countries will be reduced, thereby providing the EU with greater food security. Second, there will be fewer pressures to use additional land to grow soy beans. As a result, the negative impacts on sensitive habitats, such as Cerrado and Rainforest, are likely to be reduced.

Bioethanol – a positive catalyst for change

EU bioethanol manufacturers are motivated by the need to reduce the carbon emissions of their products, relative to fossil fuels. As a result, agricultural producers and suppliers are working to reduce the carbon balance of their supply chains. For example, fertilisers are being manufactured in new ways, using N20 abatement equipment that will reduce harmful emissions. A greater focus on yield and efficiency of land use is helping to reduce the carbon footprint of EU bioethanol. These can all be drivers for positive change across the whole of the agricultural supply chain, regardless of the product's end use, bringing even greater environmental benefits.



WHEAT BIOETHANOL DELIVERS DEFAULT GREENHOUSE GAS EMISSIONS SAVINGS OF BETWEEN 45 PER CENT AND 70 PER CENT, COMPARED TO THE FOSSIL FUEL EQUIVALENT.

4 RISKING THE BENEFITS OF GOOD BIOFUELS

Some aspects of current proposals for changing EU and UK policies could mean that the benefits of sustainable biofuels, as described above, are not achieved.

The proposed slowdown in the rollout of biofuel targets under the RTFO in the UK, and the proposed Renewable Energy Directive in the EU, could discourage the production of good biofuels. Proposals to account for indirect land use change (iLUC) are a positive step. However, an automatic penalty could shut down much of the UK's biofuels production. Both "good" and "bad" biofuels could be affected.

In addition, there are steps that, if not taken, will place the benefits of good, sustainable biofuels at risk. One example is providing a strong signal to fuel standards bodies and car manufacturers about the fuel types for road transport that might be needed in future, in order to meet a 10 per cent renewable energy target.

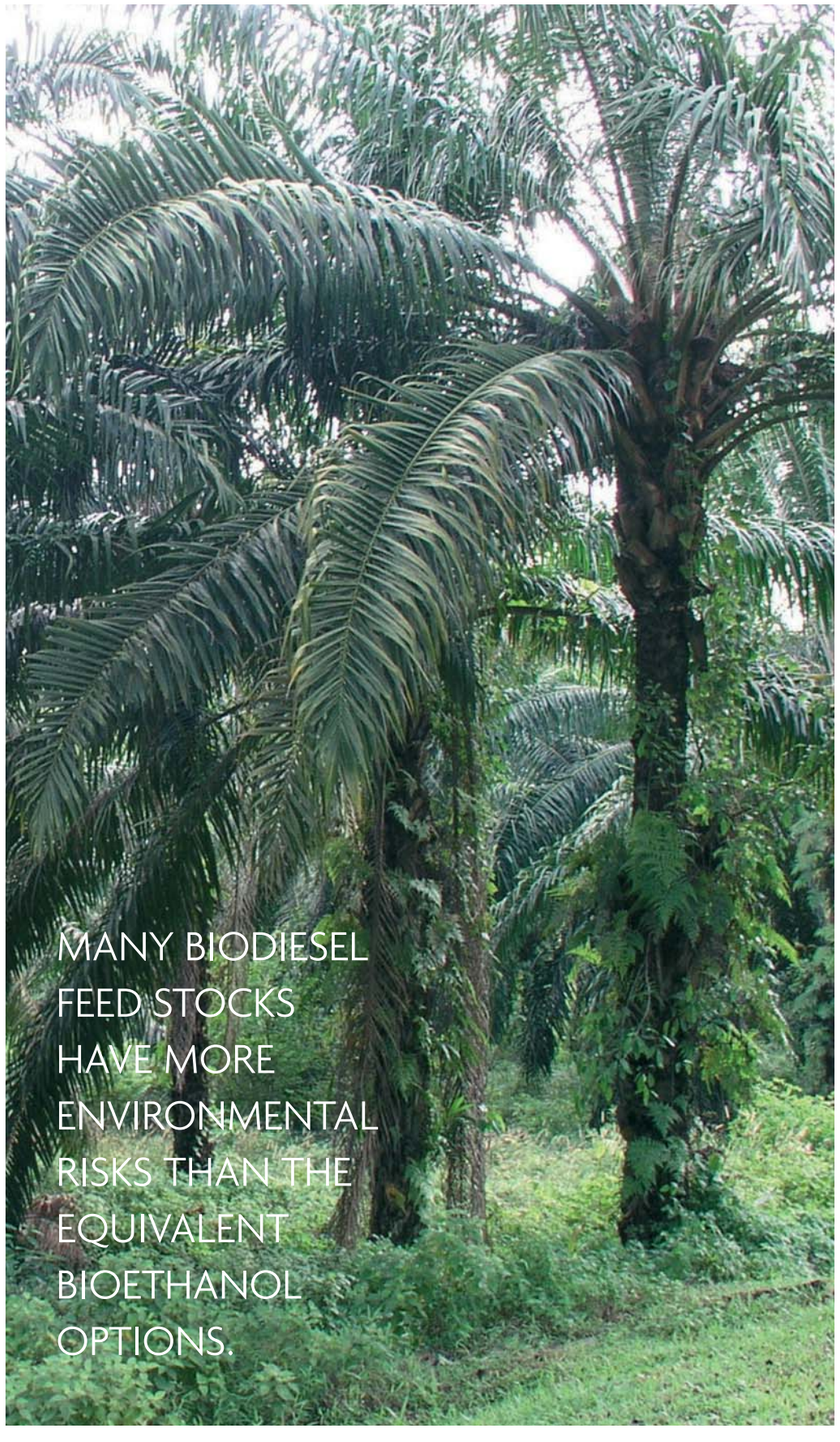
These issues are now addressed in turn.

