Feasibility study on certification for a Renewable Transport Fuel Obligation

Final report

June 2005

Prepared by E4tech, ECCM and Imperial College London

E4tech

ECCM
The EDINBURGH CENTRE for CARBON MANAGEMENT Ltd

icept

Authors

E4tech: Ausilio Bauen, Jo Howes and Adam Chase

ECCM: Richard Tipper, Aino Inkinen and Jessica Lovell

Imperial College London: Jeremy Woods

Contact

Ausilio Bauen
E4tech (UK) Ltd
46 Prince's Gardens
London
SW7 2PE

bauen@e4tech.com

Executive Summary

A Renewable Transport Fuel Obligation (RTFO) is being considered as an instrument to increase the use of renewable transport fuels (RTFs) in the UK's road transport sector. The short-term objective of an RTFO will be to increase the share of biofuels towards the indicative target of 5.75% biofuels penetration (by energy content) by 2010 set in the EU Biofuels Directive (2003/30/EC).

This study addresses whether and how greenhouse gas (GHG), broader environmental and social assurance schemes should be linked to an RTFO. The report answers six key questions on the feasibility of linking environmental and social assurance to an RTFO.

1. Why should environmental and social assurance be considered in relation to an RTFO?

Growth in the use of RTFs as a result of an RTFO and growing global demand requires consideration of the sustainability of their production. Both the EU Biofuels Directive and the UK Energy Act 2004 stress the importance of understanding and considering climate and other environmental and sustainability implications in incentivising the uptake of RTFs.

Biofuels could lead to GHG emissions savings compared with fossil fuels ranging from negative to over 100% depending on the type of feedstock, the method of cultivation and the biofuel production processes employed. This is particularly true for bioethanol where significant differences in greenhouse gas emissions exist between different sources and production routes. The uncertainty in emissions from different biofuels and the unpredictability of sources of biofuel supply as global demand grows, result in significant uncertainty as to the level of GHG emissions reductions that could be achieved by an RTFO.

Other sustainability concerns include the effects of intensification and expansion of agricultural activities associated with energy crops, which could lead to negative environmental impacts on biodiversity, water resources, soil quality, air quality and landscape character.

Concerns are also voiced in relation to potential social impacts, in particular in developing countries. These relate mainly to issues such as child labour, forced labour, poor working conditions, and health and safety risks.

2. Can environmental and social assurance be incorporated within an RTFO without amending the Energy Act or leading to challenge under EU Single Market or international trade rules?

Conclusion: Linking GHG certification to an RTFO could be legally justifiable in the UK, European and WTO context.

Legal advice sought during this study indicates that linking GHG certification to an RTFO is believed to be legally justifiable in the UK context, as the Energy Act 2004 indicates GHG emissions reductions as a principal objective of an RTFO and states that provisions can be made to differentiate RTFs based on the GHG implications of

their production, supply or use. Therefore, the Energy Act would be unlikely to require modification to accommodate certification and linking it to an RTFO.

This is also compatible with the requirements of the EU Biofuels Directive – indeed certification will enable quantification of GHG savings (a reporting requirement of the Directive) in a manner not otherwise possible.

Also, it might be feasible to construct a GHG certification scheme which would be compatible with international trade rules, but this would require further careful thought in relation to the detailed design and implementation of such a scheme. It might also be possible to include provisions related to biofuels produced from deforested areas under a GHG certification scheme, as no GHG saving would result from crops grown in these areas.

This report emphasises the importance of GHG certification in relation to the effective operation of an RTFO and its compatibility with Government and RTFO objectives. It also provides recommendations on the design of a GHG certification scheme taking into consideration the requirements of international trade rules, in particular non-discrimination of like products from different countries.

Conclusion: Linking other environmental and social certification to an RTFO would be more susceptible to legal challenge internationally.

As avoiding other environmental impacts of RTFs is also a policy objective of both an RTFO and the Biofuels Directive, a case could be made for linking an environmental assurance scheme to an RTFO. However, for several environmental areas, mandatory pass/fail criteria, rather than voluntary criteria linked to incentives, would be necessary (e.g. implementation of conservation plans, exclusion of GMO crops). Linking mandatory environmental criteria to an RTFO would greatly increase the risk of international legal challenge to the policy as a whole. It would be more difficult to demonstrate that broader environmental certification is necessary for the effective functioning of an RTFO, compared with the need for GHG certification. It is also more difficult to define precise criteria based on scientific evidence which would be regarded as non-discriminatory and internationally acceptable.

Linking trade measures to compliance with social assurance schemes is an area of considerable sensitivity within the WTO and other international fora. At present, we consider linking the operation of the RTFO to a mandatory or voluntary certification scheme requiring compliance with social criteria is not essential to satisfy the policy objectives being pursued. We believe that at the present time the introduction of such a scheme would be contentious and would add considerable complexity to the RTFO, which might render it susceptible to challenge. The legal position on linking social standards to an RTFO may evolve in time, in particular following the outcome of the international consensus building activities currently underway through ISO 26000 and other bodies.

3. Should environmental and social assurance be a key component of an RTFO?

Recommendation: GHG certification should be a key component of an RTFO, to ensure that the policy objective of reducing greenhouse gas emissions is met –

assuming the scheme can be developed in a manner consistent with international trade rules.

GHG certification is the process by which a product or service is delivered with a formally declared carbon intensity, which is a measure of the amount of GHGs produced expressed in units of CO_2 equivalent. The declared carbon intensity of each could be linked to the number of RTFO certificates issued.

GHG certification should be a key component of an RTFO for four principal reasons:

1. The uncertainty over GHG emissions from different biofuel sources and production processes means that without GHG certification it would be difficult to quantify the GHG savings resulting from the increase in biofuel use. It also means that it would be difficult to assess the contribution of RTFs to national GHG emissions reductions targets, and fulfil the reporting requirements under the EU Biofuels Directive.
2. The uncertainty over the level of emission reductions means that there is a risk of the RTFO being discredited if it were found not to deliver significant GHG emissions reductions.
3. In the absence of a policy mechanism linked to GHG certification, there would be no incentive to supply RTFs with lower GHG balances as opposed to RTFs with higher GHG balances, which will in many cases be cheaper.
4. Cheaper fuels may correspond to higher GHG abatement costs. The LowCVP Wheat to Ethanol Report shows that more efficient and renewably fuelled plants result in lower GHG abatement costs. Therefore, incentivising biofuel volumes alone may be a particularly inefficient way of achieving GHG emissions reductions.

Recommendation: Other environmental and social criteria should be covered by a separate voluntary scheme, developed by industry stakeholders, but not directly linked to the RTFO.

Environmental issues, such as biodiversity impacts, and social issues, such as labour practices, whilst recognised as being important would add considerable complexity to the scheme, making it potentially more onerous for trading partners to comply with, and would be difficult to justify as essential to the operation of an RTFO. A voluntary scheme could draw upon existing environmental assurance schemes, and upon the results of the emerging international consensus on social assurance currently being developed through ISO 26000 and other bodies. To ensure that an RTFO does not lead to sustained negative environmental and social impacts, a timetable should be set for review of this area to determine whether some of these environmental and social criteria could be linked to an RTFO in the future.

4. How could greenhouse gas assurance be linked to an RTFO?

Recommendation: RTFO certificates should be issued based on GHG savings determined though a standardised GHG certification system.

The recommended methods for GHG certification involves developing accepted industry standards for fuel carbon intensity, where the fuel's carbon intensity is calculated from a combination of verified process data, provided by the fuel producer/supplier, and of default values, developed by an independent methodology unit. Such a system provides flexibility in the amount of information and data to be provided. At the same time it would reward the provision of information and data demonstrating GHG emissions reductions relative to default values. Tools would be developed to enable suppliers to readily calculate the carbon intensity of the specific production chain. RTFO certificates would then be issued based on the GHG saving relative to appropriate fossil fuel baselines.

Linking RTFO certificates to GHG savings has a number of important benefits:

1. It provides a direct link between the policy mechanism and the policy objective of GHG reductions, ensuring that the latter is met
2. It provides an efficient market based mechanism for achieving GHG reductions through the introduction of RTFs – this will result in the lowest GHG abatement costs in relation to RTFs
3. It stimulates the development and implementation of techniques and technologies that reduce GHG emissions (e.g. efficient use of agrochemicals, efficient conversion processes, use of lower carbon intensity fuels in processing, new feedstocks and conversion technologies with higher yields and greater GHG savings) and result in additional environmental benefits e.g. reduced emissions of other pollutants.

Furthermore, stakeholders such as NGOs and oil companies are interested in assessing the environmental performance of biofuels, in particular in relation to GHG reductions. A GHG certification scheme linked to an RTFO will provide a standardised and transparent way of quantifying these impacts.

Recommendation: A criterion on avoiding deforestation should be considered for inclusion as part of GHG certification – assuming this can be done in a manner consistent with international trade rules. This could exclude fuels produced from feedstocks that have been grown on land deforested within a defined timescale.

Avoiding deforestation and the negative impacts of other land use changes are also priorities in ensuring that biofuels are produced sustainably. Calculation of the release of carbon stored where land use is changed is complex, and the subject of significant scientific uncertainty. This uncertainty makes these emissions difficult to robustly quantify within carbon intensity calculation. However, it is known that emissions from certain land-use changes (such as deforestation) may be considerably greater than those from the rest of the fuel chain, and so could negate the benefits of biofuel production for many years. On this basis it may be legitimate to exclude fuels that have been grown on land deforested within a defined timescale. The proposed approach would be to define a base-year and require suppliers to certify that fuels had not been produced upon land deforested since the defined date. Verification that land use change has not occurred can be effectively carried out using data from satellite images. A sampling regime could be devised to ensure that a sufficiently high proportion of producer areas were covered to avoid any significant incidence of fraudulent reporting. Most sources of current biofuel production are not likely to be affected by the introduction of a reasonable cut-off date, but the approach would ensure that biofuel production does not lead to deforestation as demand grows.

5. What are the implications of not linking greenhouse gas assurance to an RTFO?

Conclusion: Not linking GHG certification to RTFO certificates is likely to have important negative effects on: i) the GHG emissions reductions achieved by an

RTFO, ii) the development and use of efficient and low-GHG feedstocks, cultivation methods and conversion processes, and iii) the value and cost effectiveness of an RTFO as a policy mechanism.

As previously mentioned, if RTFO certificates are not linked to GHG savings, there will be no incentive to supply fuels with lower GHG emissions as opposed to those with higher emissions. Furthermore, as demand for biofuels increases, the unpredictability of the sources of biofuels and the probability of pulling high carbon intensity biofuels into the supply will also increase.

Fuel suppliers would source RTFs from the lowest cost sources. Initially, this is likely to be Brazilian bioethanol, which has a generally good GHG balance. However, with increasing competition for Brazilian bioethanol, bioethanol will be sourced from a variety of alternative low cost sources, with comparatively low GHG savings. Most biodiesel use in the UK to 2010 could be supplied from domestic production plants, giving a reasonable degree of certainty on the emissions from the conversion process. However, a large fraction of production is already based on imported vegetable oils and future production will increasingly depend on these, with uncertain implications for GHG emissions levels.

In the absence of GHG certification, there will be no incentive to adopt practices and technologies to produce RTFs with low GHG emissions. This means that in the short term, there will be no incentive to improve cultivation practices, or use energy efficient processes or low-carbon fuels to fuel them. Competition on price alone will not provide any advantage to companies and countries developing and investing in low-carbon processes and technologies, which is likely to hinder their introduction. For the longer term, it would be difficult to justify investment in new technologies such as lignocellulosic ethanol production, Fischer-Tropsch biodiesel production, waste to RTF routes, and renewable hydrogen. The introduction of these technologies is important since they: i) achieve higher greenhouse gas savings, ii) enable more fuel to be produced from the same land area and with a potentially lower impact upon the environment, and iii) may enable a higher content of renewable transport fuels to be used in vehicles.

Without GHG certification, it will not be possible to quantify accurately the GHG savings achieved from an RTFO. It will not be possible to determine the contribution of an RTFO to reducing emissions from road transport and its contribution to national GHG emissions reductions targets. Also, not developing a link between GHG certification and RTFO certificates will forego an efficient mechanism for minimising the cost of GHG abatement from RTFs.

It has been suggested that an alternative option for monitoring GHG emissions reductions from an RTFO would be to require each supplier to report on the overall emissions of their biofuels portfolio. The priority of suppliers under this alternative option would be the supply of biofuel volumes to meet the obligation, irrespective of their GHG emissions. GHG reporting would impose a separate and possibly conflicting requirement on suppliers. Separating GHG reporting and targets from certificate allocation will result in a less economically efficient mechanism for reducing GHG emissions. Inflicting penalties on suppliers, and in the extreme case rejecting the suppliers’ certificates, based on reporting requirements would impose a very high risk on the suppliers. Also, the alternative option would not be any simpler to manage as it is likely to require a standardised reporting and verification system similar to that for certificate allocation based on carbon intensity.

6. Can an effective assurance scheme be implemented in a reasonable timescale and at a reasonable cost?

Conclusion: A simple, transparent and verifiable GHG certification scheme can be developed in relation to an RTFO. The cost of the system would be low for government and fuel suppliers, and negligible for the consumer. The timescale for development of a GHG certification system would be consistent with that for the introduction of an RTFO.

A methodology, tools and guidance would need to be developed to ensure consistency of calculation and certification of GHG emissions. Companies would be expected to self-report using such tools and have records audited to demonstrate claims are valid. Calculation tools should be designed so as to assist with verification. The initial cost of establishing the tools and default factors is likely to be in the range of £200 to £300k. The overall establishment cost could be of the order of £0.5m. However, once established the annual cost of reviewing and updating evidence would be substantially reduced; to perhaps around £50k per year.

The annual cost to government for administering the scheme could be minimal and limited to a periodic review of the scheme and spot checks on compliance. The administrative and compliance costs could be minimised by development of standard tools, requirements for self-reporting, automatic data checking and penalties for misreporting to discourage fraud.

The costs of data collection and verification are not expected to have a significant impact on the economics of biofuels operations in the UK or abroad. Assuming fuel suppliers passed verification costs onto the consumer, the cost to the consumer of linking GHG certification to an RTFO would be imperceptible, estimated to be of the order of 0.02p/l of biofuel (equivalent to 0.001p/l of petrol with a 5% biofuel blend).

A scheme could be developed and piloted within 18 months - a timescale consistent with introduction of an RTFO. Therefore, it is recommended that if GHG certification is to be linked to an RTFO, this should be done from inception. This would send the correct policy signals and avoid later disruption of the RTFO certificate market when GHG certification was introduced.

Contents

List of figures

List of tables

Acknowledgements

The authors would like to thank the following members of the project steering group: Greg Archer (LowCVP), Aaron Berry (DTI), Lucy Bjorck (RSPB), Malcolm Fergusson (IEEP), Sue Finlay (DEFRA), Bob Saunders (BP), Konstanze Scharring (LowCVP), Ian Waller (Petroplus), Malcolm Watson (UKPIA) and Clare Wenner (British Sugar), and also Ivan Smythe (DTI), Justine Sefton (DfT), Emma Squire (DTI) and Chris Nicholls (DEFRA).

1 Introduction

This report presents the findings of a feasibility study on linking greenhouse gas, broader environmental and social assurance schemes to a proposed Renewable Transport Fuels Obligation (RTFO).

The mechanism to introduce an RTFO was included within the Energy Act 2004. An RTFO would promote the use of renewable fuels in road transport, by requiring road transport fuel suppliers to source a proportion of their fuel sales in the UK from renewable transport fuels (RTFs). Suppliers would do this through being provided with renewable fuel certificates. These would be issued when a renewable fuel was supplied onto the market, and could be traded.

Growth in the use of RTFs as a result of an RTFO and growing global demand requires consideration of their impacts at all points of the production chain. Both the EU Biofuels Directive and the UK Energy Act 2004 stress the importance of understanding and considering climate and other environmental and sustainability implications of incentivising the uptake of RTFs.

Greenhouse gas savings from the use of RTFs, compared with conventional fuels, vary significantly by specific fuel type and production pathway. Biofuels normally emit less greenhouse gases overall than mineral petrol or diesel since the biomass from which they are manufactured absorbs carbon dioxide as it grows. However, there are greenhouse gas emissions associated with the energy used in cultivation, processing and transport of the fuels. Different pathways for biofuel production achieve greenhouse gas savings compared with conventional fuels from significantly positive (including some values over 100%, where useful coproducts such as electricity are produced) to negative (i.e. worse than the fossil fuel they replace – for example if fossil fuels and inefficient processes are used in their production).

Steps in the RTF production chain, such as cultivation and processing of biofuels, can also lead to a range of other environmental effects. These include loss of biodiversity and habitats, soil degradation and increased water, fertiliser and pesticide use. Negative social impacts that might be associated with RTF production are also to be avoided, including child labour, forced labour, poor working conditions, and health and safety risks.

Assurance schemes could be used to ensure greenhouse gas emissions reductions are achieved, and that negative environmental and social impacts are avoided. Furthermore, assurance schemes should maximise the environmental and socio-economic benefits that could result from the development of RTFs, biofuels in particular. The assurance schemes could be linked to an RTFO, for example, through awarding RTFO certificates in increments, with RTFs with lower greenhouse gas emissions being issued a correspondingly higher level of certificates.

For the purpose of this study the following definitions have been used when describing assurance schemes:

- An ‘assurance scheme’ is the overall framework relating to the development of a standard, the accreditation of certification bodies, and the certification of products and services.

- A ‘standard’ refers to principles and criteria to be used consistently as guidelines, rules, or definitions of characteristics to ensure that materials, products, processes and services meet their purpose. The ‘standard’ will also define indicators and methods that are used to measure compliance with principles and criteria.
- ‘Accreditation’ refers to the formal recognition by a specialised body – an accreditation body – that a certification body is competent to carry out certification.
- ‘Certification’ refers to the issuing of written assurance by an independent, external body – a certification body – that has audited an organisation’s management system and verified that it conforms specifically to the standard.

This report develops options and recommendations for linking assurance schemes to an RTFO. It aims to answer several key questions:

1. Why should environmental and social assurance be considered in relation to an RTFO?
2. Can environmental and social assurance be incorporated within an RTFO without amending the Energy Act or leading to challenge under EU Single Market or international trade rules?
3. Should environmental and social assurance be a key component of an RTFO?
4. How could environmental and social assurance be linked to an RTFO?
5. What are the implications of not linking greenhouse gas assurance to an RTFO?
6. Can an effective assurance scheme be implemented in a reasonable timescale and at a reasonable cost?

