Environmental accreditation and carbon certification of biofuels for road transport – the UK experience

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Abstract

The UK Government has made a commitment to put the UK on a path towards a reduction in CO_2 emissions of 60 per cent by 2050. The Renewable Transport Fuel Obligation (RTFO) will help bring the UK closer to meeting European Union Directive 2003/30/EU ([1] European Commission, 2003) which sets targets for all EU countries for biofuel usage of 2 % by the end of 2005 and 5.75 % by the end of 2010. The RTFO is a requirement on transport fuel suppliers to ensure that, by 2010, 5 % of all road vehicle fuel is supplied from sustainable, renewable resources. The UK Government claims that the RTFO will save around one million tonnes of CO_2 in 2010; the equivalent of taking a million – of the UK's 30 million – cars off the road.

To hit the Government's targets, emissions of carbon dioxide through all the phases (crop production, conversion, transportation and use) of biofuels must reach the higher levels of carbon savings shown to be possible in independent studies. Potential carbon savings can vary significantly – from 7 to 77 % in one major study – depending on a number of factors including the use of fertilisers, the type of production process used and the treatment of by-products.

The UK Government is developing a carbon and sustainability assurance scheme as part of the RTFO. Companies subject to the Obligation will be obliged to report on the carbon savings they achieve and other aspects of the sustainability of their biofuel supplies. This paper provides an update on progress and assesses the likely impacts of the assurance scheme.

Introduction

Biomass has long been an important source of energy, particularly in less developed economies, mostly for heating and cooking. However, the use of biomass to produce biofuels for transport purposes is in the early stages of what now looks likely to be a very rapid growth, especially in developed economies. The uptake of biofuels for transport is being driven by regulation and other policy instruments in Europe and elsewhere.

Increasing concern about the contribution of road transport carbon emissions to climate change is a key factor in prompting the regulatory drive for the adoption of transport biofuels, especially in Europe. Biofuels are also being encouraged due to fears about the supply availability and future price of the oil-based fuels traditionally used for transport, especially in countries where there are insufficient indigenous supplies.

The introduction of biofuels is a key element of current policies aimed at the mitigation of climate change in Europe. The road transport sector is responsible for nearly a third of all CO_2 emissions in Europe – a share which is continuing to rise. In the UK, the Government claims that existing regulatory policy for biofuels introduction will, by 2010, cut carbon emissions from road transport by 1 million tonnes or the equivalent of taking a million cars off the road ([2] DTI – Energy Review, 2006). The use of biofuels is seen by governments, in Europe and elsewhere, as one of the most significant policies for cutting carbon from road transport.

The European Commission states that: "Increased biofuel use is the only means at present available to reduce the transport sector's near-complete dependence on oil, and one of the few ways to make a significant impact on transport's greenhouse gas emissions" ([11] EC, 2006).

The two main biofuels in use today are ethanol (produced from starch crops such as cereals or other crops such as sugar cane and sugar beet), which can be blended with gasoline, and biodiesel (made from oleaginous plants such as rapeseed and sunflower), blended with petroleum-based diesel. Both bioethanol and biodiesel can be used in unmodified engines of modern cars in low blends with fossil petrol or diesel, or with cheap engine modifications for higher blends.

Ethanol now accounts for about 90 % of total biofuel production, with biodiesel making up the rest. Bioethanol production more than doubled between 2000 and 2005 to 40 bn litres ([3] Worldwatch Inst, 2006). Brazil and the United States were easily the largest bioethanol producers in 2005. Biodiesel, expanding from a lower base, increased four-fold over the same period. Most biodiesel is produced in Germany, with France, the US and Italy also significant suppliers in 2005.

According to one recent study ([4,5] BIOFRAC, 2006) the European Union could potentially source 25 % of its transport energy needs from biofuels by 2030. The same report concluded that while Europe could theoretically produce sufficient biofuels for half of all its road fuel needs this would probably prove too expensive.