Slowing down the rollout of EU and UK biofuel targets

At the moment the level of biofuel blending is set at 5 per cent by volume and is planned to increase to 10 per cent by energy by 2020 (around 14 per cent by volume).

If the RTFO targets are lowered, road transport fuel suppliers could choose whether they blend biodiesel or bioethanol in order to meet their targets.

Road transport suppliers may opt to blend biodiesel, ahead of bioethanol, for two reasons. First, in order to be able to carry out bioethanol blending, suppliers need to make a substantial capital investment at the blending rack. As a result, many suppliers may choose not to make such investment and meet their demand through biodiesel blending alone. Second, given that the EU imports mineral diesel and exports petrol, they may prefer to blend biodiesel in order to reduce the quantities of mineral diesel they need to import.



Biodiesel can play a valuable role, as one source of renewable energy. However, there are "good" and "bad" types of biodiesel. In general, biodiesel has more environmental risks than the equivalent bioethanol options.

Saving carbon.
The default greenhouse gas savings for biodiesel set out in the Renewable Energy Directive show a range of reductions between 16 per cent and 77 per cent.(20) This is in line with bioethanol produced from cereal crops grown in the EU, which delivers up to 70 per cent when compared to fossil fuels. However, these estimates do not take into account the significant indirect effects that are likely to result from biodiesel feedstock production.

Direct or indirect changes in land use.
The optimistic scenarios on rape seed yield development, that were mapped out by the ADAS study for The Gallagher Review (21) only provided enough additional EU oils to meet projected EU food demands. Any additional quantities to meet biodiesel demand are likely to be met through land use change. Meeting a target of 10 percent by energy of biodiesel could drive a change of at least an additional 8.5m ha of land use.(22) This would occur either directly in the EU or indirectly in countries such as Malaysia or Indonesia. This would have a significant negative effect on the carbon balance of most new biodiesel volumes up to 2020.

Producing food as well as fuel.
Some biodiesel feedstocks, such as rape seed, provide valuable co-products that can be used as a substitute for imported high protein animal feeds. However, others, notably palm oil, do not provide these co-products and do little to maintain a balance between producing food and fuel from available land.

Impacts on food prices.
The ODI study that was carried out for the Gallagher review projected that oil seed prices would increase between 50 and 72 per cent by 2020, in order to meet increased demand resulting from existing biofuels policies.(23)

Positive impacts on energy and food security.
Many of the feedstocks used in producing biodiesel will be grown in areas outside the EU. As a result, they do not make a significant contribution to the EU's energy security. As some biodiesel feedstocks do not have the valuable co-products that EU cereals have, they will do little to offset the demand for high protein imported animal feed in the way cereal bioethanol can.