2 Renewable transport fuels

There are a wide range of renewable energy sources and pathways through which RTFs can be produced. Table 1 provides an indication of the range of RTFs, and their sources, that may be introduced in the UK market in the period to 2020. An RTFO and any linked assurance schemes will need to be flexible enough to accommodate the introduction of a wide range of current RTFs, and those in development.

Table 1: Range of renewable transport fuels and their sources

Approximate timescale of commercial availability	Fuel	Possible source
To 2010	Biodiesel	Oil crops and wastes: Rapeseed, sunflower, soybean, palm oil, jatropha, waste vegetable oil, waste animal fats
	Bioethanol	Starch and sugar crops: Wheat grain, sugar beet, sugar cane, sorghum, corn
	Biogas	Organic wastes, wet energy crops
2010 – 2020	Biodiesel, bioethanol and biogas	As above
	Bioethanol	Lignocellulosic biomass: straw, wood, biodegradable municipal solid waste
	Fischer-Tropsch diesel	Lignocellulosic biomass: straw, wood, biodegradable municipal solid waste
	Hydrogen	Electrolysis of water using renewable electricity. Biomass feedstocks (lignocellulosic, wastes, wet feedstocks)

2.1 CO_2 emissions and savings from RTF production and use

Emissions from RTF feedstock production, processing and distribution chains vary greatly, depending on the specific fuel, the production process involved and related primary energy inputs, and potentially the biomass source and activities involved in its production.

Figure 1 provides an indication of the range of GHG reductions that can be obtained from different biofuels based on a review performed by the IEA (2004)[1]. It shows that reductions could range from 110% (where coproducts such as renewable electricity are generated in addition to fuel production) to minus 30% (as a result of inefficient fuel production). The values presented in the IEA study are in many cases best estimate values of GHG emissions from the literature reviewed, which means that the actual ranges are wider than those presented. Even one specific pathway for an RTF can produce a wide range of greenhouse gas savings compared with conventional fuels. A report produced by the LowCVP[2] provides an indication of the range of emissions that could result from ethanol production from wheat grain based on variations in the production process and the use of co-products. The emission savings range between 7% and 77% compared to a gasoline baseline. This range is wider than the range found in the IEA study.

[1] IEA (2004), Biofuels for transport – An international perspective, International Energy Agency, Paris
[2] LowCVP (2004), Well-to-wheel evaluation for production of ethanol from wheat, Low Carbon Vehicle Partnership, London

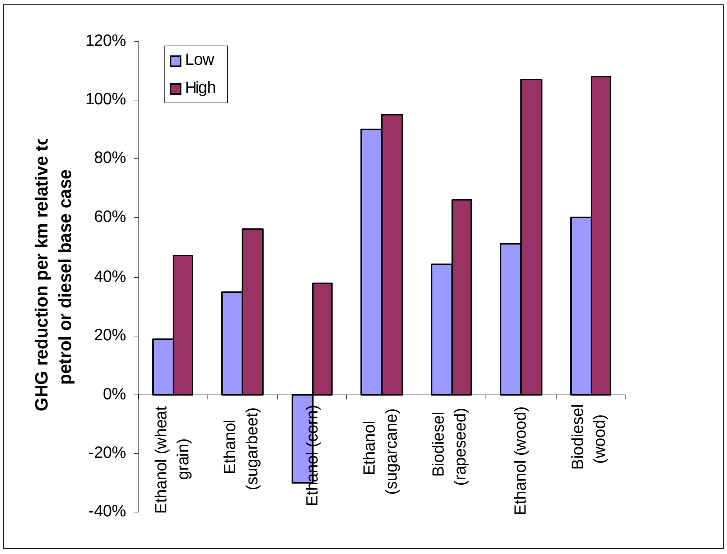


Figure 1 Liquid biofuel GHG emissions reduction ranges in the literature

In summary, GHG reduction values for biofuels relative to petrol and diesel alternatives range from negative to over 100%, although most studies indicate that biofuels can achieve positive GHG reductions. The ranges are dependant on location-specific crop characteristics and management, differences in conversion processes, the use of co-products and allocation of GHG emissions to their use.

The biofuel options presented in the figure do not represent the full range of options available. Biofuels could be produced from other sources, the implications of which, in terms of GHG emissions reductions, are less well known.

2.2 Sustainability of RTFs

While GHG emissions reductions and energy security may be the principal drivers behind the introduction of RTFs, the overall sustainability of their production needs to be considered and will be of concern to a range of stakeholders. Biofuels, like many other products, will raise a number of environmental and social issues.

The principal areas of concern in relation to the sustainability of biofuels are related to the intensification and expansion of agricultural activities associated with energy crops, which could lead to negative environmental impacts on biodiversity, water quantity and quality, soil quality, air quality and landscape character. Concerns are also voiced in relation to potential negative social impacts, in particular in developing countries. These relate mainly to the displacement of food products by energy crops and the exploitation of local populations.

There appears to be consensus that RTFs need to be produced to verifiable sustainability standards, although different priority issues are identified by different stakeholders.

2.3 Conclusion

The wide range of GHG emissions reductions that can result from the introduction of biofuels and the broader sustainability concerns associated with their production imply that assurance schemes are strongly desirable. There are several options for introducing environmental and social assurance schemes. Mandatory or voluntary assurance scheme could be linked to an RTFO or voluntary scheme independent of the RTFO could be operated by companies.

3 Policy and legal framework

The context for the introduction of an assurance scheme for renewable transport fuels is provided by the objectives and requirements of the EU Biofuels Directive and the UK Energy Act 2004.

3.1 EU Biofuels Directive

The reduction of greenhouse gas (GHG) emissions in the transport sector is the primary objective of the European Directive (2003/30/EC) on the promotion of the use of biofuels or other renewable fuels for transport. Other objectives are the promotion of "environmentally friendly security of supply" and renewable energy sources.

The Directive sets biofuels reference targets of 2% and 5.75%, on an energy content basis, of all petrol and diesel for road transport purposes to be achieved by 2005 and 2010, respectively.

The Directive states that "encouragement of the promotion of biofuels should be consistent with security of supply and environmental objectives and related policy objectives and measures within each Member State".

It states further that "in the measures that they take, the Member States should consider the overall climate and environmental balance of the various types of biofuels and other renewable fuels and may give priority to the promotion of those fuels showing a very good cost effective environmental balance, while also taking into account competitiveness and security of supply".

The Directive also mandates the Commission to produce a bi-annual report for the European Parliament and Council on the progress made in the use of biofuels and other renewable fuels in the Members States. The report should, amongst other things, cover: (i) "the life-cycle perspective of biofuels and other renewable fuels, with a view to indicating possible measures for the future promotion of those fuels that are climate and environmentally friendly, and that have the potential of becoming competitive and cost-efficient"; (ii) "the sustainability of crops used for the production of biofuels, particularly land use, degree of intensity of cultivation, crop rotation and use of pesticides"; (iii) "the assessment of the use of biofuels and other renewable fuels with respect to their differentiating effects on climate change and their impact on CO_2 emissions reduction". These requirements mean that measuring the carbon intensity of RTFs through carbon certification is entirely compatible with the Directive.

3.2 UK Energy Act 2004

The UK shares the EU's objectives of GHG reduction and promotion of energy security and renewable energy sources. The Energy Act 2004 gives the Secretary of State the power to, by order, impose a "renewable transport fuel obligation" on "each transport fuel supplier of a specified description". This order is referred to as an RTF order. The obligation is an obligation for the "supplier" to produce evidence "which shows that during the specified period the specified amount of renewable transport fuel was supplied at or for delivery to places in the United Kingdom"

A renewable transport fuel is defined as:
(i) biofuel,
(ii) blended biofuel,
(iii) any solid, liquid or gaseous fuel (other than fossil fuel or nuclear fuel) which is produced:

a) wholly by energy from a renewable source; or
b) wholly by a process powered wholly by such energy; or

iv) any solid, liquid or gaseous fuel which is of a description of fuel designated by an RTF order as renewable transport fuel.

An RTF order may make provision about how amounts of renewable transport fuel are to be counted or determined towards the discharging of an obligation. Provisions may relate, amongst other things, to fuel descriptions, specific substances, sources of energy, methods and processes.

Provisions can also be made for units of transport fuel of a specified description to count for more or less than the same units of transport fuel of other descriptions, and about how measurements in different units of different descriptions of transport fuels are to be aggregated.

Provisions can also be made on the effects of the production, supply or use of a fuel on (i) GHG emissions, (ii) agriculture, (iii) other economic activities, (iv) sustainable development or (v) the environment generally.

3.3 International trade issues and compliance with WTO rules

The essential consideration in linking assurance schemes to the RFTO is that they do not act as barriers to trade. In this regard, any assurance scheme linked to an RTFO will need to comply with World Trade Organisation (WTO) rules, in particular the General Agreement on Tariffs and Trade (GATT) and the Agreement on Technical Barriers to Trade (TBT).

GHG, other environmental and social impacts from biofuels depend on the production processes and methods associated with the biofuels. Certification schemes which relate to production processes and methods are an area of considerable contention within the WTO. Therefore, the development of certification schemes related to biofuels, and their integration within the RTFO, will need to be carefully considered. Also, linking mandatory or voluntary certification schemes to an RTFO will need to ensure that like products from different countries are not discriminated *de jure* or *de facto* i.e. explicit discrimination through law or implicit through burdensome legal requirements.

The rest of this section describes some of the key principles and guidelines that need to be considered in relation to international trade rules.

Article III of GATT introduces the ‘national treatment principle’, a key principle in relation to the WTO discipline of non-discrimination. The ‘national treatment principle’ requires that the products of other countries be treated the same way as like products manufactured in the importing country.

Two exceptions apply to Article III that are most relevant for environment-related measures:

"Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:…
(b) necessary to protect human, animal or plant life or health;
(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;"

No provisions exist within WTO agreements for linking trade with social issues and labour standards, and any attempt to make such linkages has so far been met with opposition. However, the International Organisation for Standardisation (ISO) has recently launched the Working Group on Social Responsibility with the task of publishing the ISO26000 standard on guidelines for social responsibility in 2008. They may represent a significant step forward in linking trade and social issues.

In the short-term, it is not likely to be possible to discriminate between like products based on social criteria, but it may be possible to discriminate between them based on environmental criteria if this is closely linked to a policy objective.

Any measure aimed at discriminating between like products would need to demonstrate:

- the necessity of the measure, based on scientific assessment
- a close relationship between the measure and the environmental objective
- that the measure adopted is the least trade restrictive measure to achieve the environmental objective
- that the measure adopted is not arbitrarily discriminatory, unjustifiably discriminatory or constitutes a disguised restriction on trade

An important issue related to the second bullet point above is the prominence within the RTFO legislation of the environmental objectives to be met by assurance schemes. This will affect what are considered to be the most justifiable options for assurance schemes aimed at meeting the objectives.

A clearer definition of what is meant by 'arbitrarily discriminatory, unjustifiably discriminatory or constitutes a disguised restriction on trade' in an environmental context comes from the 1998 Shrimp-Turtle case. Although the Appellate Body did not try to define these terms, it arguably defined a number of criteria for *not* meeting the tests including, for example, the following:

- A state cannot require another state to adopt specific environmental technologies or measures; — different technologies or measures that have the same final effect should be allowed.
- When applying a measure to other countries, regulating countries must take into account differences in the conditions prevailing in those other countries.
- Before enacting trade measures countries should attempt to enter into negotiations with the exporting state(s).
- Foreign countries affected by trade measures should be allowed time to make adjustments.

- Due process, transparency, appropriate appeals procedures and other procedural safeguards must be available to foreign states or producers to review the application of the measure.

Furthermore, the WTO Code of Good Practice for the Preparation, Adoption and Application of Standards should be followed. The Code states, for example, that:

- Where international standards exist or their completion is imminent, the standardizing body shall use them[3], or the relevant parts of them, as a basis for the standards it develops, except where such international standards or relevant parts would be ineffective or inappropriate, for instance, because of an insufficient level of protection or fundamental climatic or geographical factors or fundamental technological problems.
- Wherever appropriate, the standardizing body shall specify standards based on product requirements in terms of performance rather than design or descriptive characteristics.
- Early notification and regular updates of assurance schemes being prepared should be sent to the WTO.

In designing assurance schemes an assessment should be carried out in relation to potential discrimination *vis-à-vis* foreign producers resulting from:

- compliance procedures and cost
- levels of incentives provided as part of the assurance scheme

Compliance with international trade rules is a critical aspect of linking environmental assurance schemes to an RTFO, and will need to be carefully considered in their design and implementation.

3.4 Implications for linking assurance schemes to an RTFO

Both the EU Biofuels Directive and the UK Energy Act 2004 stress the importance of understanding and considering the overall climate and other environmental and sustainability considerations in incentivising the uptake of RTFs. They clearly mention environmental and other sustainability objectives and provisions, making it plausible to consider assurance schemes linked to RTFs for minimising potential negative environmental and social impacts and maximizing certain benefits (e.g. GHG reductions). International trade constraints mean that the assurance schemes linked to an RTFO would have to be carefully designed, but do not inherently rule out assurance for GHG savings or for wider environmental areas. For social issues, links between assurance and an RTFO would be likely to face opposition currently, although this may change after the ISO 26000 standards are developed.

[3] for example, see ISO14000 and ISO26000

4 GHG certification

The aim of this section is to establish whether carbon certification should be an essential component of an RTFO and to present the best approach for carbon certification and its link to an RTFO mechanism.

4.1 Definitions

GHG certification is the process by which a product or service is delivered with a formally declared carbon intensity. The process is normally based upon a standardised method that makes use of a combination of direct information provision or measurements and assumptions taken from the scientific literature.

Carbon intensity is a measure of the amount of greenhouse gas produced per unit of product over its lifecycle (or the major part of its lifecycle). Carbon intensity is normally expressed in units of CO_2 equivalent emissions per unit of product, taking into account other greenhouse gases such as methane and oxides of nitrogen that may be emitted.

4.2 Certification options

Three principal options for carbon certification were set out for consideration at the beginning of this study.

1. No carbon certification

2. Carbon certification based on default GHG emission values only.
   Two sub-options are considered:
   a. A single default value for each fuel type. The declared carbon intensity of each fuel type would be a single default value determined from a scientific review of fuel chain emissions. For example: bioethanol, biodiesel, biogas etc would each have their own, single, default value.
   b. Multi-tier of default values that can be adjusted to take account of different feedstocks and processing methods. The declared carbon intensity of each fuel would be determined using default values for different feedstocks, cultivation methods and conversion processes. For example, different carbon intensities would be determined for bioethanol from wheat produced in a plant with no CHP, compared with bioethanol from sugar beet produced in a plant with CHP.

3. Carbon certification based on a combination of verified process data (where this is available) and default GHG emission values.
   The declared carbon intensity of fuel is based on verified process data (where this is available) or on default values, where this is not available.
   Two sub-options are considered:
   a. Mandatory option. A minimum threshold of fuel chain information / data is required from producers to be included in an RTFO. Suppliers who do not provide information for carbon certification would receive no RTFO certificates, and therefore be excluded from the scheme.
   b. Base certificate option. All RTFs are included in an RTFO. Where no information on the carbon intensity is known, the declared carbon intensity

will be based on a default factor, based on the fuel type, which will result in the supplier receiving a 'base' RTF certificate

4.2.1 No carbon certification

This option implies no differentiation between fuels based on their GHG emissions. Proof of renewable origin would be the only requirement for fuels to be counted towards satisfying an RTFO.

It is recommended that this option is <u>not</u> considered in relation to an RTFO for four principal reasons:

1. The uncertainty over GHG emissions from different biofuel sources and production processes means that it would not be possible to usefully and accurately quantify if and what level of GHG savings would result from an RTFO. This is counter to the Government's objectives and to GHG emissions reductions objectives in the RTFO primary legislation. It also means that it will be difficult to assess the contribution of RTFs to national GHG emissions reductions targets, and fulfil the reporting requirements under the EU Biofuels Directive.
2. The uncertainty over the level of emission reductions means that there is a risk of the RTFO being discredited if it were found not to deliver significant GHG emissions reductions.
3. In the absence of a policy mechanism linked to GHG certification, there would be no incentive to supply RTFs with lower GHG balances as opposed to RTFs with higher GHG balances, which will in many cases be cheaper.
4. Cheaper fuels may correspond to higher GHG abatement costs. The LowCVP Wheat to Ethanol Report shows that more efficient and renewably fuelled plants result in lower GHG abatement costs. Therefore, incentivising biofuel volumes alone may be a particularly inefficient way of achieving GHG emissions reductions.

The cost penalty of achieving high GHG savings was illustrated in the LowCVP Wheat to Ethanol Study.[4] This showed that operating costs for a 100kt pa production facility using a natural gas boiler and grid electricity (producing ethanol with a 10 – 20% GHG saving) was half that of a straw fired condensing turbine system which achieved nearly 80% GHG saving. Gas-fired CHP plant is intermediate in both costs and savings between these extremes. However, the LowCVP Wheat to Ethanol study also shows that the cost-effectiveness of GHG saving is significantly enhanced by processes achieving a high GHG saving. This shows CHP and biomass fuelled processes deliver GHG savings at a cost per tonne of CO_2 five times lower than the least GHG efficient processes.

The uncertainty of GHG emissions reduction from an RTFO in the absence of certification is discussed below, based on the potential sources of biofuel supply to the UK.

[4] LowCVP (2004), WTW evaluation for production of ethanol from Wheat

4.2.1.1 Supply of biofuels in the UK and implications for CO_2 emissions

By 2010, biodiesel produced in the UK could supply at least 3% of diesel consumption and bioethanol produced in the UK about 1% of gasoline consumption, together corresponding to about 2% of road transport energy. This is based on an estimated growth in production capacity of about 800,000 tonnes for biodiesel and 200,000 tonnes for ethanol and assumes that all UK production would be used domestically. A significant part of UK biodiesel production would be from oilseed rape grown in the UK. However, a large amount, possibly over half according to industry sources[5], would be derived from the processing of imported vegetable oils such as soybean and palm oil, and a small proportion from waste oils. UK bioethanol production would be from food waste, wheat grain and sugarbeet. A significant fraction of UK production could be exported to other European countries, depending on the relative evolution of biofuel incentives.