However, in its most recent communication on the subject, the European Commission states that only around 14 % of (current requirements) of transport fuel could be comprised of biofuel without extending biocrop production beyond land that is appropriate for the purpose ([11] EC, 2006). In the same communication, the Commission nevertheless proposes that the Biofuels Obligation should be strengthened to mandate that biofuels should provide a minimum 10 % share of transport fuels market in 2020.

A rapid growth in the supply of biofuels has significant, and some potentially damaging, implications. There are, for example, concerns that conflicts may arise over the use of land to grow energy crops rather than food crops and that this could be an additional source of hunger and food insecurity ([6] WWF, 2006).

There are also a broader range of concerns about possible negative impacts on the local environment of increased biofuels use. These are explained in more detail below.

While one of the primary drivers of the policy push for transport biofuels has been the theoretical potential of such fuels to deliver greenhouse gas savings, a number of studies have shown that life-cycle - 'field-to-wheel' - carbon savings are not so clear-cut. Field-to-wheel carbon savings are highly variable and dependent on the way the fuel crop is grown, manufactured and distributed, and on the ways in which by-products are used as the following sections also explain.

This paper also provides an overview of the ways in which the Low Carbon Vehicle Partnership (see endnote) has taken a leading role in the UK in the development of draft environmental standards for biofuels and also in developing a practical system for their life-cycle carbon accreditation and certification.

Transport Biofuels: Life-Cycle Greenhouse Gas Measures

Research by the LowCVP, and others, has shown that on a life-cycle basis the net greenhouse gas emissions vary widely depending on the biofuel crop and the way it is grown and processed. A major study ([8] LowCVP, 2004) which was commissioned in an attempt to reconcile two divergent approaches to life-cycle methodology found that the field-to-wheel greenhouse gas (GHG) savings for one important fuel pathway – bioethanol from wheat – varied from 7 % to 77 %, depending on the means used to produce and process the fuel, including all inputs to the process.

The wide range of GHG emissions within specific fuel chains relate to the different ways of producing the biofuel. For example, using a coal fired plant in the conversion process will be more carbon intensive than using natural gas and therefore result in a different figure for the same chain. There are several processes in the life-cycle of biofuel production that contribute significantly to their GHG emissions.

The CONCAWE et al study points out that most of the GHG emissions associated with biofuels production come from farming and mainly from the production of nitrogen fertiliser and emissions of nitrous oxide (N_2O) from fields. Because nitrous oxide is a far more powerful greenhouse gas, even relatively small emissions can have a significant impact on the wider GHG balance. The actual N_2O emissions depend on a complex combination of many factors and vary enormously from one field to another depending on soil type, climate, crop and fertiliser and manure rates.

Most feedstock can deliver greater than 50 % GHG saving compared to their fossil equivalent. The CONWAWE study also illustrates that second generation fuels perform better than most but not all first generation biofuels.

The LowCVP study (2004) for wheat to ethanol concluded that there are three key elements in the fuel production process which were the main determinants of whether it produces small, or significant, GHG savings.

The key elements were:

- The heat and power scheme used in the ethanol plant.
- The fate of straw: whether it is ploughed back into the field or used as fuel for the ethanol plant.
- The fate of a by-product – Distillers' Dark Grains and Solubles (DDGS): whether it is used as an animal feed or as an energy source.

A wider study by CONCAWE, EUCAR and JRC ([9] CONCAWE, 2006) concluded that bioethanol produced from wood is generally better at producing GHG savings than fuel produced from sugar beet or wheat but the use of more advanced – 'second generation' – techniques can also significantly improve performance. Under the least favourable circumstances, the study showed that *bioethanol produced from wheat can result in greater GHG emissions than the burning of the gasoline fuel which it replaces*.

In a broader context, the same CONCAWE et al study also concluded that biomass to energy schemes generally show better GHG savings than the reductions possible from most crops to transport fuel pathways.