Therefore, EU and UK policy must ensure that these risks are balanced. When targets are set, they need to be capable of being achieved, in a sustainable way, by different biofuels.

Addressing the indirect effects of land use change : proposed iLUC methodologies

The UK government has accepted a key recommendation of The Gallagher Review: that sustainability criteria at the EU level should address the indirect effects of land use change.(24) In principle, this recommendation deserves support; biofuels targets in future should take into account the indirect effects when calculating GHG emissions. There is still, however, no clear scientific consensus on how iLUC effects can be properly monitored or measured. At the same time, the political momentum behind efforts to agree an iLUC methodology must be recognised.

The challenge now is to make sure that proposed iLUC methodologies do not have adverse impacts on sustainable biofuels. Proposals exist for an iLUC methodology that includes an automatic penalty of 30gCO2/MJ.(24) The effect of applying such an arbitrary penalty would be to shut down much of the UK's and EU biofuels production and to seriously inhibit the use of imports from places like Brazil. No distinction would be made between sustainable biofuels and other biofuels. Both the good and the bad would be adversely affected.

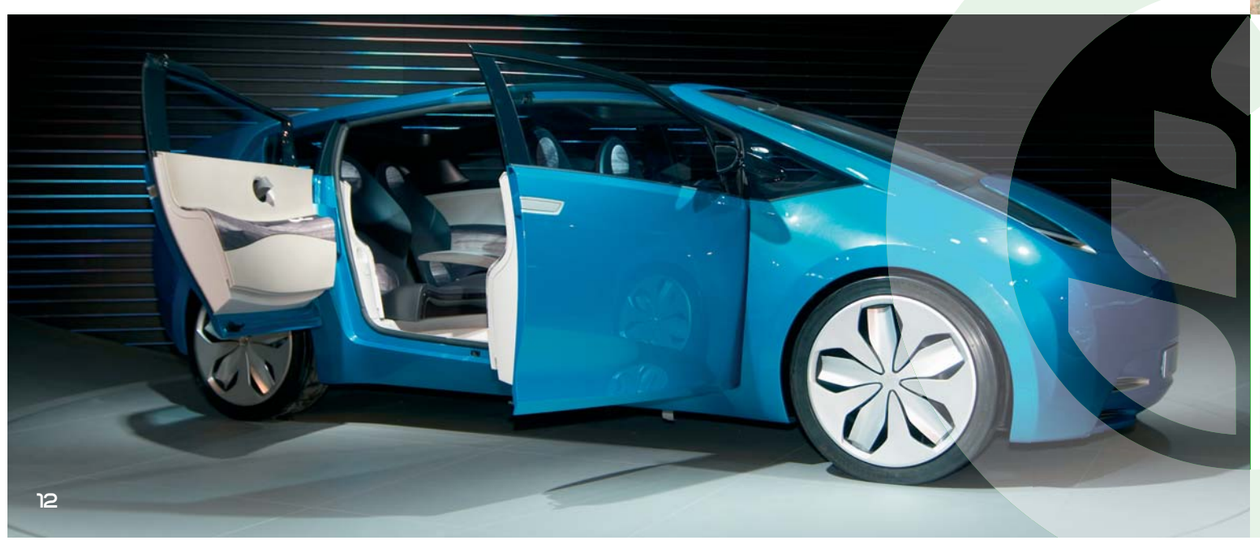
The development of an iLUC methodology should continue, but without an automatic penalty. The methodology should ensure that a distinction can be made between feedstocks and, therefore, between "good" and "bad" biofuels.

"Future proofing" cars and fuel types

The implications of moving to a 10 per cent energy target for renewables in road transport need to be considered. For example, higher renewable fuel mix standards and cars capable of taking higher blend percentages of bioethanol may be needed in future, even if fuels with such high percentage blends are not available at the moment. Such changes can take up to ten years to work their way through the vehicle parc, so that all vehicles on the road are compatible.