The introduction of additional biofuel volumes to the UK market in the same period will rely on imports. Imported biodiesel could be produced from palm, soybean and jatropha oil produced in Africa, Asia and Latin America, or from rapeseed and sunflower oil in other European countries. Imported bioethanol would mainly be from sugarcane producing countries such as Brazil, however some ethanol imports may be from molasses or grain-based production around the world.

Best estimates of GHG savings from the use of biodiesel produced in the UK from oilseed rape are of the order of 45% to 55% per unit of diesel energy displaced[6]. However, the savings could be outside this range depending on agricultural practices, process energy use and efficiency. In the case of biodiesel imports, GHG emissions from the production of vegetable oil from trees may be lower that those from arable oilseed crops. However, there could be significant penalties in terms of GHG emissions depending on the land use changes that take place in order to plant biofuel crops e.g. deforestation[7]. Also, if process plants are less efficient and fuelled with high carbon content fossil fuels, e.g. oil and coal, the emissions could be higher compared with production plants in Europe, where GHG savings estimates are based on natural gas fuelled plants.

Best estimates of GHG savings from the use of bioethanol from wheat grain produced in the UK are of the order of 20% to 40%[8] per unit of gasoline energy displaced for process plants generating heat and electricity from natural gas. The savings may be a few percent higher in the case of ethanol from sugarbeet. However, the savings could be significantly improved if renewable energy is used to run the process plant e.g. straw or distiller's dried grains. They could also be worse, if for example, combined heat and power systems were not used or natural gas were not used for process energy. The use of efficient processes and low carbon fuels requires incentives, as shown in LowCVP (2004).

---

[5] Greenergy, personal communication

[6] Based on Concawe report (Concawe/EUCAR/JRC, 2004) and 'Carbon and energy balances of a range of biofuels options', by M.A. Elsayed, R.E. Horne, N.D. Mortimer, 2004, report no. 23/1 for British Sugar

[7] It must be noted that as biofuel production expands in the EU, land use changes may also become an issue e.g. conversion of grass land to energy crops. In the short term it is assumed that set aside arable land is used.

[8] Based on LowCVP (2004), WTW evaluation for production of ethanol from Wheat

Imports of sugarcane-derived ethanol from Brazil are likely to lead to very high (>80%) GHG savings per unit of gasoline energy displaced, where bagasse (sugar cane stalks and leaves) is used to fuel the process plant. However, this may not always be the case. For example, ethanol produced from molasses in a process plant not integrated with the sugar production plant may be fuelled with fossil fuel and not bagasse. This would lead to much lower GHG savings compared with the production of ethanol in integrated sugar and ethanol mills. This is common practice in Brazil because of the long history and significance of the ethanol programme. Note that transport in bulk has a relatively small impact on the overall GHG balance.

Other imports based on grain-derived ethanol could result in much smaller (or negative) GHG savings. These could be worse than those of bioethanol produced in the UK if process plants are less efficient and fuelled with high carbon content fossil fuels, e.g. oil and coal.

Also, as discussed in Section 4.3.3.5, land use changes in exporting countries should be considered to ensure that they do not result in significant GHG penalties.

In the absence of certification it is very difficult to determine the effect of an RTFO on GHG emissions reductions. While best estimates of GHG emissions from UK biofuel production indicate that 20% to 55% emissions reductions could result from the substitution of a unit of gasoline and a unit of diesel fuel energy, there is no guarantee that these emissions reduction levels will be achieved.

In the absence of a direct policy linkage to GHG savings, there will be limited incentive for the industry to invest in lower GHG production processes. **While at the current low level of demand there is a reasonable supply of low carbon intensity biofuels, as demand increases it is very likely that higher carbon intensity fuels will be drawn into the UK market.**

Imports are likely to play a significant role in gasoline substitution. Brazilian ethanol could provide a substantial amount of the target set by an obligation in the period to 2010, with high GHG savings[9]. However, there will be increasing international demand on Brazilian exports, e.g. from Japan[10], which could limit availability of Brazilian ethanol to the UK market. The potential for additional ethanol production from other sugarcane producing countries is limited because of growing sugar demands and lack of infrastructure[11]. As demand for ethanol increases, other low cost sources of ethanol from grains and molasses, with uncertain GHG emissions, could find their way to the UK.

In the absence of an incentive scheme based on GHG savings the total annual CO_2 emissions from transport fuels in 2010 could be around 1.5 to 3 million t CO_2 higher than they would be with a properly functioning GHG assurance scheme in place[12]. This differential would increase over the longer-term, as the main effect of GHG assurance would be to influence the type of production processes that are developed over the next 20 years.

---

[9] In 2004 Brazil exported about 2.5 billion litres of ethanol, based a total production of ethanol of about 15 billion litres. Brazilian ethanol exports could grow by about 2 billion litres in the period to 2010.
[10] A 3% volume of ethanol relative to gasoline target would create a demand for about 1.8 billion litres.
[11] International Sugar Organisation, personal communication.
[12] Based on a difference in carbon intensity of 20% to 40% and a volume of biofuels of 2.8 million tonnes.

Therefore, assessing the carbon intensity of biofuel production and linking RTFO certificates to GHG emissions savings is important because of:
1. the uncertainty in emissions from biofuels produced from a range of sources;
2. the unpredictability of sources of biofuels entering the UK market, in particular as biofuel demand grows worldwide;
3. the higher cost of low GHG emission biofuel production processes, other than bioethanol from integrated sugar and ethanol mills, based on conventional and new technologies;
4. the large long-term benefits, in particular in terms of GHG savings, that will derive from efficiently incentivising a lower carbon trajectory.

4.2.2 Carbon certification linked to an RTFO

GHG certification should be a key component of an RTFO. In particular, linking RTFO certificates to GHG savings has a number of important benefits:

1. It provides a direct link between the policy mechanism and the policy objective of GHG reductions, ensuring that the latter is met
2. It provides an efficient market based mechanism for achieving GHG reductions through the introduction of RTFs – this will result in the lowest GHG abatement costs in relation to RTFs
3. It stimulates the development and implementation of techniques and technologies that reduce GHG emissions (e.g. efficient use of agrochemicals, efficient conversion processes, use of lower carbon intensity fuels in processing, new feedstocks and conversion technologies with higher yields and greater GHG savings) and result in additional environmental benefits e.g. reduced emissions of other pollutants.

Furthermore, stakeholders such as NGOs and oil companies are interested in assessing the environmental performance of biofuels, in particular in relation to GHG reductions. A GHG certification scheme linked to an RTFO will provide a standardised and transparent way of quantifying these impacts.

4.2.2.1 Carbon certification based on default GHG emission values only

While this option may be relatively simple in terms of reporting requirements, it is recommended that it is not considered in relation to an RTFO for a number of reasons. In the case of a single set of default values based on fuel type, it is difficult to define the default values because of the large ranges and overlap in emissions for different biofuel production chains associated with each fuel type. Therefore, default values are likely to be difficult to justify to stakeholders and are more likely to be challenged legally (i.e. as technical barriers to trade). Also, this approach offers limited benefits in terms of providing incentives for investment in technology to reduce carbon intensity. Multi-tier default values, that can be adjusted to take account of different feedstocks and processing methods, might be perceived by trading partners to be arbitrary and discriminate against products from different regions, leading to challenge under international trade rules. This option may also be limited by the comprehensiveness of methods and processes covered and by insufficient updating with the latest advances. This may lead to some producers' fuels falling between the prescribed categories and limited incentives for innovation beyond the prescribed categories.

This option is considered as a component of the next option, which also allows for more detailed assessment of GHG emissions based on verified process data.

4.2.2.2 Carbon certification based on a combination of verified process data and default GHG emission values

In this approach, the assessment of GHG emissions would be based wherever possible on verified data from the specific production chain, provided by the producer. Where this data was not available, simpler information on the farming system, plant type etc, provided by the producer would be used to select default values.

This is the only option recommended for consideration in relation to an RTFO. It is judged to be the most efficient option for meeting the government objective of reducing GHG emissions in conjunction with an RTFO, as well as being conducive to innovation for GHG emissions reduction. It is also the option most likely to be compatible with trade rules as it can be based on scientific evidence, transparent and non-discriminatory.

It is possible that for some fuels, very little information will be available on production – not even the simple information on feedstock and plant type described above that would enable default values to be selected. Two options for dealing with these fuels are described below:

Mandatory information provision option

Fuel suppliers would be required to provide a minimum amount of information or data about process-related GHG emission from the supplied fuels in order to be eligible for RTF certificates. Fuel suppliers who did not do this would therefore be excluded from an RTFO.

The principal argument for the mandatory option is that this would ensure that RTF certificates were only awarded to fuels that provided clearly demonstrated GHG savings. Also, as certificates would only be given to fuels with a measured GHG saving, the GHG benefit of the policy as a whole would be measurable.

The disadvantages of this option are susceptibility to legal challenge, and large volumes of fuels entering the UK market outside an RTFO.

- Excluding fuels from the RTFO on the grounds of lack of information about their carbon intensity could potentially have an adverse effect on trade. Detailed examination would be necessary to asses whether this approach is compatible with international trade rules. Thought will need to be given as to how the carbon emissions reduction fits in with the overall scheme and purpose of the RTFO and whether it can be demonstrated that the operation and objective of the scheme would be undermined if the information on the carbon intensity of certain fuels was not available so as to warrant their exclusion from the scheme. It is recognised, however, that this might be difficult to achieve, leaving this option more susceptible to challenge than a scheme allowing uncertified fuels
- If a large volume of uncertified fuels were to enter the UK market outside the RTFO system, then this would undermine the credibility of an RTFO as the principal mechanism for meeting UK RTF targets. The uncertified fuel suppliers could argue that they were contributing to the targets as defined by the EU Directive. This would only occur if large volumes of uncertified fuel were available at a cost competitive with certified fuels plus certificates, where both were receiving the duty derogation.
- The blending of batches of fuels of ‘unspecified’ carbon intensity with fuels of specified carbon intensity could create GHG accounting problems.

The unspecified fuels would effectively need to be allocated a zero GHG benefit rating (which is likely to be worse than scientific evidence would indicate), again increasing the risk of legal challenge.

No mandatory information / Base certificate option

This second option for carbon certification recognises possible limitations in the availability of verifiable data within the biofuel supply chain. Rather than excluding biofuels supplied with no or inadequate information from an RTFO, these fuels would be assigned a conservative default carbon intensity value, depending on the type of fuel, and would therefore be eligible for a corresponding "base certificate". This option would not exclude any fuels and, therefore, it may be easier to justify that it does not create trade distortions.

The main advantage of the base certificate option is that it means that the provision of carbon intensity-related data and information is voluntary, and so producers and suppliers will be able to select the level of information provision that suits their situation. It is recommended that the "base certificate" should be set at a level corresponding with the estimate of carbon intensity for that fuel type (bioethanol, biodiesel, etc), since an arbitrary allocation of base certificates would be seen as not based on scientific evidence and therefore be more vulnerable to legal challenge. Care would be needed to ensure the base certificate, as far as possible, neither unfairly discriminated against certain suppliers, nor overstated the GHG saving and discouraged reporting.

This option would, however, allow fuels to contribute to the RTFO targets that had an unknown, and possibly very low level of GHG saving. If large volumes of fuel entered the market at the base certificate level the total GHG saving of an RTFO as a whole could not be estimated accurately. The influence of 'base certificates' would therefore have to be minimised through an appropriate design of the allocation of certificates (see section 4.5).

4.2.3 Alternative option for GHG emissions reporting

It has been suggested[13] that an alternative option for monitoring GHG emissions reductions from an RTFO would be to require each supplier to report on the overall emissions of their biofuels portfolio. **This option is not thought to be appropriate for a number of reasons**:

- The priority for suppliers under the alternative option would be the supply of biofuels volume to meet the obligation. This would favour supply of volumes of low cost biofuels, irrespective of their GHG emissions. GHG reporting would impose a separate and possibly conflicting requirement on suppliers.
- This is less efficient, and also more risky for suppliers, than an integrated approach where the clear objective is to reduce GHG emissions through the introduction of biofuels, and certificates are issued based on relative GHG savings. Separating GHG reporting from certificate allocation is likely to create distortions in a volume-based RTFO certificate market, as a result of sub-optimal efforts to balance volume and emissions requirements.
- Imposing mandatory reporting without any corresponding regulatory action would be inconsistent with good regulatory practice. Without a regulatory

[13] Climate Change Capital Ltd (2005), Optimising the design of the RTFO, draft report 16 May 2005

link, the Government could be in a position of observing a negative environmental practice without any means of ameliorating it.

As part of the alternative option, it has been suggested that a target overall GHG emissions value could be set for each suppliers' biofuels portfolio. Suppliers not achieving this target would be penalised, or in the extreme case have their RTFO certificates rejected.

- Suppliers would need to balance their GHG emissions to meet the target through supplying volumes of fuel with different GHG intensities. This is considerably less economically efficient, both for the suppliers, and for the policy as a whole, than allowing suppliers to balance their emissions by trading certificates linked to GHG intensity.
- Inflicting penalties on suppliers, and in the extreme case rejecting the suppliers' certificates, based on reporting requirements imposes a very high risk on the suppliers. This is counter to an RTFO's objectives of creating a properly functioning market for biofuels.

The alternative option also would not be any simpler to manage than the option we have discussed:

- GHG reporting would need to be standardised, as in the option we have discussed. Non-standardised mandatory GHG reporting would be of limited value, as GHG reports could only be treated as approximate if no standardised methodology is used. Regulation of non-standardised reporting may also be problematic (how would Government determine whether a supplier had complied with reporting requirement if there is no standard?).
- Regulating compliance with reporting requirements would require the same system of GHG monitoring and reporting that would be used for certificate allocation based on carbon intensity, so there would be no reduction in the administrative burden.
- Similar considerations to the option recommended above would apply in terms of compliance with international trade law.

4.3 GHG assessment

4.3.1 Principles of carbon assessment and certification

For carbon certification to be accepted as a credible basis for policy instruments or purchasing decisions it is essential to demonstrate that it is based upon objective scientific methods and that it is applied in a non-discriminatory way. It is suggested that the following principles are applied in order to demonstrate a scientific, unbiased approach:

Principle 1. Use of Best Available Evidence

For measures of carbon intensity to be scientifically defensible[14], it is essential that they be based upon the "best available evidence" (BAE). A number of methods have been developed to assess evidence and select BAE, in the medical and environmental sciences. Depending upon the context, BAE may consist of:

- Verified data of energy and material inputs to processes within the lifecycle;

[14] The importance of demonstrating a scientific / non-biased method is an important to establishing the legal case for carbon certification.

- Estimates of process efficiency based upon studies of process plants operating under various conditions;
- Estimates of process efficiency based upon theoretical calculations of process efficiency.

In general, where verified data relating to a specific fuel supply chain is available this is likely to be BAE. However, where this data is either not available or not verified then estimates based on the type of material and types of process employed will become BAE.

Principle 2. Consistency of Assessment

For measures of carbon intensity for different products to be comparable, it is essential that the methods used should be as consistent as possible. The key issues for consistency are the boundaries of the assessment, the types of GHGs included, the thresholds used for *de minimus* exclusions and the methods of allocating GHG emissions between co-products.

Principle 3. Transparency

For carbon intensity measures to be accepted by most stakeholders, and to enable critical peer review, it is important that the methods by which carbon intensities are calculated are transparent and reproducible.

4.3.2 Practice of carbon certification for biofuels

The practice of carbon certification for biofuels has developed over the past 5 years, based upon a number of lifecycle studies for different types of fuels[15], and data streams from a number of UK biofuel importers and producers. While some evidence gaps still exist, for example in the inclusion of non fossil GHG farm emissions and specific information relating to fertilisers and fuel supply to biofuel plants, there is now a considerable body of literature and practical experience to draw upon.

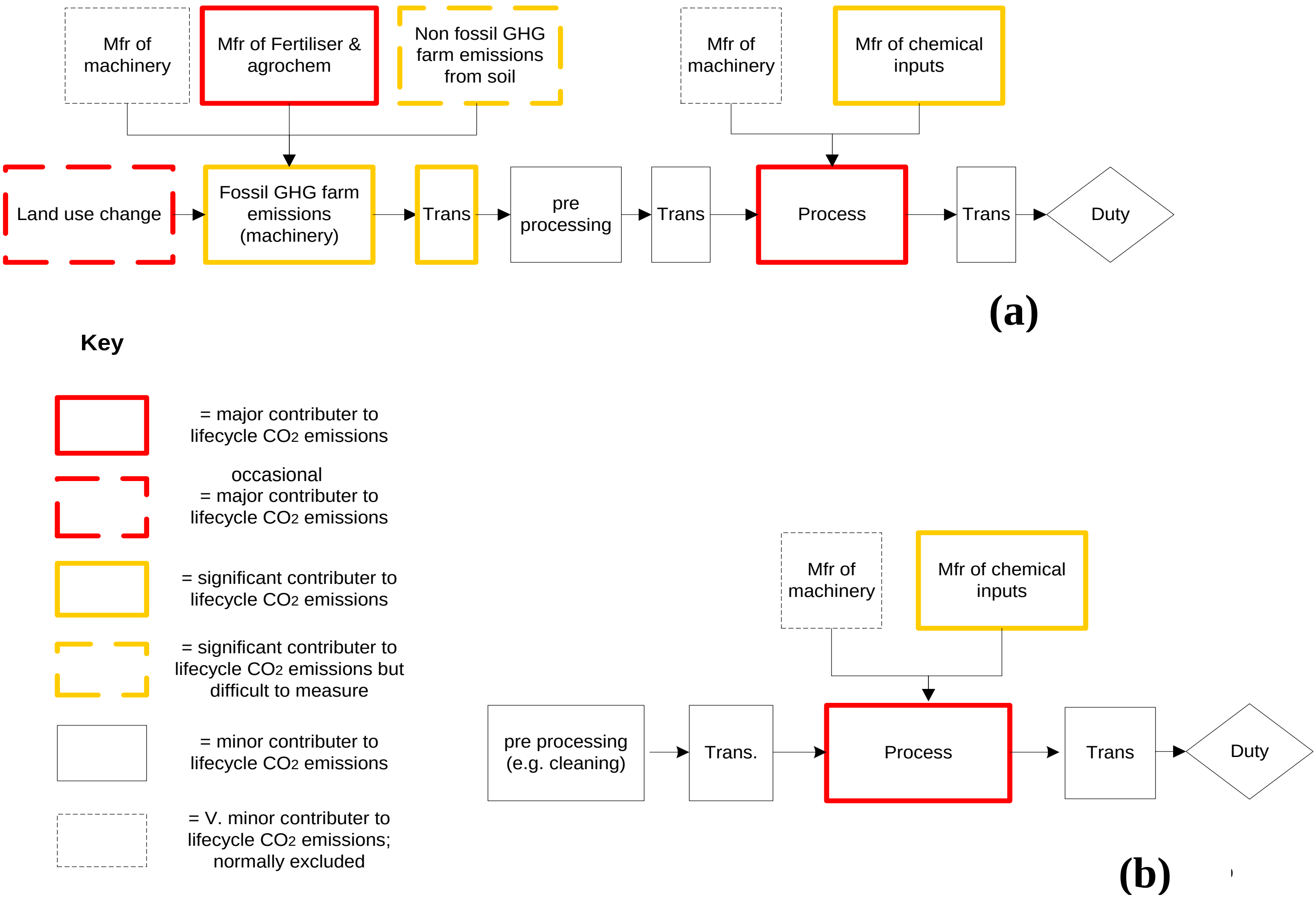
4.3.3 System boundaries

The boundaries of the GHG assessment are one of the most important aspects of the carbon certification system. To obtain a valid measure of GHG intensity it is important to include all major sources of GHG emissions that are directly attributable to the production of the biofuel. To achieve comparability, it is essential that the boundaries used for different biofuels are consistent.