Larson's review of life-cycle GHG performance reviews the available published analyses of the subject, which mainly focus on Europe or North America ([10] ESD Journal, 2006). Larson comments that there are wide ranges in the net energy balance and GHG impacts among different biofuels – and even for the same biofuel. He notes that there is a lack of focus on evaluating GHG impacts per unit of land area. According to Larson, the four most significant factors in determining the GHG performance of different transport biofuel production routes are: (1) the climate-active species included in the calculation; (2) assumptions around nitrous oxide emissions; (3) the allocation measures used for co-product credits; and (4) soil carbon dynamics.

The life-cycle calculations for GHG emissions enable direct comparisons to be made between specific fuel chains. Most biofuels produce significant GHG savings compared to their fossil equivalent but there are a number of environmental concerns, including land-use change, which could not only affect the GHG balance but also lead to a number of undesirable environmental impacts.

Transport biofuels: environmental impacts

There are concerns that a rapid expansion of biofuels supply could lead to serious negative environmental impacts. Broadly these can be categorised as:

- Biodiversity loss and associated negative ecosystem impacts. For example, the replacement of natural forest with biofuel crops such as palm oil. A potentially harmful tendency towards local monoculture.
- Impacts on the local water supply leading to scarcity, poor water quality and degradation of land.
- The degradation of soil and/or erosion where biofuels are grown on unsuitable soils.
- Increased emissions of CO_2 as a result of land use changes, for example from loss of rainforest. Emissions of CO_2 in the process of growth, production and distribution that – in the extreme case – can wipe out gains from CO_2 absorbed in the growth phase ([7] LowCVP, 2006).

In terms of biodiversity loss, the World Wildlife Fund ([6] WWF, 2006) identify as a particular concern, the conversion of extensive 'high-nature-value' farming to more intensive monoculture, and the conversion of primary forests and other habitats into energy plantations, both of which would lead to a major loss in biodiversity. WWF demand the protection of ecosystems and habitats containing high diversity, large numbers of endemic or threatened species, and wildernesses needed by migratory species which are of social, economic, cultural or scientific importance – in line with the Convention on Biological Diversity.

Agricultural water use is of particular concern in arid and semi-arid regions where water is scarce, or where there is limited availability at some times of the year. An increase in irrigation for biocrop production could reduce water tables and levels in rivers and lakes leading, potentially, to salinization, loss of wetlands and loss of habitats as dams and reservoirs are created to supply irrigation requirements. The competition for water in the more arid parts of the world between agriculture, urban land uses and natural ecosystems has been increasing for some years.

WWF also highlights the potential impacts of an increasing use of pesticides and fertilisers in biocrop production, leading to potentially serious discharges of contaminated effluent.

The increased use of irrigation, agrochemicals and industrial-scale harvesting equipment can degrade fertile soils. Soil erosion is a particular problem in regions with limited soil cover with long, dry seasons followed by monsoonal rains.

By contrast, however, perennial bioenergy crops have the potential to improve soils and help reduce erosion by creating year-round soil coverage.

In their most recent communication on the subject, the European Commission ([11] EC, 2006) stated: "It is clearly essential to design biofuel promotion policies so that they continue to contribute to sustainability in future, in particular if biofuel use is to increase by an order of magnitude beyond today's levels."

Assuring the Sustainability of Biofuels

While legal requirements for current agricultural practices may limit negative environmental impacts in many countries, most stakeholders recognise that an additional level of international assurance is needed to guard against negative impacts and to make sure the nascent industry maintains credibility and can benefit from a supportive policy environment.

An environmental assurance scheme could be effective in ensuring products are sourced from land where responsible management practices are employed, reducing the risk of harm to ecosystems and natural resources. However, experience of such schemes in the context of forestry has shown that they have limited impacts on land-use decisions outside of specific designated areas and, thus, are not a substitute for good governance and regulation for environmental protection, but can complement and strengthen the governing/regulatory environment.

There are already a range of assurance schemes in the agricultural and forestry sectors that can play a role in assuring the environmental integrity of biofuels, but the most important of these schemes are focused on food safety rather than the environmental impacts ([7] LowCVP, 2006).