The European Commission needs to provide car manufacturers with clear signals that they should act to "future proof" new vehicles. One way is to ensure that, as a matter of urgency, CEN develops bioethanol and petrol blend standards of up to 25 per cent by volume. This is the norm in well developed bioethanol markets, such as Brazil. The European Fuel Quality Standard can then be raised, as sustainably - produced feedstock volumes allow blend standards to be increased.

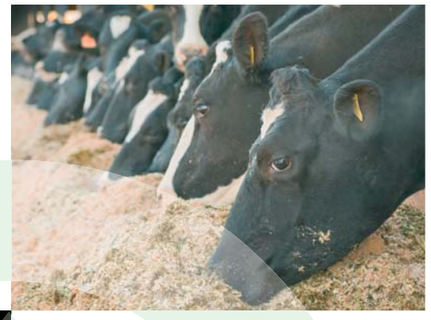
The vehicle parc and fuel standards will then able to achieve more ambitious goals to reduce carbon emissions up to 2020, and the decades beyond.



5 SECURING THE BENEFITS OF GOOD BIOFUELS: A WAY FORWARD

EU and UK policies need to be designed so as to secure for all of us the benefits of good biofuels.

In particular, they must ensure that the market receives a strong signal for investment in increasing crop yield, so that the potential for delivering fuel, as well as food in the EU, as mapped out above, is achieved.



Priorities for the UK and the EU are to:

- provide a clear signal to the market in support of sustainable biofuels, by keeping to the original timetable for rolling out the RTFO so that oil companies and fuel importers are required to deliver a 5 per cent of their annual fossil fuel sales from biofuels by 2010/11;

- create a more balanced market for sustainable biofuels, by requiring that petrol with a bioethanol content of at least 5 per cent by volume is made available in the majority of filling stations by 2012;

- ensure that sustainability criteria take into account the indirect effects of land use change (iLUC), by pioneering research work to establish feedstock specific iLUC factors and introducing such factors as a mandatory reporting requirement for the UK as soon as practicable as a precursor to EU wide mandatory iLUC factors;

- provide clear signals to car manufacturers to future proof vehicle fleets for a more sustainable fuel mix, by completing, before 2012, CEN research to enable a fuel standard for bioethanol blends in petrol of up to 25 per cent by volume and raising the European Fuel Quality Standard in stages towards those blends as soon as it is practicable and sustainable to do so; and

- ensure that increased demand for crops can be met on a sustainable basis, by introducing incentives for increasing crop yields on existing arable land across Europe.

At the EU level, Vireol supports policies to:

- provide a robust framework for investment in good biofuels, including setting a mandated target that 10 per cent of transport fuels should come from renewable fuels by the year 2020;

- ensure that biofuels make their maximum contribution to cutting carbon emissions, by setting mandatory targets and reporting requirements for reducing greenhouse gas emissions, with a minimum threshold of 35 per cent for greenhouse gas savings, rising to 50 per cent by 2015; and

- guarantee a sustainable biofuels industry, by introducing comprehensive, mandatory sustainability criteria and certification schemes, based on those in the UK's RTFO.

4 Key Priorities

- Continue with the existing RTFO targets – provide clear signals to investors and consumers.

- Ensure that petrol with a minimum 5 per cent bioethanol blend is available to consumers throughout Europe.

- Make sure that indirect land use change factors are considered when calculating emissions.

- Work to "future proof" vehicle fleets for a more sustainable fuel mix.

REFERENCES

(1) Environment Agency, http://environmentagency.wales.gov.uk/aboutus/512398/289428/1881465/?lang=_e

(2) Renewable Fuels Agency, *The Gallagher Review of the indirect effects of biofuels production (2008),* p.22

(3) Gallagher Review, op. cit., p.8

(4) Gallagher Review, op. cit., pp. 12 – 17

(5) Gallagher Review, op, cit., Chapter 3

(6) Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources(COM(2008) 30 final)(SEC(2008) 57) (SEC(2008) 85), Annex VII

(7) Gallagher Review op. cit., section 7.1

(8) Gallagher Review, op. cit., Table 7.1

(9) Gallagher Review, op. cit., Box 3.2

(10) Renewable Fuels Agency, *Carbon and Sustainability Reporting Within the Renewable Fuels Obligation Technical Guidance Part Two Carbon Reporting – Default Values and Fuel Chains* (August 2008), p. 31 (wheat to ethanol – UK default)