Figure 2 a) illustrates the main stages of the production of a biofuel while b) shows a biofuel produced from recovered waste oil. The key denotes the importance of each stage in terms of emissions per unit of biofuel produced.

[15] Examples of lifecycle studies for different biofuels include 'Energy and Greenhouse Gas Emissions for Bioethanol Production from Wheat Grain and Sugar Beet', by N.D. Mortimer, M.A. Elsayed and R.E. Horne, 2004, report no. 23/1 for British Sugar, and 'Assessment of Greenhouse Gas Emissions in the production and use of fuel ethanol in Brazil' by Isaias de Carvalho Macedo et al, 2004, the Government of São Paulo.

Figure 2 Diagram of the main stages in production of a typical biofuel, and (b) one recovered from waste oil, with key showing the relative importance of the lifecycle CO_2 equivalent emissions contributors



4.3.3.1 Major sources of GHG emissions from biofuel production

The largest components of the GHG impact of biofuel production chains are normally associated with fertiliser inputs and the biofuel production process. Emissions associated with the manufacture of fertilisers can be obtained from fertiliser manufacturers, or standard industry figures for emissions per unit fertiliser production. The IPCC provides standard conversion factors for CO_2 emissions from the application of lime to fields[16]. Emissions associated with fuel used on farms and energy inputs to pre-processing and processing can be accurately determined using emission established coefficients for the relevant fuels / energy sources.[17] Table 2 provides a breakdown of the ranges of GHG emissions for different stages of production for ethanol from wheat.

[16] IPCC Good Practice Guidelines for Land Use, Land Use Change and Forestry. Intergovernmental Panel on Climate Change, 2000

[17] The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, World Business Council for Sustainable Development, 2004; Environmental Reporting: Guidelines for company reporting on greenhouse gas emissions, 2001, DEFRA; Revised 1996 Guidelines for National Greenhouse Gas Inventories, Intergovernmental Panel on Climate Change, 2000.

Where land use change (either deforestation or conversion of other high carbon density ecosystems such as grassland) is associated with biofuel production, the emissions from loss of above ground stocks of biomass and soil carbon are generally much greater than GHG benefits from avoided use of fossil fuels for a period of at least 50 years. However, as discussed below, it is often difficult to establish a direct relationship between biofuel production and GHG emissions from land use change.

4.3.3.2 GHG emissions from transportation of biofuels and feedstocks

The contribution by transportation to overall GHG impacts of biofuels is generally of secondary importance (as shown in Table 2) and as transportation routes of processed biofuels (from production plant to duty point) are likely to be of similar magnitude to those of fossil fuels it is possible to exclude these without introducing a significant level of error. Furthermore, the calculation of GHG emissions, while not technically difficult, can be operationally complex where transportation involves multiple cargoes, splitting of loads, back-loading and complex routing associated with many logistical operations. It is therefore recommended that the only transportation component to be considered within the production chain is the movement of harvested biomass feedstocks from the farm to the pre-processing stage. The GHG emissions arising from the transport of feedstock are more significant than those arising from transport of the biofuels due to the lower volumetric density of the material transported. This component is also likely to be more straightforward to verify (on the basis of distance between pre-processing facilities and farms and mode of transport).

4.3.3.3 Minor sources of GHG emissions, not normally considered

GHG emissions associated with the manufacture of machinery and infrastructure associated with biofuel production (e.g. tractors, farm buildings, processing plant and trucks) are normally excluded from lifecycle studies of biofuels as they have been demonstrated to make a very minor contribution (and they are also generally excluded from lifecycle studies of comparison fossil fuels[18]).

4.3.3.4 Uncertain sources of GHG emissions

The sources of GHG emissions associated with biofuel production that are technically more difficult to measure with accuracy are nitrous oxide and methane emissions from agricultural land. These emissions are highly spatially and temporally variable and thus ‘pose an unresolved challenge to modelling, monitoring and prediction’[19]. Variability arises from the effects of physical, climatic and environmental conditions upon the rates of denitrification and nitrification and anaerobic decay. In the case of nitrous oxide, emissions are also dependant upon the amount of nitrogen fertiliser addition to the land[20]. Several lifecycle assessments of biofuel manufacture either omit entirely, or do not include all sources of these emissions, whilst some studies (e.g. Mortimer et al 2004) use approximate figures with correspondingly high levels of uncertainty. It is likely that models based on soil type, climatic conditions and fertiliser regime will improve with time as they become more sensitive to spatial and temporal variability in emissions. Until then, it is recommended that non-fossil fuel GHG emissions from farming be accounted for by the application of appropriate

[18] ‘Energy and Greenhouse Gas Emissions for Bioethanol Production from Wheat Grain and Sugar Beet’, by N.D. Mortimer, M.A. Elsayed and R.E. Horne, 2004, report no. 23/1 for British Sugar

[19]/ [7] ‘Controls and models for estimating direct nitrous oxide emissions from temperate and sub-boreal agricultural mineral soils in Europe’, by Annette Freibauer and Martin Kaltscmitt, 2003, *Biogeochemistry*, 63 93-115

[8] ‘IPCC Third Assessment Report: Climate Change 2001’, Intergovernmental Panel on Climate Change, 2001.

default factors or are excluded from the assessment. As methods for improving the estimation of non-fossil fuel GHG emissions improve, they may be included in future developments of the system.

4.3.3.5 GHG emissions associated with land use change

Deforestation and other land use changes from high carbon density ecosystems (such as grasslands, cerrado vegetation or miombo woodland) to energy cropping systems can give rise to significant CO_2 emissions that should be taken into account within the boundary of the GHG assessment to produce a robust assessment.

One of the key difficulties of associating CO_2 emissions from land use change with the production of specific amounts of biofuel is that land use change nearly always occurs outside the physical boundary of the land producing the biofuel feedstock. On a given block of land a change such as deforestation is generally a one-off event followed by a long period under the new use (e.g. pasture or cropland). After land is deforested it may be used initially for cattle grazing, subsistence agriculture or cash crop production (e.g. tobacco, coffee or tea) prior to being used for biofuel production. Therefore it is often difficult to establish a direct relationship between a deforestation (or other land use change event) and subsequent biofuel feedstock cultivation.

Nevertheless, where deforestation or other vegetation change has occurred, one-off emissions in the range of 200 to 1000 t CO_2 /hectare associated with the combustion and/or rapid decomposition of above-ground biomass[21] are likely to negate any GHG benefits from the production of biofuels for a period of at least 50 years. It is therefore argued that some mechanism to prevent or discourage further deforestation should be an essential component of any assurance scheme associated with an RTFO.

It is suggested that the most practical approach to dealing with land use change is to determine whether areas used for biofuel production have been deforested or converted from other ecosystems within a given timeframe or since a specified cut-off date. For example, the year 1990 could be used since this is the reference date used for targets under the Kyoto Protocol[22]. It is suggested that for biofuel to be accepted under an RTFO they have to come with a guarantee that they have not been produced from land deforested prior to a certain date. Most source of current biofuel production are not likely to be affected by the introduction of a reasonable cut-off date, but the approach would ensure that biofuel production does not lead to deforestation as demand grows.

Verification that land use change / deforestation has not occurred would be most effectively undertaken by a central, independent agency with access to worldwide LANDSAT™ and other satellite images for the relevant dates. A sampling regime could be devised to ensure that a sufficiently high proportion of producer areas were covered to avoid any significant incidence of fraudulent reporting. It should be noted

---

[17] IPCC (2000) Special Report and Land Use, Land Use Change and Forestry, Intergovernmental Panel on Climate Change, Geneva.

[22] A cut-off date is applied by the Forestry Stewardship Council (FSC) to plantations established in areas converted from natural forests after November 1994. These do not qualify for certification, unless sufficient evidence is submitted that the manager/owner is not responsible for the conversion. In the EurepGAP coffee scheme, a new farm cannot be planted on areas of primary forest deforested after September 2004 or on areas of secondary forest without compensation.

that to comply with WTO rules, all producers, irrespective of their geographic location should be included within the verification regime.

For land use changes that involve gradual emissions of carbon from soils, for example as a result of conversion of grassland, default emission factors from the IPCC Good Practice Guidelines for Land Use, Land Use Change and Forestry could be applied[23].

4.3.3.6 Example of GHG emissions from biofuel production

Table 2 shows indicative figures for the ranges of GHG emissions associated with each of the main stages in the production of bioethanol from wheat (expressed in kg CO_2 /tonne ethanol), and the factors that determine the GHG emission per unit of biofuel produced. These figures illustrate the considerable variation of emissions that may occur at certain stages in the production chain, most notably in the use of fertilizers, in the fuel manufacturing process and where land use change occurs.

Table 2 Indicative ranges for GHG emissions from main stages in the supply chain for bioethanol production from wheat[24].

Stage of Process / Source of Emissions	kg CO_2 /t ethanol	Key variables
Feedstock Production		
Land use change	0 to >1000	Type of vegetation replaced, (only significant where deforestation or other vegetation change occurs)
Fertiliser manufacture	0 to 450	Fertiliser regime, type of fertiliser, yield of crop, co-products
Emissions from soil	0 to 100	Soil conditions, climate, fertiliser regime, co-products
Fossil fuels used for cultivation	60 to 180	Tillage methods, tractor efficiency, co-products
Fossil fuels used for drying and storage	10 to 100	Farm equipment, energy used for drying, co-products
Transport to processing		
Fossil fuels for transport	20 to 50	Distance from farm to process, mode of transport
Processing		
Fossil fuels used for pre-processing (crushing / cleaning/ drying)	50 to 250	Type of crusher, moisture content, fuel used to power crusher, co-products
Hydrolysis, fermentation & distillation	-700 to 550	Type of process, export of heat / electricity, source of energy inputs, use of co-products
Transportation of ethanol		
Fossil fuels for transport	20 to 80	Distance from farm to process, mode of transport
Possible Range	-540 to >2900	(Note that extremes are unlikely but possible)
Unleaded gasoline	3135[25]	

In the case of production of bioethanol derived from wheat, the lifecycle carbon intensity could either be less than zero (this is possible if the production process is very efficient and co-products are used to generate electricity that substitutes for fossil fuels), or at worst case similar to petroleum-based gasoline.

---

[23] IPCC Good Practice Guidelines for Land Use, Land Use Change and Forestry, 2000, Intergovernmental Panel on Climate Change.
[24] From ECCM-Imperial study on lifecycle impacts of bioethanol production, 2005.
[25] Environmental Reporting: Guidelines for company reporting on greenhouse gas emissions, 2001, DEFRA. Based on carbon content of gasoline only.

The variability of emissions for each of the stages in the supply chain of bioethanol (and other biofuels) clearly illustrates the desirability of obtaining specific information about the actual processes used to produce biofuels. Specific information may either be in the form of verified process data or verified information about the types of production systems employed. Section 4.3.4 discusses types of data or information that can be used to quantify GHG emissions from each stage in the production chain.

4.3.3.7 Boundary recommendations:

As shown in Figure 2 a) and b), **only significant sources of emissions should be included within the boundary of the certification system. These include land use changes (where appropriate), emissions from soil (where appropriate), manufacturing of (agro)chemical inputs, agricultural practices, process plants, and some forms of transport**. The following areas would therefore be excluded:

- GHG emissions associated with the manufacture of machinery used in the production of feedstocks, in processing or transport should be excluded, since these have been demonstrated to be minor and would create inconsistencies in comparisons with lifecycle studies of fossil fuels;
- GHG emissions from the transportation of ethanol from factory to duty point may be excluded as these are a relatively small component and may be more onerous in terms of quantification when considering complex transport routes, blending, movement by pipeline.

We also recommend that the following exceptions should be made:

- GHG emissions from soils (N_2O and CH_4) may be excluded in initial stages until more reliable evidence is available about the factors that control the processes that form them (to be addressed in detailed design);
- GHG emissions from land use change should be avoided by a mandatory criterion excluding RTFs produced on land deforested or converted from other ecosystems within a given timeframe or since a specified cut-off date – assuming such a scheme can be introduced is a manner consistent with international trade rules
- For gradual emissions of carbon from soils from land use changes such as conversion of grassland, default emission factors could be applied

4.3.4 Data and information requirements

In accordance with the principle of using best available evidence to quantify the GHG emissions of biofuels (and any other carbon certified product), the following approach to data collection is proposed.

The most accurate way of quantifying GHG emissions will be to use actual process data (where the accuracy and validity has been verified). This is therefore the "most preferred data" and is referred to as "Tier A" evidence. Where this data is available it should be used to quantify the GHG emissions of the different stages of the production process.

It is anticipated that Tier A evidence would be collected in standard template forms designed for ease of data entry and verification.

When this data is not available, verified information about the types of farming systems and productions processes can be used to provide a more approximate estimate, and is referred to as "Tier B" evidence.

When neither Tier A nor Tier B evidence is available, default factors based on a conservative value for the relevant stage may be applied. This is referred to as "Tier C". Tier C "default" emission factors would be based upon a review of the available scientific literature and reviews of process data and information from within the carbon certification system.

This three tier approach to compiling best available evidence is analogous to the method developed by the IPCC for the reporting of national emissions under the UN Framework Convention on Climate Change and for the Kyoto Protocol[26].

Practical experience of operating proprietary carbon certification systems has shown that it is essential to provide a degree of flexibility in using information from the supply chain. While some producers are able to provide verifiable data about their production processes, others are either unable or unwilling to do so, and in these cases straightforward procedures for applying appropriate default values are required.

By providing the opportunity for organisations within the production chain to provide Tier A or Tier B evidence, any objections regarding the Tier C default values should be minimised. However, care would be needed to ensure that Tier C default values neither unfairly discriminated against certain suppliers, nor overstated the GHG saving and discouraged reporting.

Table 3 sets out the specific types of data and information that form the basis of Tier A and Tier B evidence at each stage of the production chain. Figure 3 and Figure 4 illustrate how data from each stage in the production chain in the case of wheat to ethanol is combined on a weighted average basis to provide a final carbon intensity figure for biofuels at the Duty Point.

[26] Revised 1996 Guidelines for National Greenhouse Gas Inventories, Intergovernmental Panel on Climate Change, 2000

Table 3 Sources of Data / Information for Carbon Certification of biofuels (excluding land use change).

Stage of Process / Source of Emissions	Tier A: Most Preferred Evidence = Verified Data from Specific Sites	Tier B: Next Most Preferred Evidence = verified information about production processes	Tier C: Least Preferred Evidence
Feedstock Production	Area cultivated; crop yield; co-products	Crop type; co-products; tillage system; general fertiliser regime; type of farm equipment	No specific information (only information is type and quantity of feedstock)
Fertiliser manufacture	Type of fertiliser used; quantity used		
Emissions from soil*[27]	Type of fertiliser, type of soil;		
Fossil fuels used for cultivation	Type of fuel; quantity of fuel used		
Fossil fuels used for drying and storage	Type of fuel; quantity of fuel used		
GHG Calculation / Estimate	*Calculation based on activity data * GHG coefficients+ adjustment for co-products*	*Default value for different crop production methods*	*Default figure based on conservative value for crop production*
Transport to processing	Quantity of feedstock transported	Distance from farm to process, mode of transport	No specific information (only information is type and quantity of feedstock)
Fossil fuels for transport	Type of fuel; quantity of fuel used		
GHG Calculation / Estimate	*Calculation based on fuel consumption * GHG coefficients*	*Default value based on distance and transport emissions per t.km*	*Default value based on conservative value for feedstock transportation*
Processing	Bio-fuel output; co-product output	Type of equipment, configuration of plant; source of energy inputs	No specific information (only information is type and quantity of fuel & feedstock origin)
Fossil fuels used for pre-processing (crushing / cleaning)	Type of fuel used; quantity of fuel used;		
Energy used in conversion process	Type of fuel; quantity of fuel used; energy exported		
GHG Calculation / Estimate	*Calculation based on fuel/energy consumption * GHG coefficients + adjustment for co-products*	*Default value for different process plant types and energy inputs*	*Default value based on conservative value for biofuel production from various feedstocks*
Transportation of ethanol	Quantity of biofuel transported	Distance from plant to duty point	No specific information (only information is type & quantity of fuel delivered)
Fossil fuels for transport[28]	Type of fuel; quantity of fuel used		
GHG Calculation / Estimate	*Calculation based on fuel consumption * GHG coefficients*	*Default value based on distance and transport emissions per t.km*	*Default value based on conservative value for fuel transportation*

[27] May be excluded initially
[28] May be excluded as relatively minor but with significant costs of data collection

Figure 3 An illustration of how data from each stage in the production chain in the case of wheat to ethanol is combined on a weighted average basis to provide a final carbon intensity figure for biofuels at the Duty Point.