As a consequence of the current absence of fully effective schemes capable of guarding against negative or harmful environmental impacts arising from the growth of biofuels, some countries are working on measures to better safeguard the environment. The UK has been at the forefront of these initiatives, introducing environmental safeguards into national legislation introduced to enforce the introduction of transport biofuels.

Biofuels – the UK Context

In the UK, the main policy mechanism for meeting the EU's Biofuels Obligation ([1] European Commission, 2003) is the Renewable Transport Fuel Obligation (RTFO). The RTFO requires suppliers of transport fuels to ensure that 5 % (by volume) of all fuel supplied to the market comes from renewable sources by 2010/11.

Following pressure from the LowCVP, a stakeholder organisation representing over 230 organisations with a role or representative interest in the low carbon transport agenda (including some environmental NGOs) the UK Government included in the RTFO a requirement that *all suppliers must report on the* *greenhouse gas savings and broader sustainability of the fuel they supply*.

An earlier report into the feasibility of introducing an environmental assurance scheme into the RTFO had concluded that the introduction of a mandatory reporting scheme can be developed to a timescale consistent with the introduction of the Obligation and that the introduction costs would be low for Government and fuel suppliers and negligible for the consumer. It also concluded that the scheme would not act as a trade barrier and would be permissible under trade rules ([12] DfT, 2005).

The report commented that without a policy mechanism linked to GHG certification, there would be little incentive for producers to supply renewable transport fuels with lower GHG balances because those with higher balances will, in many cases, be cheaper.

One significant recommendation was that a criterion on avoiding deforestation should be considered for inclusion as part of GHG certification. This is considered an important concern as it is well known that certain land-use changes – and, particularly, deforestation – could negate any greenhouse gas benefits from biofuels grown on that land for many years.

The wide range of environmental outcomes resulting from land-use changes to grow biofuel crops is noted by the European Commission: The Commission's latest communication states that land-use change to biofuels production can be positive (as it would be, for example, if sugar cane plantations replaced degraded pasture land), largely neutral (where biofuel demand leads to higher yields from areas that are already cultivated) or severely negative (for example, if soybean cultivation replaced rain forest) ([13] EC, 2006).

A CARBON AND SUSTAINABILITY REPORTING SCHEME FOR BIOFUELS WITHIN THE RTFO

The UK Government has concluded that for the first phase of the RTFO (2008-11) a mandatory carbon and sustainability reporting scheme will be introduced. It will initially, however, be permissible to submit 'not known' responses in order that reporting cannot act as a de facto trade constraint. This is because it may be harder to provide information for fuels sourced from overseas, particularly on the spot market. There will be no exclusion of fuels or feedstocks irrespective of how they have been produced, thereby avoiding potential challenge through the World Trade Organisation.

For its effectiveness the scheme therefore relies upon the pressure bought through the publication of annual company reports and comparative assessments of performance undertaken by the RTFO Administrator.

The system will require obligated companies to complete both monthly and annual reports. The information covered will include: GHG savings of the fuels supplied and the methods used to calculate the results; details of the origin of the fuels; details of the environmental standards observed in the cultivation of processing of crops; and details of land-use change.

On an annual basis, reports will be submitted that aggregate the monthly data and will additionally require companies to report on the activities they are undertaking to improve both their data capture and sustainability performance. Annual reports are expected to be publicly available and will be independently verified.

Technical guidance will be produced to enable companies that are obligated to report on their biofuel supplies to comply with the reporting requirements of the RTFO. The guidance is being piloted by a number of companies in Spring 2007.

CARBON REPORTING METHODOLOGY

Carbon reporting will enable market actors to distinguish between fuels on the basis of their carbon intensity. Stakeholder pressure will have the potential to create an incentive for companies and other market actors to produce or purchase the least carbon intensive fuels. It is possible that the UK Government may seek in future to incentivise the least carbon intensive fuel production by linking the award of Renewable Transport Fuel Certificates with the carbon intensity of a fuel.