(11) Gallagher Review, op. cit., Chapter 3

(12) ADAS Insight and Solutions, *Anticipated and potential improvements in land productivity and increased agricultural inputs with intensification, A study commissioned by AEA Technology as part of The Gallagher Biofuels Review for the Renewable Fuels Agency and the Department for Transport,* pp. 48-49

(13) FAOSTAT Production Crop Database

(14) FAOSTAT Production Crop Database

(15) Gallagher Review, op.cit., Box 3.1

(16) ADAS, op. cit., p.50

(17) http://www.theparliament.com/latestnews/news-article/newsarticle/piebalgs-one-voice-one-eu-energy-policy/

(18) See Annex 1

(19) USDA Foreign Agricultural Service, Oilseeds World Markets & Trade (August 2008). Table 8.

(20) Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (COM(2008) 30 final)(SEC(2008) 57) (SEC(2008) 85), Annex VII

(21) ADAS, op. cit., pp. 30 – 31

(22) These figures are compiled using ADAS, USDA and FAO statistical data.

(23) Overseas Development Institute, Review of the indirect effects of biofuels: Economic benefits and food insecurity (2008), pg 67

(24) http://www.dft.gov.uk/press/speechesstatements/statements/gallagherreview

(25) Annex to the (RED) impact assessment, SEC (2008) 85, 27 Feb 2008

(26) DG Agri, Prospects For Agricultural Markets & Income In The European Union 2007-14, Brussels, European Commission, March 2008

(27) FAOSTAT Production Crop Database

(28) Vireol projections based on work done by ADAS for The Gallagher Review op. cit.

(29) USDA Foreign Agricultural Service, Grain Markets & World Trade, May 2008

(30) Tackling Climate Change – Warwick Lywood, Ensus, July 2008

ANNEX

Potential For EU Cereal Bioethanol by 2020

EU Transport Fuel Demand (25)	Mtoe/yr	330				
EU Gasoline Demand projection 2020 (25)	Mtoe/yr	139.5				
EU Set Aside Avg 2005-07 (26)	Mha	7				
Re-use set aside land	Mha	3.5				
Land from reduced Sugar Beets (26)	Mha	0.5				
Extra land available for cereals from Cropland	Mha	4				
		WHEAT	MAIZE	BARLEY	TOTAL	
Total EU cereals production 2002-06 (27)	Mt/yr	131.3	57.8	60.6	249.8	
Total EU crop yield 2002-06 (27)	t/ha	5.1	4.2	6.5	5.1	
EU Crop area 2002-06 (27)	Mha	25.83	13.85	9.33	49.01	
EU15 increase in crop yield 2007-20 (28)	%	1.50%	1.50%	1.50%		ADAS 1.79%
EU12 increase in crop yield 2007-20 (28)	%	2.03%	2.03%	2.03%		ADAS 3.29%
Increase in EU production from yield to 2020	Mt/yr	33.1	16.2	14.4	63.7	
Additional cereals from set aside in 2020	Mt/yr	21.5	10.8	0.0	32.3	
Impact of non biofuel consumption by 2020 (26)	Mt/yr	18.8	-1.9	-1.8	15.0	
Net Trade Balance (29)	Mt/yr	8.2	5.9	1.5	15.6	
Additional cereal crops available (after non bio consump and net trade bal)	Mt/yr	27.7	23.0	14.7	65.4	
Cereal displaced by DDGS co product (30)	Mt/yr	6.5	7.0	5.2	18.7	
Total Cereals Available for bioethanol	Mt/yr	34.2	30.0	19.9	84.1	
Bioethanol production from cereals 2020	Mt/yr	11.6	10.5	6.0	28.1	
Sugar Beet Ethanol	Mt/yr				1.2	
Total Bioethanol production potential EU	Mt/yr				29.3	
Total Bioethanol production potential EU	Mtoe/yr				18.8	
Potential as % of Total Fuel Demand	% of mtoe				5.7%	
Potential as % of Projected Gasoline Demand	% of mtoe				13.4%	
DDGS Available	Mt/yr	11.1	9.5	8.2	28.8	