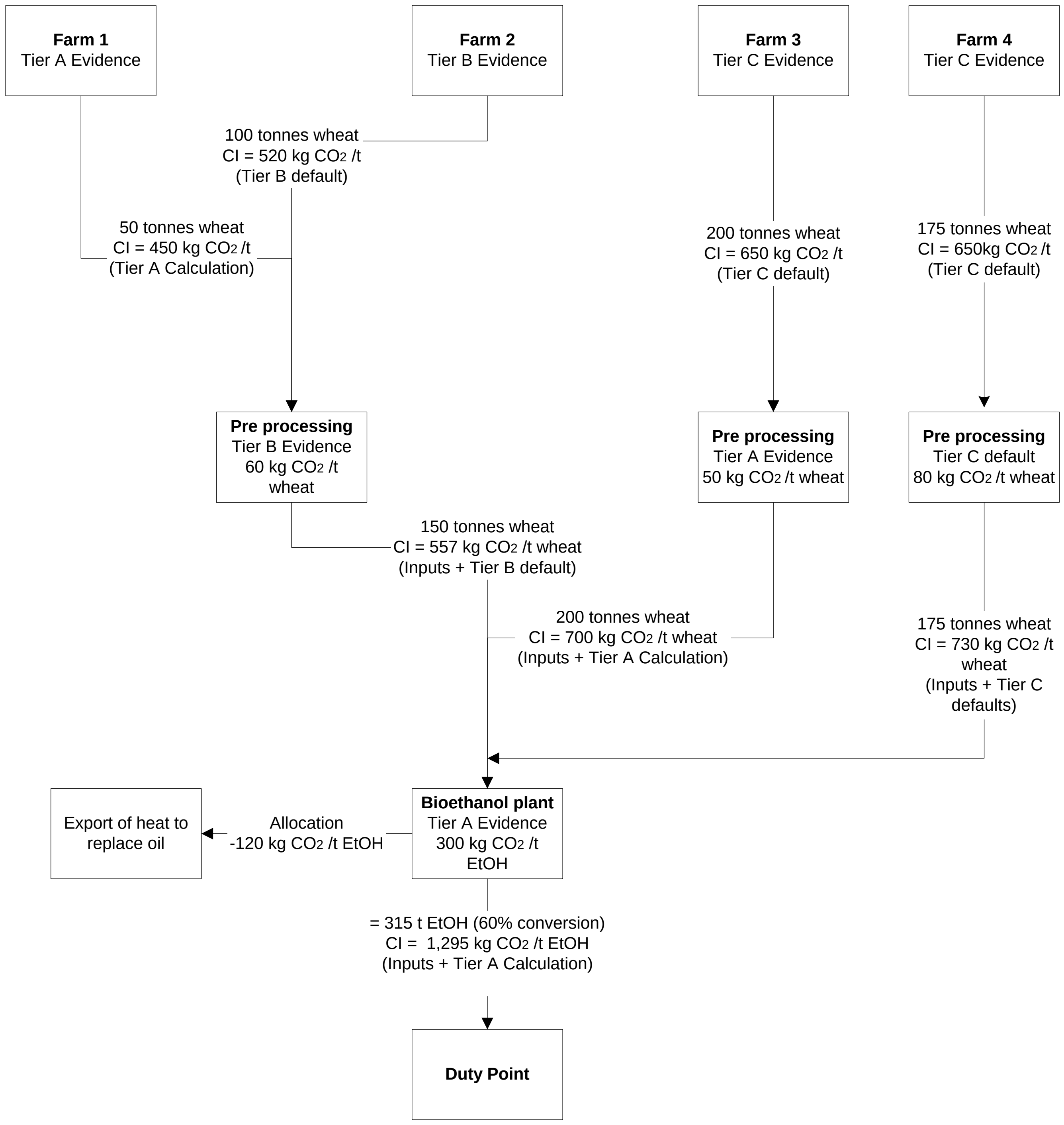
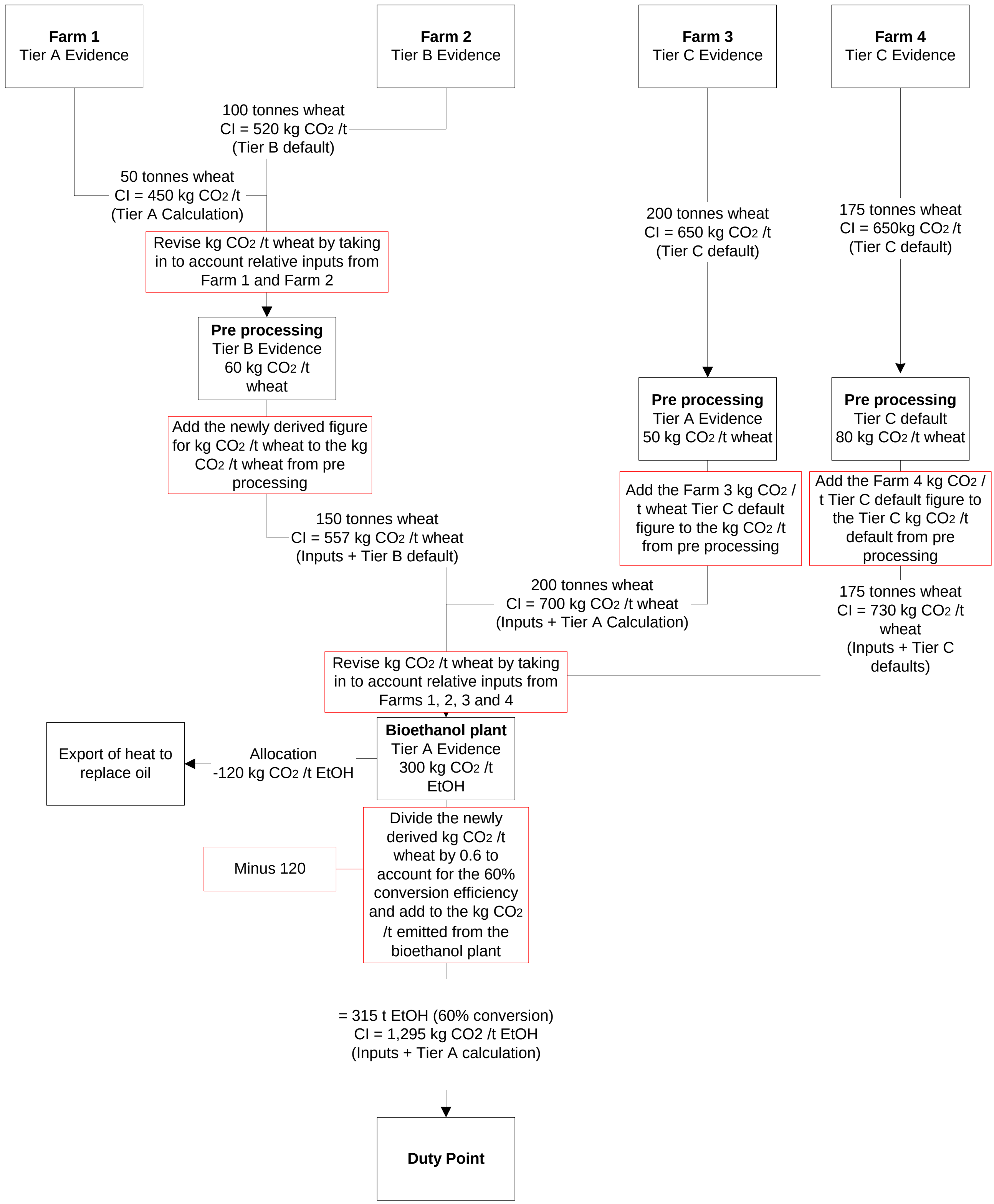


Figure 4 An illustration showing the method used to combine data from each stage in the production chain in the case of wheat to ethanol to provide a final carbon intensity figure for biofuels at the Duty Point.



4.3.5 Data availability and verification costs

Table 4 provides a more detailed description of the availability of verified Tier A evidence for different components of the supply chain. In practice, none of the evidence should be difficult or costly to obtain. The main cost incurred by the suppliers would be organising data collection in a way that would facilitate independent verification and the cost of verification itself. The costs of data collection and verification are not expected to have a significant impact on the economics of biofuels operations in the UK or abroad. There may be a skills / capacity building issue that may need to be overcome in the short-term. However, once data entry templates and checks are standardised the costs will be low.

Estimates of the costs of verification were based upon information about charges for independent verification to companies operating within the UK's Climate Change Agreements and Emissions Trading Scheme[29]. For most processing plants the cost of verification is likely to be under £2000 per year.

The costs to farms are less certain but unlikely to be significant if verification can be incorporated within the procedures for existing farm assurance schemes. It should be noted that nearly all the data requirements for Tier A evidence at the farm level are also required within the UK's assurance scheme for combinable crops (ACCS). The costs then would be dependant upon the size of the farm, with farms greater than 250 hectares incurring an annual fee of £225[30].

For organisations within the supply chain that consider the cost or effort of providing Tier A evidence to be too high, the provision of Tier B evidence (verified information about the type of process and equipment used) represents a more straightforward option. The verification costs for Tier B evidence are likely to be somewhat lower, since the verifier would only need to check that equipment inventories and basic management procedures were in place.

For organisations unwilling or unable to provide any information, a default factor would be applied by the organisation at the next level in the supply chain.

[29] Personal communication, Gareth Phillips Head of GHG Certification Services, SGS 5/5/2005
[30] 'The Costs and Benefits of farm Assurance to Livestock Producers in England' by Andrew Fearne and Richard Walters, 2004, Imperial College London

Table 4 Availability of sources of data for Tier A evidence, costs of collection and verification

Stage of Process / Source of Emissions	Tier A: Most Preferred Evidence = Verified Data from Specific Sites	Availability	Cost of collection
Feedstock Production	Area cultivated; crop yield; co-products	Readily available from farm records	Low/zero
Fertiliser manufacture	Type of fertiliser used; quantity used	Readily available from farm records	Low/zero
Emissions from soil*[31]	Type of fertiliser, type of soil;	Readily available from farm records	Low/zero
Fossil fuels used for cultivation	Type of fuel; quantity of fuel used	Readily available from farm records	Low/zero
Fossil fuels used for drying and storage	Type of fuel; quantity of fuel used	Readily available from farm records	Low/zero
Verification & traceability	*Annual verification may cost £250 per farm /yr (less if farm is already within existing assurance scheme)* [32]		
Transport to processing	Quantity of feedstock transported	Readily available from delivery orders	
Fossil fuels for transport	Type of fuel; quantity of fuel used	Readily available from business records	
Verification & traceability	*Annual verification may cost £700 per logistic company /yr*[33]		
Processing	Fuel output; co-product output	Readily available from business records	Low/zero
Fossil fuels used for pre-processing (crushing / cleaning)	Type of fuel used; quantity of fuel used;	Readily available from process records	Low/zero
Hydrolysis, fermentation & distillation or similar processes for BioD	Type of fuel; quantity of fuel used; energy exported	Readily available from process records	Low/zero
Verification & traceability	*Annual verification may cost £2000 per plant /yr*[34]		
Transportation of ethanol[35]	Quantity of biofuel transported	Readily available from process records but need to disaggregate from other fuels	Moderate
Fossil fuels for transport	Type of fuel; quantity of fuel used		Moderate
Verification & traceability	*Annual verification may cost £700 per operator /yr*[36]		

4.3.6 Default value development

4.3.6.1 Tier B default values

Tier B default values would be developed from the best available evidence, which may include reviews or studies of existing bioenergy production processes with specific operating conditions and process equipment.

[31] May be excluded initially
[32] Information from British Farm Standards
[33] Pers. Comm. Estimate by Gareth Philips, Head of GHG Certification Services, SGS.
[34] Pers. Comm. Estimate by Gareth Philips, Head of GHG Certification Services, SGS.
[35] May exclude - a minor component of total emissions and moderate cost of data collection and verification.
[36] Pers. Comm. Estimate by Gareth Philips, Head of GHG Certification Services, SGS.

To minimise the potential for legal challenges to default values it will be necessary to establish defined procedures for reviewing and updating the available evidence (see section 7 for discussion of the requirements for a methodology unit). There are a number of standard scoring or ranking procedures for scientific evidence that can be applied in a verifiable way to determine what scientific or technical information is used to provide the basis for Tier B default values (See Appendix for an example of evidence-ranking procedures[37].)

Figure 5 provides some examples of default values that were developed for specific stages in the supply chain for the production of bioethanol from wheat. To use Tier B default values producers would simply select the corresponding processing option from a list that most closely corresponded to their situation.

The task of verifying correct selection of default values would be relatively straightforward, and would simply require the verifier to confirm that the actual process equipment and mode of operation corresponded to the selection.

[37] Greenergy 2003

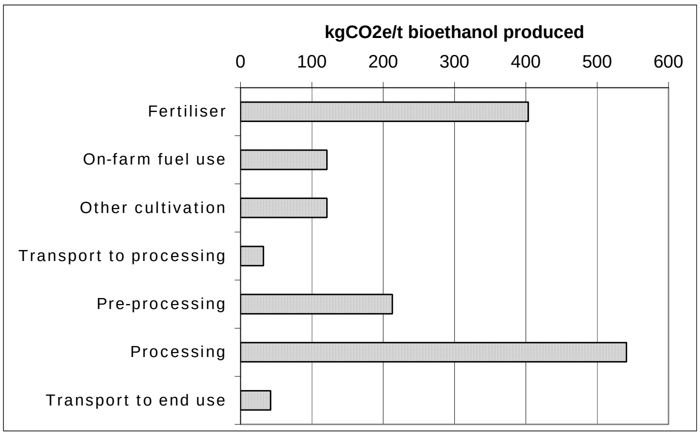
Figure 5 - Examples of carbon calculator input page using default values developed for specific stages in the supply chain for production of bioethanol from wheat[38]

BIOETHANOL CARBON CALCULATOR

REPORT PAGE

The following page shows the greenhouse gas emissions associated with the production of 1 tonne of bioethanol based on the lifecycle inputs from the data entry page

FEEDSTOCK SELECTION		Wheat	
			EMISSIONS PER TONNE BIOETHANOL
FERTILISER		Standard - wheat	403.29 kg CO_2e
ON FARM FUEL USE		standard factor	121.15 kg CO_2e
OTHER CULTIVATION		standard factor	121.15 kg CO_2e
TRANSPORT		50 km	32.13 kg CO_2e
PRE-PROCESSING		standard factor	212.76 kg CO_2e
PROCESSING	Allocation option:	DDGS as animal feed	
	Energy generation method:	NG boiler and grid	541.11 kg CO_2e
TRANSPORT TO END USE		225 km	42.21 kg CO_2e
		TOTAL	1,473.79 kg CO_2e/t bioethanol delivered



4.3.6.2 Tier C default values

Tier C Default values are conservative estimates of GHG emissions associated with one or more stages in the production chain. It is strongly recommended that a standardised method for producing Tier C default values is applied, since this should reduce the basis for any legal challenge.

[38] Output from Bioethanol Carbon Certification tool produced by ECCM-Imperial College for British Biogen / HGCA.

4.3.7 Allocation methods

One of the key issues to be addressed within the carbon intensity assessment is the method for allocating emissions to co-products. The method of allocation will have important consequences for biofuels with significant volumes of co-products (such as dry distilled grains with solubles from wheat to ethanol process).

Life cycle analysis researchers have debated the pros and cons of alternative allocation methods at length, and the basis for a justifiable approach is transparency and repeatability. Table 5 sets out the main options and implications. While 'substitution' is often proposed no standard allocation method exists for carbon intensity assessment has yet emerged. At present, the choice of method remains discretionary as long as basic guidelines are followed (e.g. where the product is used for energy, allocate on energy basis).

Table 5 Ways in which allocation can be undertaken:

Options	Description	Implications
By weight or volume	This is a simple method based on mass balance calculations and may be appropriate in circumstances where the outputs are of very similar value and have the same types of use.	Simple to do, but often does not reflect a real impact in terms of greenhouse gas emissions. This method favours biofuels with high volumes of co-products and therefore can be viewed as misleading in terms of real emissions impact.
By energy content	This is a simple method based on the energy content of all coproducts of a process. This may be useful in circumstances where all co-products are used for energy.	As with the previous method, this type of allocation should be restricted to processes where all co-products have a similar use, i.e. combustion for power or heat. It is logically difficult to justify for cases where uses are not energy related, as the allocation does not reflect reality.
By current market value	Co-products are assigned emissions according to current market value.	This is a flexible method that can be applied to many different types of coproducts, but does not necessarily reflect physical reality. Market value also fluctuates, so allocation should change accordingly to be consistent. Continual updating is likely to be costly and onerous to verify.
Substitution rule: emissions are allocated based on the GHG displaced from a substituted alternative product	The emissions arising from substituted product pathways are essentially cancelled out, and credit assigned accordingly.	This method is complex and time-consuming as it requires the assessment of alternative products' GHG balance, or calculating emissions allocation according to existing studies. It is the most intellectually justifiable method of allocation but does depend on the existence of data relative to the lifecycle of alternative products. Further, the substitution approach may create cyclical arguments, which cannot be solved.
Variable	Where no single allocation option is deemed satisfactory/feasible to implement, a variable allocation approach may be adopted. This could take the form of allocation according to the nature of the particular co-product in question.	A variable approach is flexible and can be designed to reflect the actual emissions impact of co-products without requiring the complex workings of substitution calculations. It is a less academically justifiable approach, but can be transparent and replicable.

It is recommended that allocation procedures will be standardised within calculation templates or tools that are provided to organisations within the supply chain, but could vary between different chains. The decision on which procedure to use in given circumstances would be decided as part of the methodology development, and will be reviewed periodically.

4.4 Linking GHG assessment to certificate allocation

4.4.1 Options for linking GHG assessment to an RTFO (recap)

As described in section 4.2.2.2, carbon certification could be linked to an RTFO in two ways,

- Mandatory option - Fuel suppliers would be required to provide a minimum amount of information or data about process-related GHG emission from the supplied fuels in order to be eligible for RTF certificates. Fuel suppliers who did not do this would be excluded from an RTFO.
- Base certificate option – Biofuels supplied with no or inadequate information would be assigned a conservative carbon intensity and provided with a corresponding "base certificate". No minimum information requirement would be set.