Carbon reporting under the RTFO will also enable the Government to monitor the GHG savings resulting from its policy of promoting biofuels.

The primary objectives of a carbon reporting scheme are that it:

- Encourages and facilitates reporting which accurately represents the actual fuel chains companies are using.
- Is simple to use and is capable of assessing the GHG emissions from different fuel chains with a range of characteristics ([15] E4Tech, 2006).

The detailed methodology and calculations for fuel chains that are expected to represent significant biofuels volumes in the early stages of the RTFO are now being developed based on the report by E4Tech. These include the following production pathways:

- Ethanol from: sugar cane, sugar beet, wheat and corn
- Ethanol converted to ETBE
- FAME biodiesel from: tallow, used cooking oil, palm oil, soy and rapeseed
- Biomethane from anaerobic digestion of MSW and manure

The system boundaries for analysing life-cycle emissions are now in the process of development to define the scope of the reporting system. These are detailed in the following chart. To simplify the system, it is proposed that some of the emissions associated with the fuel pathways are not reported because they are not likely to represent a significant contribution to overall GHG emissions resulting from biofuel production. These include: GHG emissions associated with the manufacture or maintenance of machinery or equipment used in the production of feedstocks, in their conversion to biofuels or in their transport; and emissions of the three GHGs: perfluorocarbons, hydrofluorocarbons and sulphur hexafluoride.

The aim is to create a practical and credible reporting system through the use of default values that provide estimates of the carbon intensity of the fuel chain. An international expert group was assembled to produce default values which have been peer reviewed by stakeholders. At the simplest level fuel default values will provide conservative estimates of GHG savings. If the feedstock is known, a more precise default value can be used.

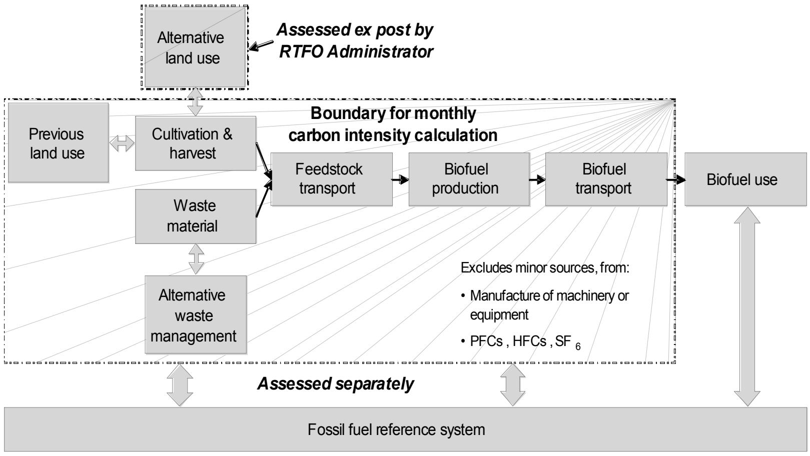

Figure 1 (Source: [15] E4Tech, 2006)

If additional qualitative information about the origin and process of production a typical default can be calculated – for example, where a company has considerable knowledge of its supply chain – a more detailed calculation can be made.

The carbon intensity calculation allows different fuel chains to be compared on a like-for-like basis. It is recognized, however, that the impacts of land use change may serve to nullify any savings the fuel offers in comparison with its fossil alternative. Therefore the calculation will include any emissions associated with land use change where information on land use in 2005 has been provided (through the requirements of the wider sustainability criteria). Default values for specific land use changes within countries will be developed based on IPCC guidelines, in order to provide a practical approach. Where information has not been provided an ex-post analysis conducted by the Administrator will provide indications of the potential emissions had certain land use changes occurred.

Initial experience with proposals for GHG calculation methods suggests that once information is requested of actors in the biofuels supply chain, they are able to respond. The Home Grown Cereals Authority has, for example, developed a simple tool that can be used by farmers to calculate emissions from cultivation and the early indications are that farmers are able to operate the system and provide the detailed data required.