4.4.2 Mandatory information provision option

A mandatory option would exclude fuels from an RTFO that reached the duty point without carbon intensity information. Note that these fuels would, however, still qualify for any duty derogation that was in place.

Certified fuels would receive RTFO certificates according to their carbon intensity. For example, this could be done proportionally, with the number of certificates rising from zero for zero GHG saving, up to X certificates for 100% GHG saving.

This would give producers and suppliers a very strong incentive to certify the carbon intensity of their fuels. However, as described in the GHG assessment methodology above, Tier B default values could be used where data was not available, or difficult to determine, in order to reduce the burden of certification on producers. For the mandatory option, a minimum level of information that would be required in order to receive certification would need to be set. At the least, this could be qualitative information such as feedstock type, conversion process and fuel used in the conversion process, to enable the correct Tier B default values to be used.

Table 6: Example of linking allocation of RTFO certificates to carbon certification for three fuel batches under the mandatory option

Fuel	Carbon certification status	RTFO status
1	No carbon intensity presented at duty point	No certificates awarded - excluded from RTFO
2	Carbon intensity presented at duty point – producer supplying basic qualitative information	RTFO certificates awarded based on GHG saving, calculated using Tier B default values
3	Carbon intensity presented at duty point – producer supplying data about process	RTFO certificates awarded based on GHG saving, calculated using Tier A data provided plus some Tier B default values

4.4.3 No mandatory information / Base certificate option

In this option, suppliers with certified fuels would be issued RTFO certificates according to the carbon intensity. Suppliers who did not provide information for carbon intensity would receive a 'base certificate', based on Tier C default values. As it is straightforward to distinguish between fuel types (ethanol, diesel, biogas, hydrogen) at the duty point, even if no information is given on their origin, a different level of base certificate could be given for each.

The most practical way to set the base certificate level would be to base it on the Tier C default values for each fuel type. For example, the wheat to ethanol chain will have Tier C default values for each piece of data required to calculate the GHG intensity. The level at which these values is set has been discussed in section 4.3.6– each value is likely to be a reasonable but slightly high estimate of the carbon intensity, to give producers an incentive to provide their own data. As a result, using Tier C default values for all stages in the chain will give a high end estimate of the carbon intensity of wheat to ethanol. In the same way, there will be high end estimates based only on Tier C values for all other ethanol chains – based on sugar cane, sugar beet, corn etc, produced by different processes. The base certificate for uncertified ethanol could be set at the highest carbon intensity – i.e. lowest GHG saving of all these chains.

Table 7 Example of linking allocation of RTFO certificates to carbon certification for two fuel batches under the base certificate option

Fuel	Carbon certification status	RTFO status
1	No carbon intensity presented at duty point	Base certificate awarded – level of GHG saving based on fuel type only
2	Carbon intensity presented at duty point – based on producer supplying information and/or data about production and process	RTFO certificates awarded based on GHG saving, calculated using Tier A data provided and/or Tier B default values

4.5 Certificate allocation

4.5.1 Target setting

In an RTFO, each year a target would be set for the proportion of fuel volume supplied by RTFs. This target would represent a volume of fuel, which would be translated into a number of certificates. In a scheme including carbon certification, fuels with lower carbon intensity would be allocated a greater number of certificates.

This mechanism means that the RTFO certificates are no longer directly related to fuel volume. The volume target set will therefore not be met exactly. This does not pose a problem in terms of achieving the policy goal of GHG saving, but may be more difficult to explain when presenting the results of the policy where the target is expressed in terms of volume.

In either of the options above, there would be a lower bound, reference level of carbon saving that could be assigned to a fuel (see section 4.5.2). This level of carbon saving would be given one certificate. As an example, we will consider that this is calculated to be 20%.

As a result of this, linking carbon certification to RTFO certificates effectively means that a GHG target would be set for the RTFO as a whole. For example: a volume target of 1 bn litres of fuel could be translated into an obligation of 1 billion certificates. As the carbon saving of one certificate - the reference level- would be fixed at 20%, this would be equivalent to setting a GHG target for the scheme.

If a higher GHG target were desired by policymakers, then an obligation of a higher number of certificates could be set. For example, the 1bn litres of fuel translated into 1.5 bn certificates. Suppliers would meet this target through higher volumes and/or higher GHG saving. The reference level, and the method of allocation of certificates to each fuel would not change.

4.5.2 Setting the number of certificates allocated, the reference level and base certificates

The relationship between the number of certificates and carbon intensity of the fuel will need to be agreed in close consultation with government and other groups working on the financial and other RTFO design components. Given that a main objective of an RTFO is GHG saving, the most accurate way to reflect this would be to make the number of certificates awarded directly proportional to the GHG saving. For example, if the reference level had a carbon saving of 20%, a fuel with a carbon saving of 40% would receive double the number of certificates.

The reference level would be set at the lowest level of carbon saving of all of the fuel chains, calculated using Tier C default values.

In the mandatory option, all fuels receiving RTFO certificates would have certified carbon intensity. The carbon savings of each chain would therefore be translated into a number of certificates ramping up from the reference level as described above.

In the base certificate option, uncertified fuels would be given a base certificate, which would vary depending on the fuel type. Uncertified ethanol would be given an ethanol base certificate set at the lowest carbon saving of all of the ethanol chains, calculated using Tier C default values. Uncertified biodiesel would be given a biodiesel base certificate set at the lowest carbon saving of all of the biodiesel chains, calculated using Tier C default values, and so on. The lowest carbon saving of all the base certificates will be equal to the reference level, as defined above. Figure 6 below shows an example of different levels of base certificate for different fuel types, with the boxed example below showing how this could work for one supplier.

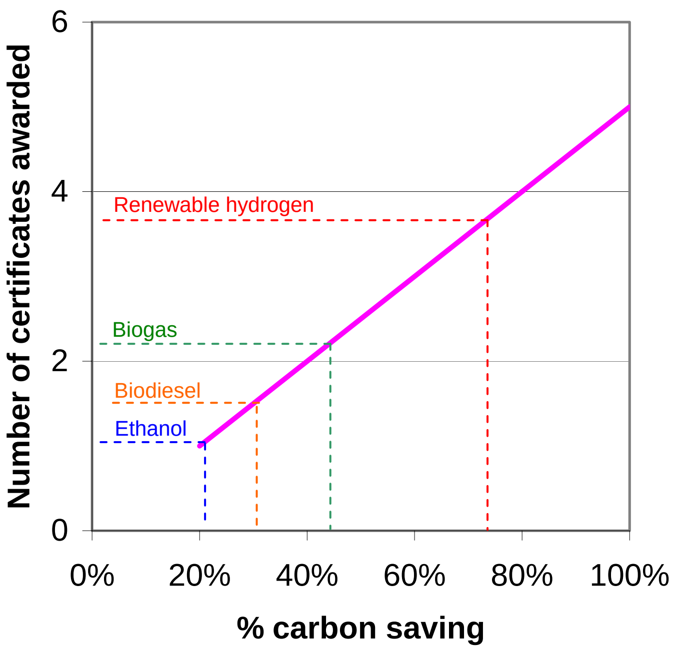


Figure 6 Examples of different base certificate levels for different fuel types. Note that these would be calculated using the default values from the GHG assessment methodology for the chain with the lowest GHG savings for each fuel type.

Example using the base certificate option

- A target is set of 2% of fuel volume
- For a particular supplier, this is 10 million litres of RTFs
- This is translated into an obligation to redeem 10 million certificates
- The supplier meets the obligation using fuel from four sources:
  - 2 million litres of carbon certified biodiesel at 60% carbon saving = 6 million certificates
  - 1 million litres of carbon certified ethanol at 40% carbon saving = 2 million certificates
  - 0.5 million litres of uncertified biodiesel. This is given a base certificate, set at the carbon saving of the biodiesel chain with the least carbon savings, for example, 30%. This therefore receives 1.5 million certificates
  - 0.5 million litres of uncertified bioethanol. This is given a base certificate, set at the carbon saving of the biodiesel chain with the least carbon savings, for example, 20%. This therefore receives 0.5 million certificates

4.5.3 Implications for linking with introduction and operation of an RTFO

The scheme would allow the volume and GHG saving targets of an RTFO to be changed year on year, by changing the total number of certificates required. The number of certificates allocated to each fuel chain would not change.

The carbon savings of the reference level for the system and of the base certificates for each fuel would not need to be changed frequently once the scheme was in operation given the flexibility in target setting described above. Changing these carbon savings would add to the uncertainty of producers and suppliers over the value of their fuels and certificates, and also add administrative complexity. Changing the certificates allocated might also present problems with banking certificates from one compliance period to the next.

These problems would also need to be overcome if carbon certification were not introduced from the beginning of an RTFO. In an RTFO with no carbon certification, the certificates would be proportional only to fuel volume. When the scheme was introduced, fuels which previously had the same certificate value would immediately be allocated different values based on their carbon intensity. This would significantly change the certificate market, affecting certificate price and availability, the proportion of the obligation met by suppliers paying the buy-out price, and many other factors. This could be mitigated by setting out a clear framework for introduction of carbon certification, so that the market would account for future benefits of GHG savings, but would always lead to greater market disruption than introducing an RTFO with carbon certification from the outset.

5 Environmental assurance

5.1 Introduction

Environmental assurance is the term given to a range of schemes designed to give consumers or investors confidence that products, for example food and fibre, have been produced under conditions that meet sustainability standards. Several of these schemes also include social and ethical criteria; however these will be discussed separately in section 6.

The aim of linking an environmental assurance scheme to an RTFO would be to ensure that in achieving the primary policy objective of GHG emissions reduction, sustainability is not compromised through other forms of environmental degradation. For example, incentives aimed solely at achieving low GHG emissions might encourage unsustainable land use or poor agricultural practices.

There are many existing assurance schemes which include environmental criteria, most of which work on a voluntary basis and are not linked to regulatory instruments. These schemes' standards tend to be based on sets of published principles, as this allows inclusion of aspects of sustainability that are not directly quantifiable, although they can also be based on processes and systems (e.g. ISO 14000). Existing schemes vary considerably in scope, as many were developed as a result of concerns about specific products, for example:

- UK (and European) farm assurance schemes are mostly based around a core set of concerns relating to agrochemical handling and use, the safety of farm workers, hygiene and food traceability issues. Many of the standards required are now similar to health, safety and environmental regulations required by national / European legislation.
- The Forest Stewardship Council (FSC) responds to concerns about forest destruction and the loss of biodiversity associated with the timber industry.

No comparable environmental schemes exist which would cover all of the areas relevant to renewable transport fuels. However, some of these schemes have criteria which could be adapted for use with RTFs, or could even be cross-certified with an RTF scheme. A specific environmental assurance scheme for RTFs would therefore need to be developed, whether linked to an RTFO or not. This scheme would need to be developed in parallel with the ongoing work on national and international rationalisation between certification bodies and between accreditation bodies, such as is occurring in the International Accreditation Forum (IAF) and the International Social and Environmental Labelling Alliance (ISEAL).

5.2 Options for environmental assurance

At the beginning of this study, three alternatives for environmental assurance certification were set out:

1. Separate voluntary scheme, not linked to an RTFO
2. A linked assurance scheme where RTFO certificates are awarded for producers voluntarily meeting environmental criteria.
3. A linked assurance scheme with some mandatory criteria for RTFO inclusion, with the option of RTFO certificates awarded for producers that voluntarily met further criteria.

The analysis and stakeholder discussions carried out during this study showed that there was interest in linking environmental assurance to an RTFO, but also support for a separate voluntary scheme. As a result, all three of the options above are discussed in more detail in this section. However, it is recognised that the number of any mandatory environmental criteria would need be limited to minimise the risk of legal challenges, and that these would need to be related to problems of global importance and to the policy objectives of an RTFO.

5.2.1 Separate voluntary scheme, not linked to an RTFO

If no environmental certification were linked to an RTFO, there is interest from some stakeholders in setting up a separate voluntary scheme. Voluntary schemes without links to a policy mechanism operate successfully in several other areas, such as forestry and food, as described above.

Not including environmental certification within an RTFO removes administrative complexity: the scheme development and operation would be led by producers and suppliers themselves, the timing of scheme development need not be matched to RTFO introduction, and there would be no costs to government. Design and operation would also be made considerably simpler as it would not be necessary to assess and manage the effect of allocation of certificates for environmental performance on an RTFO target. Removing the link between environmental certification and an RTFO would also reduce the likelihood of legal challenge to the policy as a whole.

The principal disadvantage of a separate voluntary scheme is that an RTFO would not be able to reduce, manage or assess the environmental impacts of the fuels sold. It would be difficult to evaluate whether an RTFO was meeting the stated environmental objectives of the EU Biofuels Directive and UK policy. Data from producers/suppliers participating in the voluntary scheme would provide some information on good practice, but the scheme would be very unlikely to show negative impacts. It would be difficult to determine whether those not participating in the scheme were put off by the administrative burden, or were unwilling to report on negative impacts. There has been some criticism of the record of UK voluntary agricultural schemes, such as pesticide use and straw burning stipulations which were perceived to have failed, and were subsequently replaced by statutory provision[39].

The success of a certification scheme in promoting environmentally beneficial practices in RTF production depends upon two factors: the environmental criteria covered within it, and the uptake of the scheme.

[39] [39] See Friends of the Earth report on http://www.foe.co.uk/resource/briefings/scimac.html

As a result of the administrative and possible legal constraints to an RTFO-linked scheme, a separate voluntary scheme would be able to include a wider range of criteria. A voluntary scheme might also have greater flexibility to change or add criteria, with changing processes and additional fuel chains entering the market. Note that there is no reason that a separate voluntary scheme could not run in parallel with an RTFO-linked scheme, and so provide a broader range of criteria in this way.

A separate voluntary scheme would have lower uptake than an RTFO-linked scheme, either with voluntary or mandatory and voluntary criteria, as there would be neither incentive nor compulsion to participate in the scheme. However, a separate voluntary scheme is likely to have a high uptake if it is strongly adopted by the major fuel suppliers. A large proportion of the RTFs sold in the UK in the short term are likely to be blended fuels, sold through the oil majors. If several oil majors were to support a separate voluntary scheme, it would likely be supported by all suppliers, as a result of the need for product exchanges. In turn, this would encourage producers to certify their production. One example is the requirement by most pre-processors within the UK for farmers to supply oilseeds that comply with the Assured Combinable Crops scheme. In the case of the UK market the level of coverage is therefore almost 100%.

The RTF producers and suppliers that are interested in setting up a separate voluntary scheme consider that environmental certification would be beneficial to maintain the 'green' image of biofuels, and reduce their reputation risk. They may consider that they would have greater influence on the design and criteria included in a separate voluntary scheme, and on the timing of its introduction. RTF producers and suppliers unwilling to certify their fuels are placed under no burden by this option. Possible early proliferation of voluntary schemes could lead to concerns over credibility and transparency of the information; however, it would be likely that in the longer term scheme convergence will occur, as is seen in other areas.

5.2.2 Linked assurance scheme with voluntary criteria only

This option is an assurance scheme linked to an RTFO, where RTFO certificates would be awarded for producers voluntarily meeting environmental criteria.

Linking an assurance scheme to RTFO certificates would demonstrate to producers and suppliers that environmental protection was an important policy objective, and incentivise them to certify their fuels. Publishing and disseminating criteria would also give information to all producers about environmental best practice.

The voluntary nature of the criteria may reduce the likelihood of challenges under international trade rules, compared with mandatory criteria. This is especially true as many environmental impacts are highly dependant on local factors making a single universal design to the scheme highly complex. However, difficulties in defining criteria because of greater uncertainties and geographic dependencies in the in the scientific evidence base, are still likely to represent a major barrier for the international acceptance of a voluntary scheme linked to an RTFO.

By definition, options for linking environmental assurance to an RTFO will require greater involvement, complexity and cost to RTFO design and operation than for a separate voluntary scheme. These requirements will include:

- Development of environmental criteria, plus links with other schemes.
- Development of a certification procedure.
- Monitoring and verification of reports and claims of criteria met.

- Development of a mechanism for awarding additional certificates to suppliers meeting voluntary criteria.
- Dissemination of criteria to ensure supply chain awareness.
- Regular updating of criteria according to best available evidence.

If incentives are given for meeting voluntary criteria, in the form of additional RTFO certificates, the relative value of meeting environmental criteria compared with the policy goal of GHG emissions reduction, and with incentivising higher volumes of biofuels in the market must be considered.

Adding certificates to the market by awarding them to fuels meeting environmental criteria will reduce the number of certificates that will need to be earned through GHG savings or through supply volume. However, this effect can be overcome by increasing the level of the obligation – i.e. the total number of certificates required.

This option adds complexity –RTFO certificates would be based on a mixture of carbon intensity and environmental performance. It would be very difficult to determine a non-arbitrary way of deciding what level of additional certificate should be given for environmental performance, in order to avoid legal challenge.

Certificates could be awarded in several ways. For example:

- A certificate bonus - A point would be given for each environmental criterion met, and an additional certificate/proportion of certificate to be awarded to fuels achieving a set number of points. The number of points associated with each criterion could vary depending on the importance of their impacts
- A proportional system – a smaller proportion of certificate would be given for each environmental criterion met. Again the proportion of certificate associated with each criterion could vary depending on the importance of their impacts

Providing an incentive for environmental assurance should lead to increased uptake and therefore increased environmental benefits when compared with a separate voluntary scheme. The range of criteria included may need to be tightly controlled, in order to link explicitly with policy goals. The scheme could, however, co-exist with a separate voluntary scheme to allow a wider range of criteria to be included.

The information gained from RTFO-linked environmental assurance could be used to assess the environmental impacts of some of the fuels supported by an RTFO. However, as only producers with good environmental performance would be likely to certify their fuels, this option would not provide information on those with the greatest environmental impacts.

Making environmental assurance voluntary would not place an additional administrative burden or cost on producers/suppliers who were unable to certify their fuels. Those who did participate would benefit both from the additional certificates awarded, and from the credibility of a single, RTFO-linked scheme.

5.2.3 Linked assurance scheme with mandatory and voluntary criteria

This option is an RTFO-linked assurance scheme with a small number of mandatory criteria that must be met for RTFO inclusion, plus additional RTFO certificates awarded for producers who voluntarily meet further criteria. The criteria which could be made mandatory are discussed in section 5.4.