REPORTING ON SOCIAL AND ENVIRONMENTAL SUSTAINABILITY

In addition to reporting the carbon intensity of the fuels supplied, the UK Government also aims to encourage the supply of biofuels which meet broader sustainability criteria. The framework for Sustainability Reporting is being developed through a parallel project.

The wider sustainability principles will cover:

- carbon storage (above and below ground)
- biodiversity conservation
- soil conservation
- sustainable water use and
- air quality

The full details of the specific indicators which underlie each principle are covered in a report by Ecofys for the UK's Department for Transport ([14] DfT, 2006).

The scope of the sustainability reporting scheme will focus on the plantation or farm level rather than the full biofuel production chain. The majority of sustainability risks are present at the farm level and this focus is also in line with the existing standards on which the scheme will be based.

The objective is to develop a 'meta-standard' which builds upon and strengthens existing assurance schemes that are already present in the UK and internationally. Several of the existing standards for agriculture and forestry are so-called 'farm-gate' standards: they deal with activities within the farm. Extending the scope of the biofuels sustainability scheme beyond the farm gate would make rapid implementation of a meta-standard more difficult ([14] DfT, 2006). After the initial phase of the RTFO (2008-11) it is proposed that the administrators reassess the scope, or boundaries, of the sustainability criteria.

The standards that have been benchmarked against the defined sustainability criteria are listed below. Additional standards may be benchmarked by the RTFO Administrator at the request of fuel suppliers.

- The Assured Combinable Crops Scheme
- EurepGAP
- LEAF Assurance Scheme
- Rainforest Alliance/Sustainable Agricultural Network Farm Assurance Standard
- The Roundtable on Sustainable Palm Oil Standard (RSPO)
- The Basel Criteria (draft standards for soybean cultivation) – to become the Round Table on Responsible Soy
- Forest Stewardship Council
- International Federation of Organic Agriculture Movements (IFOAM)

No scheme presently measures the carbon intensity of feedstock but several of these schemes, including LEAF and those operated by the Rainforest Alliance, fully address the environmental criteria listed above. The RSPO and Basel Criteria (Soy) also address most concerns. The principal European schemes for cereals are mainly designed for food safety but address some of these issues.

Only a small proportion of feedstock is presently covered by the most comprehensive schemes but by encouraging producers to operate to these standards, uptake of the schemes should grow. For example, the UK reporting scheme will require companies supplying palm oil to state the proportion sourced from RSPO compliant plantations. Thus it is hoped that UK producers of biodiesel from palm oil will buy from more sustainable suppliers and drive demand for RSPO compliant product. By working with existing schemes that do not cover the criteria it is hoped the range can be extended for biofuel feedstock producers.

By-products used for biofuel production represent significantly reduced sustainability risks and reporting on environmental and social standards will not be applicable ([14] DfT, 2006).

If this overall approach is successful it should lead to the use of more sustainable fuels, as defined by the RTFO.

International Implications

The internationalisation of biofuels sustainability schemes along the lines of the standards being developed in the UK is a clear aim of stakeholders in the LowCVP. The development of the UK principles for the RTFO carbon and sustainability reporting are the subject of regular discussions with the Dutch Government which has also taken an active interest in this area. The two governments aim to align the technical principles for the carbon calculation methodology, where possible. In addition the UK has worked on the development of environmental criteria in collaboration with a Dutch working group.

There are a number of initiatives being developed to address sustainability issues surrounding biofuels. These include: the IEA Taskforce; the Swiss Federal Institute; UNEP + Daimler Chrysler 2005 initiative; UNFCC and EU-South Africa Taskforce; also government initiatives in the, Netherlands, Germany and Brazil. All are exploring biofuels certification. Any initiative is likely to depend on the successful development and implementation of standards for biofuel feedstocks. The Better Sugarcane Initiative, Round Table on Responsible Soy etc. are in the early stages of development and depend largely on adequate resourcing. Governments and companies wishing to source sustainable biofuels should support these most promising initiatives to ensure their implementation.