Adding mandatory criteria to an RTFO-linked scheme would provide an incentive for producers to reduce the environmental effects of producing their fuels. The mandatory criteria could also include reporting requirements, which would raise awareness of environmental best practice, whilst enabling monitoring of the environmental impacts of the policy.

Requiring producers/suppliers to meet environmental criteria and to certify the fuels produced as a condition of entry into the RTFO will add to the complexity of the scheme and impose additional burdens on traders which could distort traditional patterns of trade and render the scheme vulnerable to challenge. The risks of challenge would be reduced if the environmental criteria set out in the environmental certification scheme are linked to existing international norms. When developing any such scheme thought will need to be given not just to its design but also to its application and its impact on trade from other countries.

By definition, options for linking environmental assurance to an RTFO will require greater involvement, complexity and cost to RTFO design and operation than the option for a separate voluntary scheme, as listed above. The only additional requirements of establishing a scheme with mandatory criteria would be selecting which criteria were of greatest importance, and the form the criteria should take: reporting requirements, quantitative indicators etc. Once the scheme was in operation, there would be a greater volume of information and greater verification requirements than under a voluntary scheme with lower uptake.

Mandatory environmental assurance would lead to reduced environmental impacts from fuel in an RTFO when compared with linked or separate voluntary schemes, as there would inherently be higher uptake. The range of mandatory criteria included would be narrower – potentially only covering major areas such as biodiversity - but could be supported by additional voluntary criteria in the scheme, and in a separate voluntary scheme if needed.

Mandatory criteria defined as reporting requirements would enable assessment of the environmental impacts of RTFO-supported fuels, and highlight areas for improvement along the RTF supply chain. These areas could then be targeted by future mandatory criteria, increased incentives to meet voluntary criteria, or by flanking measures.

Mandatory environmental assurance for a small number of criteria will give confidence to all producers/suppliers within the scheme that their reputation would not be damaged by reports of possible environmentally unsustainable practices of others in the scheme. Those who met additional voluntary criteria would benefit both from the additional certificates awarded, and from the credibility of a single, RTFO-linked scheme. However, making environmental assurance mandatory would place an additional administrative burden and cost on all producers/suppliers.

5.3 Examples of existing schemes

No environmental schemes exist which would cover all of the areas relevant to RTFs. The following are examples of schemes which contain some relevant criteria:

EurepGAP – an international scheme covering a range of products, based on sector-specific farm certification standards. It aims to ensure the integrity, transparency and harmonisation of global agricultural standards, including the requirements for safe food production that respects the consumers' environmental concerns.

Some of the EurepGAP criteria are relevant for GHG assessment, for example those on fertiliser use, while many are relevant for RTF-based environmental assurance, such as those on soil management, irrigation and biodiversity. EurepGAP certifies three Malaysian palm oil plantations, suggesting that its environmental assurance criteria could be applied to imported vegetable oils for use as a biodiesel feedstock. However, the cost of certification to the producer is not known, and it is also not clear whether criteria on change of land use were applied in this case. EurepGAP does not include the conversion and processing sectors.

Soil Association – a UK scheme with international links, which covers a wide range of products, and includes areas further down the supply chain like processing and sale. The Soil Association symbol can be found on over 70% of Britain's organic produce, and schemes have also been developed for timber and wood products. Soil Association Certification Ltd enforces these standards through certification and regular inspections of producers, processors and suppliers.

It is possible that some Soil Association standards could be cross-certified with those for the production and use of biomass for energy, although many would not apply (for example prohibition of use of non-organic fertilisers, herbicides and pesticides). The Soil Association's Woodmark programme for responsible forest management has been accredited by the FSC and therefore includes criteria compatible with ISEAL and so applicable internationally.

British Farm Standard – a UK scheme including assurance for crops. The Little Red Tractor logo is used on British farm products to show that they have been produced to independently inspected standards set out by assurance schemes. It is intended to reduce the proliferation of farm assurance schemes in the UK by eventually providing a common standard. The scheme is managed by Assured Food Standards (AFS), an independent organisation, including the retail and food processing sectors, and others from research, consumer and environmental groups.

For cereals, oil-crops and livestock-derived bioenergy products, existing UK Farm assurance schemes such as the Assured Combinable Crops Scheme could provide some of the criteria required for GHG and environmental assurance. Though they do not cover all criteria needed they could provide partial cross-certification for UK production.

Renewables Obligation Certificates – a mandatory scheme for guaranteeing origin of renewable electricity, run by Ofgem. This is included here, as it is one of the very few mandatory schemes covering an area which could be relevant to RTF production. The generating station must declare their generation every month, and provide required additional monthly information and evidence if using or co-firing biomass or waste. As a minimum, routine representative monthly sampling and volume measurement of the fuels used is required to determine the eligible renewable output. No environmental criteria are included in the Renewables Obligation, although a requirement for less than 2% contamination of the biomass or biological waste input could be applied in an RTF scheme.

5.4 Criteria selection for environmental assessment

Linking environmental assurance to an RTFO would require the development of a list of criteria which can, or must be met. Experience from existing assurance schemes has shown that this should be done in a collaborative way, with involvement from stakeholders from all stages of the RTF chains, together with policymakers, NGOs and others. However, this section will give an initial view of the criteria that could be included in an RTFO-linked scheme; which, if any, should be mandatory, and the practicality of measuring and reporting on the criteria. This will allow the scale of a proposed scheme to be established, enabling the discussion in subsequent sections of the mechanisms and actors involved in linking the scheme to an RTFO.

5.4.1 Renewable transport fuel production-related policies

Some assurance schemes include proof of compliance with regional, national and international laws, regulations and plans as criteria for assurance. Compliance with laws, regulations and plans related to renewable transport fuels, where they exist, would be important for fuels sold in the UK under an RTFO. However, it would not be appropriate for this compliance to be enforced through an environmental assurance scheme. If it became clear that fuels entering the market were not complying with RTF-related policies either in the UK or elsewhere, then it may be necessary to work with policy and plan-making bodies to remedy this.

5.4.2 Energy crops and crop residues

Most of the RTFs entering the market in the early stages of an RTFO are likely to be liquid biofuels, produced from crops - including wheat, sugar beet, corn (maize), sugar cane, rapeseed (canola), palm oil, Jatropha (physic nut) and others. In the longer term, there is also likely to be significant use of dedicated lignocellulosic energy crops, and of crop residues. As many of the environmental impacts commonly associated with biofuel chains are related to the cultivation stage, this will be an important area for standards development.

For energy crops and crop residues, widely used schemes exist that could inform criteria development, and possibly provide cross-certification in some areas. The ACC scheme and the EurepGAP combinable crops schemes cover criteria on farmer awareness of environmental protection, record keeping, handling and use of agrochemicals, use of GMOs etc. The EurepGAP scheme contains more criteria, but many of these are classed as ‘minor’ or ‘recommended’. A scheme for crops for biofuels could link with these schemes by using some of the same criteria. These schemes do not, however, have many criteria relating to land use change, conservation and biodiversity. Schemes such as the Rainforest Alliance General Standards for agriculture and RSPB farm standards could be used to suggest criteria in these areas. It may, however, be more difficult to achieve international agreement on some of these criteria.

The areas where environmental criteria could be applied are listed below, with reasons for their inclusion or exclusion from an RTF scheme, and discussion of whether they could be made mandatory. This section covers all feedstocks from crops and residues including arable crops, tree crops, residues, and dedicated lignocellulosic energy crops.

5.4.2.1 Site history

One of the main concerns cited about biofuel production is change of land use. The growth of crops on deforested land or on previously uncultivated grassland could lead to many impacts including reduction in carbon storage, carbon emissions from soil tillage, reduction in biodiversity and soil erosion. This area is covered under GHG certification, in section 4.3.3.5.

5.4.2.2 Soil and substrate management

This includes reduction of soil erosion and soil structure disruption.
Examples of criteria used are:

- Use of appropriate techniques required – EurepGAP requires visual or documented evidence of field cultivation techniques to reduce soil erosion.
- Harvesting techniques – e.g. recommended levels of arable crop residue that should be left in the field to maintain soil quality, harvesting short rotation coppice once leaves have fallen, and avoidance of soil compaction by agricultural machinery.
- Plan – The Rainforest Alliance Sustainable Agriculture Network standards include the preparation and implementation of soil conservation plans to reduce erosion risks that consider the topography, soil type, weather conditions and farming practices for the plantation.
- Best practice recommendations - techniques proven to improve or maintain soil structure, and to avoid soil compaction recommended under EurepGAP.

These impacts are important, but are likely to likely to vary considerably in importance between regions and crop types. As a result, it might be most appropriate to use criteria based on preparation of a management plan, rather than on use of particular techniques. Reporting on preparation and implementation of the plan would be a suitable criterion on a voluntary basis.

5.4.2.3 Varieties and rootstocks

Food-based assurance schemes such as the UK Farm assurance scheme and EurepGAP schemes include criteria covering use of genetically modified organisms (GMOs), in terms of reporting on GM varieties used, and separate handling and storage from non-GM crops.

Types of criteria used are:

- Reporting on GMO use – in the EurepGAP scheme, farmers must inform their clients of the GM status of the product, and documentation must be available on any planting, use or production of products derived from genetic modification (including compliance with country-specific GMO legislation).
- GMO best practice guidelines – cover mitigation of risks associated with GMO use, and include biodiversity protection and crop separation. In the UK AAC scheme, farmers must meet the SCIMAC Code of Practice on this (see below).
- Restriction on storage and handling - GM crops and other GM materials must be physically separated from other crops when stored. If any mixing occurs then the whole bulk must be regarded as GM and labelled as such.

As a result of concerns about the environmental risks associated with cultivation of GM varieties, reporting on their use, labelling and traceability could be used as a criterion in an RTF assurance scheme. As there is uncertainty about the nature and importance of these risks, and so full information on GMO use is needed for this criterion, it would be more appropriate for this criterion to be a mandatory reporting requirement than a voluntary criterion in a linked scheme. This is currently in place for GM products for food and feed under EU Regulation 1829/2003, and the same could be done for biofuels. However, the legality of rules in this area is currently being questioned, as a result of the US/EU WTO GM food dispute. A voluntary reporting incentive would be unlikely to produce representative information on the use of GMOs in the UK biofuels market.

As criteria for this are included in other schemes, reporting, verification and cross-certification is likely to be relatively straightforward. However, there has been criticism of the SCIMAC scheme[40], in terms of the technical guidelines for reducing risks from GMOs, and of the institutional framework for monitoring and verification.

Criteria on separate handling and storage of GM varieties used for biofuels may not be as necessary as in the food sector, because there is less risk to human health associated with their use. However, as co-products of biofuel processing could have other uses including in the food and cosmetics industries, it may be desirable to keep these criteria.

5.4.2.4 Fertiliser use

The need for environmental assurance related to fertiliser use is reduced by two factors: firstly, that fertiliser use will be an important component of GHG assessment, and therefore will be considered elsewhere, and secondly, that there is little economic incentive for over-use of fertilisers. However, there are still aspects of fertiliser use that could have environmental impacts, and which could therefore be covered by environmental criteria, as in the UK AAC and EurepGAP schemes:

- Restriction of fertiliser storage –require storage in adequately maintained containers, to reduce the risk of run-off of spillage into water courses.
- Guidelines for fertiliser application – technical competence should be shown in fertiliser choice, quantity and application method.
- Guidelines on how to protect SSSIs, wetlands, riparian zones and vulnerable areas from nitrification.

These criteria would be most appropriately covered by voluntary criteria, either in a separate or RTFO-linked scheme, as impacts of over-use are a local problem. Cross-certification with other schemes would be straightforward.

5.4.2.5 Irrigation/fertigation.

Increased growth of crops for biofuels could lead to depletion of water resources, both on and off-farm, particularly as a result of growth of some energy crop species. The need for criteria to promote practices that minimise this risk will vary between regions, and therefore management-plan type criteria could be appropriate in this area.

Examples of these types of criteria used:

- Water management plan – a water management plan to optimise water usage and reduce waste should be in place, with calculations to predict irrigation requirements. In the Rainforest Alliance SAN scheme an environmental management program must be established in farms using underground water
- Reporting requirement – records of irrigation water usage must be maintained, which indicate the date and volume per water meter or per irrigation unit.
- Link with local bodies - there must be written evidence of advice on abstraction from water authorities

[40] See Friends of the Earth view on SCIMAC criteria - http://www.foe.co.uk/resource/briefings/scimac.html

Although this is an important issue, especially in relation to fast-growing energy crops such as energy grasses, there are no international agreements on water-use, as this is a local and regional problem (water use and availability is recognised as a trans-boundary issue and is the focus of particularly stringent policy, particularly in South Africa). As a result, voluntary criteria could be set in an RTFO-linked scheme, but it would be difficult to set mandatory criteria, even based on reporting requirements.

5.4.2.6 Crop protection

Many of the criteria related to pesticide use, storage and handling in existing assurance schemes are in place to prevent unsafe levels of pesticide residues in food products, and to protect worker health and safety. Criteria that could be important for environmental assurance for an RTF scheme concern reducing the impact of pesticide use on biodiversity and of the risks associated with pesticide storage, spillage and container disposal. These include:

- Record keeping – records must be kept of all products used and justification for their use.
- Product choice – appropriate products should be used, that are registered in the country of use and approved for use on the crop grown.
- Training – those choosing and applying products should hold a certificate of competence.
- Application – products should be applied so as to avoid contamination of watercourses, and to minimise risks to the surrounding area.
- Product storage and handling – the product should be stored as to minimise environmental risks from spillage and from container disposal.

Criteria of this type are included in many assurance schemes, including UK AAC, EurepGAP, and Rainforest Alliance SAN. This means that there are established methods for measurement, reporting and verification, and that cross-certification is likely to be possible in many cases. As the most severe crop protection-related impacts, such as use of banned chemicals should be covered by national laws, many of these criteria could be adopted on a voluntary basis only.

5.4.2.7 Environmental protection

Reduction of impacts in other environmental areas, such as animal and plant biodiversity, and conservation and creation of habitats also requires assurance criteria. Biodiversity, in particular, is recognised as an issue of global importance, which has led to agreements such as the 1992 Convention on Biological Diversity.

Given the variation in the nature of action to be taken between regions, conservation management plans may be the most effective form of criteria in this area, as used in EurepGAP and Rainforest Alliance SAN. Here the farmer would be required to establish and follow a conservation management plan, or follow an existing regional plan if it exists, including action to enhance habitats and biodiversity. The plans could be made more specific by including actions such as maintaining remnants of forests and linking them via forested corridors, or conversion of unproductive areas into habitats.

This criterion could be included as a voluntary criterion in either a separate or RTFO-linked scheme, but there would also be a case for including a mandatory reporting requirement on plan preparation and implementation, as a result of the global importance of the issue. The additional burden on producers could be reduced by providing guidance on plan preparation, in cooperation with local and regional bodies.

5.4.3 Forestry products

Assurance for biofuel chains using wood and residues from forestry could be developed with strong links to schemes established for other forestry product uses.
The Forestry Stewardship Council (FSC) works on assurance of forestry products internationally, and is now working with the UK Woodland Assurance Scheme (UKWAS) on a combined standard for UK forestry. The FSC works on ten principles, covering forestry management, conservation, biodiversity, the local community, and the forestry workforce. FSC is a full member of ISEAL and is therefore also working for the standardisation of assurance schemes internationally.

Nearly all of the environmental criteria in the FSC scheme are applicable to environmental assurance of biofuels. Principle 6 states that "Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest." Criteria include:

- Assessment of environmental impacts.
- Protection of rare, threatened and endangered species and their habitats.
- Maintenance, enhancement or restoration of ecological functions and values.
- Protection of samples of existing ecosystems within the landscape.
- Written guidelines to control erosion, minimize forest damage and protect water resources.
- Management systems to promote non-chemical methods of pest management. If chemicals are used, provide proper equipment and training.
- Appropriate disposal of chemicals, containers, non-organic wastes.
- Control of use of biological control agents. Prohibition of use of GMOs.
- Control of the use of exotic species.
- No forest conversion to plantations or non-forest land, except where conversion a) entails a very limited portion of the forest management unit; and b) does not occur on high conservation value forest areas; and c) will enable clear, substantial, additional, secure, long term conservation benefits.

These could be supplemented by:

- A more general criterion requiring development of a management plan, including sustainable harvesting plans (FSC Principle 7).
- Specific additional criteria from FSC on wood from dedicated forestry plantations (Principle 10). These cover use of deforested land, and also layout and species choice. Note that these are not designed to cover short rotation coppice, but could be adapted to do so.

These criteria could all be included in a scheme for use of forestry products in biofuel chains. As for energy crops, some of them could be made mandatory e.g. prohibition of use of recently deforested land, biodiversity and habitat protection plan etc, and the rest included as voluntary criteria.

5.4.4 Waste products

For waste products, such as organic municipal solid waste, organic industrial waste, sewage sludge, food processing wastes, and abattoir waste, there are few environmental impacts associated with their collection and handling for biofuel use that could require assurance criteria. In the UK and many other countries, there are existing regulations to cover waste collection, and some on use of waste for energy. Impacts associated with chains from waste are likely to occur at the conversion stage.

5.4.5 Renewable electricity

Renewable hydrogen could be produced from renewable electricity sources. In many countries, environmental impacts such as effects on flora and fauna, hydrology, marine currents, visual impacts and noise will be covered by national planning guidance. Given that in the early stages of hydrogen use it is unlikely that large volumes of hydrogen would be transported over long distances, and therefore from outside the EU, criteria to cover impacts of the renewable electricity used to produce hydrogen may not be needed in the near term. In the longer term, criteria could be developed or flanking measures used, such as assisting with development of regional plans, if these were not already in place.

5.4.6 Feedstock transport

Environmental assurance criteria are unlikely to be needed in this area. GHG emissions from feedstock transport will be included in greenhouse gas assessment.

5.4.7 Conversion

For conversion plants producing renewable transport fuels, environmental criteria could cover emissions to air (including noise), water and land. In the UK, tight controls are in place under planning guidelines and under the Integrated Pollution Prevention and Control measures (IPPC) with similar legislation occurring across Europe. To cover production in other areas, criteria could be used to cover:

- Environmental impact assessment for new plants.
- Emissions monitoring.