The LowCVP has proposed the establishment of a multi-stakeholder forum to take forward the development of an EU-wide sustainability assurance scheme for biofuels, funded through the Commission Services. A part of the role of this group would be to propose whether such an EU-wide scheme should be voluntary or mandatory as well as the precise requirements under which it should operate.

The European Commission has announced that it will explore biofuels certification in its review of the Biofuels Directive. The introduction of an EU-wide scheme would offer a number of benefits. These would include reducing costs and administration through the harmonisation of biofuel environmental standards and, thus, strengthening the single market. The creation of such a large market with consistent, regulated standards for biofuels would encourage more international suppliers to comply with the standard. It would also help to encourage existing agricultural and biofuel assurance schemes to address the full range of environmental concerns raised by biocrop cultivation.

It is important to recognise that there are limitations to the scope of any assurance scheme. Macro issues such as 'leakage' or indirect land-use change cannot be successfully managed through a biofuels assurance scheme. The development and use of the Forest Stewardship Council has not stopped deforestation, for example. Such issues are more successfully managed at the international scale with co-operation at the government level. Proper land use planning and enforcement with suitable monitoring capability is required.

Conclusions

Most developed country governments (including the EC and the US) have concluded that the introduction of biofuels is one of the most promising technical measures with the greatest potential to cut greenhouse gas emissions from transport sector - and the only currently available measure that decreases transport's reliance on oil. A recent European Commission communication, for example, says that biofuels introduction has the potential to cut oil dependence of transport in Europe by 43 mtoe by 2020; easily the largest single measure and equivalent to about a third of the savings from all potential measures put together ([11] EC, 2006).

There is much convincing evidence, however, that the large-scale introduction of biofuels for transport use carries significant risks of environmental damage including valuable eco-system destruction, soil degradation and water resource depletion. Moreover, biofuels will not necessarily deliver the greenhouse gas savings that are one of the main forces driving their introduction. Energy intensive production and distribution processes and the use of nitrous oxides in fertiliser to grow biocrops can significantly reduce – or even completely eliminate –greenhouse gas savings from biofuel use. Land-use change, too, can impact on the GHG balance, particularly where natural forest is cleared for biofuel uses.

Research and trials in the UK show that environmental sustainability and carbon accreditation schemes are feasible, do not need to add significantly to costs borne by government, industry or consumers and can help to ensure that biofuels deliver a net environmental benefit as well as making a contribution to climate change mitigation.

The schemes need to be further developed and tested in practice. Further discussions need to take place with the aim of introducing similar schemes in other countries and, ideally, with a high degree of consistency in their requirements. Future policy may use environmental performance of particular biofuels to provide incentives for the adoption of best practice and to encourage the introduction of biofuel pathways that deliver the greatest GHG savings in the most environmentally benign ways.

Without schemes for environmental accreditation and carbon certification there is a high risk that the industry could flounder if evidence of environmental damage from biofuel production becomes apparent and policy makers decide to reduce the obligatory mechanisms and financial subsidies that are now stimulating biofuel developments.

In the longer term, the certification and accreditation debate is likely to be extended to other energy (and wider product) pathways as governments seek to safeguard the environment and to stabilise climate change. Schemes introduced to provide confidence in the environmental integrity of biofuels may form a basis of future schemes designed to evaluate the full life-cycle impacts of products in other areas.

THE LOW CARBON VEHICLE PARTNERSHIP

The Low Carbon Vehicle Partnership is a UK-based action and advisory group, established in January 2003 to take the lead in accelerating the shift to low carbon vehicles and fuels in the UK. The LowCVP is a partnership of organisations with a clear stake in the low carbon shift, including those from the automotive and fuel industries, government, academia and the environmental sector. Leading initiatives of the LowCVP include the 'brokering' of the introduction of a new, colour-coded fuel economy label for new cars and leadership on the development of environmental standards for biofuels. The LowCVP is a central pillar of the UK Government's Powering Future Vehicles Strategy (2002).

Annex 1: Biofuels in the EU Member States, 2003-2005

Member State	Biofuel share 2003 (%)	Biofuel share 2004 (%)	Biofuel share 2005 (%)	National indicative target 2005 (%)
Austria	0.06	0.06	0.93	2.50
Belgium	0.00	0.00	0.00	2.00
Cyprus	0.00	0.00	0.00	1.00
Czech Republic	1.09	1.00	0.05	3.70[1]
Denmark	0.00	0.00	no data	0.10
Estonia	0.00	0.00	0.00	2.00
Finland	0.11	0.11	no data	0.10
France	0.67	0.67	0.97	2.00
Germany	1.21	1.72	3.75	2.00
Greece	0.00	0.00	no data	0.70
Hungary	0.00	0.00	0.07	0.60
Ireland	0.00	0.00	0.05	0.06
Italy	0.50	0.50	0.51	1.00
Latvia	0.22	0.07	0.33	2.00
Lithuania	0.00	0.02	0.72	2.00
Luxembourg	0.00	0.02	0.02	0.00
Malta	0.02	0.10	0.52	0.30
The Netherlands	0.03	0.01	0.02	2.00[2]
Poland	0.49	0.30	0.48	0.50
Portugal	0.00	0.00	0.00	2.00
Slovakia	0.14	0.15	no data	2.00
Slovenia	0.00	0.06	0.35	0.65
Spain	0.35	0.38	0.44	2.00
Sweden	1.32	2.28	2.23	3.00
UK	0.026[3]	0.04	0.18	0.19[4]
EU25	**0.5%**	**0.7%**	**1.0% (estimate)**	**1.4%**

(Note[1] - Source:[11] EC, 2006)

Annex 2: European Commission: Greenhouse Gas Emissions from Transport Fuels

Estimated greenhouse gas emissions from transport fuels, EU (mid-range estimates of the cost of the cheapest biofuel production techniques) – well-to-wheel analysis of individual fuels compared with diesel or petrol.

	greenhouse gas emissions ($tCO2_{eq}$/toe)	expected saving 2020 (%)
diesel	*(3.65)*	
biodiesel from rape	1.79	51%
biodiesel from soy	2.60	29%
biodiesel from palm	1.73	53%
BTL from straw	n.a.	n.a.
BTL from farmed wood	0.27	93%
petrol	*(3.62)*	
ethanol from sugar beet	2.17	40%
ethanol from wheat	1.85	49%
ethanol from sugar cane	0.41	89%
cellulosic ethanol from straw	0.33	91%

(Source:[13] European Commission, 2006)

Annex 3 – Principles and Criteria for a draft standard for biofuel production

Principles and Criteria for a draft standard for production of biofuel crops

* *Conservation of carbon stocks*
  – Protection of above-ground carbon
  – Protection of soil carbon
* *Conservation of biodiversity*
  – Conservation of important ecosystems & species
  – Basic good biodiversity practices
* *Sustainable use of water resources*
  – Efficient water use in water critical areas
  – Avoidance of diffuse water pollution
* *Maintenance of soil fertility*
  – Protection of soil structure and avoidance of erosion
  – Maintain nutrient status
  – Good fertiliser practice
* *Good agricultural practice*
  – Use of inputs complies with relevant legislation
  – Use of inputs justified by documented problem
  – Safe handling of materials
* *Waste management*
  – Waste management complies with relevant legislation
  – Safe storage and segregation of waste

([7] LowCVP, 2006)

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Abbreviations

BIOFRAC – Biofuels Research Advisory Council
CONCAWE – Conservation of Clean Air and Water in Europe (An organisation of European oil companies)
DDGS – Distillers' dark grains and solubles
DfT – Department for Transport (UK)
DTI – Department of Trade and Industry (UK)
GHG – Greenhouse gases
JRC – Joint Research Centre of the European Commission
LowCVP – Low Carbon Vehicle Partnership
Mtoe – Million tonnes of oil equivalent
RTFO – Renewable Transport Fuel Obligation

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