These criteria would need to be consistent with IPPC to enable cross-certification for plants covered by IPCC. They would be likely to be appropriate on a voluntary basis only, as this is a local/national issue.

5.4.8 Fuel transport, storage and dispensing

This area is likely to be covered by existing health and safety codes and standards for fuels transport, storage and dispensing. Renewable transport fuels are unlikely to require more standards than their fossil-derived equivalents.

5.5 Summary and conclusions

Areas of environmental impact and criteria types that would be needed for an RTF assurance scheme, as identified in the previous section are shown in Table 8 below.

Table 8: Criteria for an environmental assurance scheme for RTFs

Area	Criteria type	Details of how these could be covered in an RTFO-linked scheme
Energy crops and residues	Land use change	Mandatory criteria on deforestation could be part of GHG assurance, other land use changes could be included in carbon intensity calculation
	Soil management	Voluntary criteria on techniques and/or management plan
	GMOs	Mandatory reporting requirement and/or mandatory/voluntary criteria on techniques
	Fertiliser use	Voluntary criteria on techniques
	Irrigation	Voluntary management plan
	Crop protection	Voluntary criteria on techniques
	Biodiversity	Mandatory or voluntary management plan
Forestry products	Environmental criteria (FSC)	Mandatory criteria on deforestation etc, other voluntary criteria
	Management plan (FSC)	Mandatory or voluntary
Conversion plants	Environmental impact assessment	Voluntary
	Emissions monitoring	Voluntary reporting requirement

Two of the areas – biodiversity plans and GMO reporting – were identified as being more suitable to be covered by mandatory criteria than voluntary criteria in an RTFO-linked scheme. For these areas, a strong link could be made to international recognition of environmental impacts, and giving incentives for complying with voluntary criteria in an RTFO-linked scheme would not be appropriate. However, linking these two mandatory criteria to an RTFO would increase the risk of legal challenge to an RTFO as a whole, especially as a result of the nature of these areas. Biodiversity risks, and plan-making capabilities vary considerably between regions and crops. GMO reporting and GMOs in general are the subject of ongoing international legal disputes. We therefore recommend that these areas should not be covered by mandatory criteria at the start of an RTFO. Once criteria were developed, and some impacts monitored, as part of voluntary schemes, a pathway could be defined for inclusion of criteria at a later date.

We therefore recommend that all of the criteria be covered by a voluntary scheme outside an RTFO. This avoids the complexity of introducing additional certificate allocation for meeting voluntary criteria in an RTFO linked scheme, and reduces the risk of legal challenge as a result of any RTFO-link. Note that it

is recommended that deforestation and other land use changes be covered under GHG assurance. Uptake of a separate voluntary scheme is likely to be high, and the range of criteria that can be included is broad. A separate voluntary scheme would not need to be developed and managed by actors in RTFO development, and so the institutional and administrative framework for this is not discussed further in this report. However, it would be likely that the process for assurance could be set up in a similar way to that described in section 7. We recommend that development and implementation of a separate voluntary scheme should be encouraged to coincide with the start of an RTFO. A timetable for reviewing the environmental impacts of biofuels in an RTFO should also be drawn up in cooperation with those operating the voluntary scheme, in order to monitor impacts, and assess the need to link criteria to a functioning RTFO at a later date.

6 Social assurance

6.1 Introduction

Social equity is one of the three cornerstones of sustainable development. The use of the term 'renewable' in the concept of a renewable transport fuels obligation implies the need for the 'sustainable' supply of such fuels. Whilst there is much debate about how to measure sustainability it is generally accepted that in order to assess it, the three main pillars of sustainability need to be considered equally i.e. environmental, economic and social. The need for such a broad base arises because the concept of sustainability is rooted in intergenerational equity. Therefore, for example, were the production of 'renewable transport fuels' to damage livelihoods or encourage child labour, their supply could not be regarded as sustainable. Although, ensuring wider social development for current and future generations is beyond the scope of any assurance scheme, such schemes can contribute through ensuring that certain basic social standards are met. It is difficult to determine whether appropriate social standards will be met in supplying RTFs, biofuels in particular, as demand grows. Therefore, it is important to consider social assurance schemes in relation to the supply of RTFs under an RTFO.

However, establishing the basis for evaluating social equity remains internationally contentious. Discussions with legal authorities have identified the difficulties in reconciling international trade rules with seeking to couple mandatory or even voluntary social assurance criteria to an RTFO-linked scheme[41]. It remains unclear what the implications would be with regard to WTO approval if a separate, voluntary, non-RTFO linked scheme were to develop in parallel with an RTFO. Note that requiring assurance on health and safety standards for the supply of goods is recognised by the WTO as a necessary exception to the more general moratorium on the inclusion of other social standards (see below).

6.2 International activities

Despite these problems, the key principles of social assurance have been established at the international level. Existing national and international schemes that have relevant sections in their certification questionnaires have been identified and possible linkages to an RTFO highlighted.

Recently, the relevant international organisations have started to develop a coherent set of internationally acceptable standards. For example, in March 2005, the ISO held a meeting to launch its Working Group on Social Responsibility with the task of publishing an ISO 26000 standard on guidelines for Social Responsibility, due in 2008. The other main international organisations involved in developing social assurance systems are the International Labour Organisation (ILO) and Social Accountability International (SAI) which accredits social certification bodies to its SAI8000:2001 international standard. The development of the SAI8000 standard is closely coupled to the work and underlying principles of the International Labour Organisation (ILO) which is the UN agency tasked with promoting 'social justice and internationally recognized human and labour rights.' A few other national and international assurance schemes exist which include social principles and standards as summarised below.

[41] Ivan Smyth, Department of Trade and Industry, personal communication

Finally, the British Standards Institute recently announced (March 2005) that it had achieved global accreditation to SAI's 8000:2001 standard and is therefore able to provide SAI8000 certification services nationally and internationally.

6.3 Social standards

These include[42]:

- Rights to associate and belong to a trade union.
- Safeguarding equal opportunities (gender and disability).
- Avoiding or managing child, youth and forced labour.
- Occupational health and safety.
- Working conditions (salary, hours, hygiene, health care, housing, etc).
- Worker training.
- Effects on local community.
- Reporting on and monitoring of social issues.

Whilst these over-arching principles and standards have been developed by the ILO and SAI, most implementing accreditation bodies have so far chosen not to certify to full SAI 8000:2001 standards. Instead, they have chosen to develop their own standards and verifiable criteria or to cherry-pick a relevant sub-set of the standards for their sector. For example, EurepGAP covers some of the social standards above, and has recently published its revised General Regulations, Control Points and Compliance Criteria and the Checklist for Integrated Farm Assurance (Version 2, March 2005) which includes a substantial section on 'worker health, safety and welfare.' The UK ACC and APS schemes also cover some aspects on occupational health and safety, hygiene and worker training for combinable crops and fruit farming. They could therefore provide a basis for essential criteria for the energy crops and residues part of an RTF assurance scheme. Other schemes providing more wide ranging standards such as Fairtrade could be also be used to give recommended criteria in this area. **However, until general social standards have been developed by an acceptable international body, such as ISO, achieving acceptance at the WTO level remains unlikely**.

6.4 Criteria selection for renewable transport fuels

SAI outline nine categories (or standards) required for certification of a company as being 'socially responsible'. As with other assurance schemes, each standard can be evaluated by collecting data on verifiable indicators as listed in Table 9.

Many of the concepts of social equity are controversial, differing between cultures, and are therefore location specific. This is particularly the case with regard to minimum wages and the definition of the age of a 'child'. In developing countries for example, child labour may be an essential part of the survival strategy of a family. As a result of these issues, the development of social assurance standards, as carried out through the UN's International Labour Organisation[43], has taken place as a stakeholder-based consensus process, often with definitions being characterised by the need to account for different national perspectives. For example, the definition of child labour as enshrined by the 'Minimum Age Convention'[44] allows some flexibility

[42] Details of these standards and their associated definitions are published by SAI and are available on their website (www.cepaa.org).
[43] see ILO declaration, 1998; www.ilo.org
[44] ILO Convention No 138

in the minimum age limit, which is generally set at 15 years old, due to national circumstances.

The nine standards as outlined in SAI 8000 are each assigned verifiable criteria. However, most existing assurance schemes evaluated have so far focused on health and safety alone, with the criterion for measuring compliance with the health and safety standards being well established and demonstrably workable. They are applicable to all forms of biomass production and supply for energy and should be used as the basis for implementing the other social assurance standards once the ISO 26000 guidelines are published in 2008.

Table 9 Social Accountability Standards (as defined by SAI 8000:2001).

Category / Standard	Definition	Criteria	Scheme Coverage
Child Labour	ILO definition- a child is a person under the age of 15 years- some exceptions exist and ILO rules allow some exceptions for developing countries	Where children are employed they must be able to attend school and that total school and employment work must not exceed 10 hours per day.	SAI 8000 UK Ass. Schemes (e.g. APS). BSI.
Forced Labour	Work that is 'extracted under menace of any penalty for which a person has not offered themselves voluntarily or if such work is demanded as a means of repayment of debt.'	A company shall not engage in or support the use of forced labour, nor shall personnel be required to lodge 'deposits' or identity papers upon commencing employment.	SAI 8000. BSI.
Health & Safety	Multiple. E.g. see SAI 8000:2001 or EUREP GAP IFA ver 2, 2005.	Company must appoint senior manager to be responsible for H&S. Personnel must receive regular safety training. Systems to detect, avoid or respond to threats must be established. Must ensure reasonable and clean working conditions.	SAI 8000. EUREPGAP IFA 2005. UK Ass. Schemes (e.g. ACCS & APS). BSI. UKWAS 2000.
Freedom of Association & Right to Collective Bargaining	Rights of workers to meet together and join a trade union	Rights to collective bargaining. Company must not discriminate against union members.	SAI 8000. UK Ass. Schemes (e.g. ACCS & APS). BSI. UKWAS 2000.
Discrimination		Must not discriminate on the basis of race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation or age. Company must not allow threatening or discriminatory behaviour by its staff.	SAI 8000. BSI.
Disciplinary Practices		Company shall not engage in or support the use of corporal punishment, mental or physical coercion	SAI 8000. BSI.

		and verbal abuse.	
Working Hours		Company must abide by national laws. Working week must not regularly exceed 48 hours. At least one day off per week. Overtime should be rewarded and should not exceed 12 hours per week.	SAI 8000. UK Ass. Schemes (e.g. ACCS? & APS). BSI.
Remuneration		Wages must meet minimum legal or industry standards. Deductions from wages must not be made for disciplinary purposes.	SAI 8000. BSI.
Management Systems & Control of Supplier and Sub-contractors		Numerous- based around ensuring compliance with above standards not just for the company but also its suppliers and sub-contractors.	SAI 8000. BSI.

None of the social criteria listed in Table 9 above appear to be more difficult to measure or verify than the other criteria under other existing schemes. If only a small number of additional criteria are required, it might be possible to cross-certify by adding them onto an existing scheme, removing the need for additional inspection and reducing costs. Also, given that these schemes are currently applied by certification bodies who are accredited to certify under several assurance schemes, accrediting them to add a new bolt-on scheme for bioenergy supply may not lead to significant extra costs.

6.5 Scheme establishment

Many aspects of social certification remain controversial and await the international consensus building outcome of the ISO 26000 process. The guidelines for ISO 26000 are due to be published in 2008 and will represent a major step forward in the general acceptability of social assurance. Given the importance of considering social assurance in relation to the supply of RTFs under the RTFO, the following is proposed:

1. Include health and safety criteria in the establishment of a separate voluntary environmental assurance scheme.
2. Develop a plan for the adoption of social criteria agreed under ISO 26000 consistent with the timing of its publication. Initial implementation could be carried out through a separate voluntary scheme in order to demonstrate that implementation is practical and cost-effective. Social issues related to the introduction of RTFs under an RTFO should be reviewed after its implementation to determine future actions in relation to social assurance.

6.6 Design

There are now a number of organisations that have been ratified to certify to SAI8000:2001 standards including BSI. Within the UK, a number of schemes have developed criteria for certifying Health and Safety, child labour, freedom to associate (e.g. to join a union) and maximum working hours. Both BSI and CMI have stated that they would be willing to develop certification if it could be shown to be commercially viable. The organisations that might be interested in becoming involved in designing the social standards coupled to an RTFO include:

- UK-based
  - BSI (http://www.bsi-global.com; contacted 5 May 05)
  - UKWAS / FSC (UK Woodland Assurance Scheme; not contacted)
  - CMI (http://www.cmi-plc.com; contacted 6 May 05)
- International
  - ISO (http://www.iso.org; not contacted)
  - SAI (http://www.cepaa.org/ a member of ISEAL; not contacted)

6.7 Operation

An entirely separate scheme exclusively covering social standards would result in significant additional costs, complexity and bureaucracy, particularly to biomass producers. It is therefore likely that to be cost-effective social assurance schemes will need to be operationally linked to other assurance scheme e.g. environmental assurance schemes.

Any activities linking social assurance to an RTFO, whether mandatory, linked voluntary or independent voluntary, would need to be considered very carefully. However, it is possible that suppliers of raw biomass or processed biofuels may already participate in the relevant assurance schemes highlighted in Table 9. Further developments in this area will result from the work on ISO 26000.

6.8 Summary

Linking trade measures to compliance with social assurance schemes is an area of considerable sensitivity within the WTO and other international fora. While social assurance may be an important component in ensuring the sustainability objective of an RTFO, we believe that at the present time linking it to an RTFO on a mandatory or voluntary basis would be contentious and would add considerable complexity to an RTFO which might render it susceptible to challenge.

However, voluntary social assurance of RTFs supplied under the RTFO needs to be encouraged based on existing schemes, and social issues arising from the supply of RTFs need to be monitored. The development of the ISO 26000 guidelines on Social Responsibility may provide an opportunity for linking social assurance to an RTFO. It should signalled that social assurance could be linked to an RTFO in the future.

7 Institutional and administrative framework and certification procedures

This study has concluded that the most vital aspect of environmental assurance to include within an RTFO is the assurance of GHG benefits, using a carbon certification approach. This section describes the administrative framework that would be required to implement and oversee this system.

7.1 Essential roles and competencies

Figure 7 illustrates the main institutional roles that would be required to implement a carbon certification system for the biofuels industry.

The proposed system would be based upon standard calculation templates and default values that would be developed by an independent 'methodology unit'. It is important that the methodology unit has relevant expertise on biofuel systems, GHG life cycle analysis, and also an understanding of the practical operating requirements of different organisations within the agricultural and fuel supply chains. The methodology unit should be seen to be developing calculation templates and default values in an independent[45], transparent and evidence-based manner, using established methods for meta-analysis and quality assurance procedures.

The initial cost of establishing the tools and default factors is likely to be in the range of £200k to £300k. However, once established, the annual cost of reviewing and updating evidence would be substantially reduced; perhaps to around £50k per year. The costs of developing the tools, default factors and establishing the methodology unit could either be borne by industry or by government (or a partnership between government and the private sector), depending on the approach used to develop the system.

Tools, consisting of calculation templates, would be disseminated to organisations within the supply chain through verification companies that are already working in the supply chain. Verifiers are already active throughout the agricultural sector and fuel supply chain fulfilling the role of assuring information about the physical properties of fuels (such as sulphur content, aromatics, viscosity, etc.). The provision of carbon certification inspections would constitute a relatively minor addition to the range of inspection services already being provided to the industry[46].

The verification of carbon intensity calculations is likely to be undertaken on a sampling basis. In the early stages of the system, training of verifiers would be required, and their accreditation to verify would be conditional upon demonstrating competency to an accreditor (possibly provided by UKAS in the first instance). The costs of training and accreditation would be borne by the verifiers themselves.

A UKAS-type accreditation body would need to be responsible for ensuring that verifiers were competent to undertake auditing of carbon intensity calculations and

---

[45] It is recommended that the unit is independent of government and the fuel industry but will take inputs from both

[46] For example BSI provides a broad range of inspection services ranging from vessel loading/discharge supervision; tank and meter calibration; through to pipeline transfers and sampling (including provision of automatic samplers).

input data. UKAS has organised similar accreditation processes for verifiers within the UK Emissions Trading Scheme (UKETS) and the European Union Emissions Trading Scheme (EUETS). The competency and training requirements for the verifiers would be determined by the accreditation body in collaboration with the methodology unit and relevant Government departments.

As noted before, the costs of accreditation would be borne by the verifiers (and eventually passed on to the supply chain through the cost of verification (see Table 4 for estimates). If passed on to the consumer, these costs are likely to have a relatively insignificant impact on costs at the pump. For example, it is estimated that the total costs of GHG assessment and verification will be of the order of 0.02p/l of biofuel (equivalent to 0.001p/l of petrol with a 5% biofuel blend e.g. E5 or B5). This is based on assurance costs presented in Table 4.

The competencies of verifiers for carbon intensity information and data from biofuel processing plants and logistical operations would be virtually identical to the requirements for verification of the UKETS, the Climate Change Agreement Scheme (CCA), or EUETS. The process for accreditation of verifiers should therefore be relatively straightforward. It is likely that verifiers already providing services in the above areas will add verification of biofuels for transport to their list of services.

The competencies of verifiers for carbon intensity information and data from feedstock production would be the same as those already used in the British Farm Standards (including the Assured Combinable Crops Scheme) and Eurep-GAP. The main requirement would be to verify the validity of fossil fuel use, fertiliser and pesticide records, all of which are already covered within existing schemes. Government and the accreditation entity may wish to recommend an increase in the stringency of auditing of some figures in order to minimise the risk of erroneous or false reporting. However, this is not likely to represent a significant increase in the overall verification effort. There may be some training required to ensure that there are no / minimal gaps between farm-level verification systems and those in place in processing plants.

The only aspect of the assurance scheme that may require additional effort in terms of the development of new competencies, is the checking of historic land use. It is suggested that this could be done using a sampling basis by an independent scientific institution with access to relevant Landsat™ data and expertise in image interpretation. However, it should be noted that checking for historic land use change is something that will only need to be done once per farm / production area. Once this has been checked it will not need to be re-checked. The cost of setting up this verification system is estimated at £150,000.

7.1.1 System design

Figure 7 provides an illustration of the procedure for certifying the carbon intensity of biofuels.

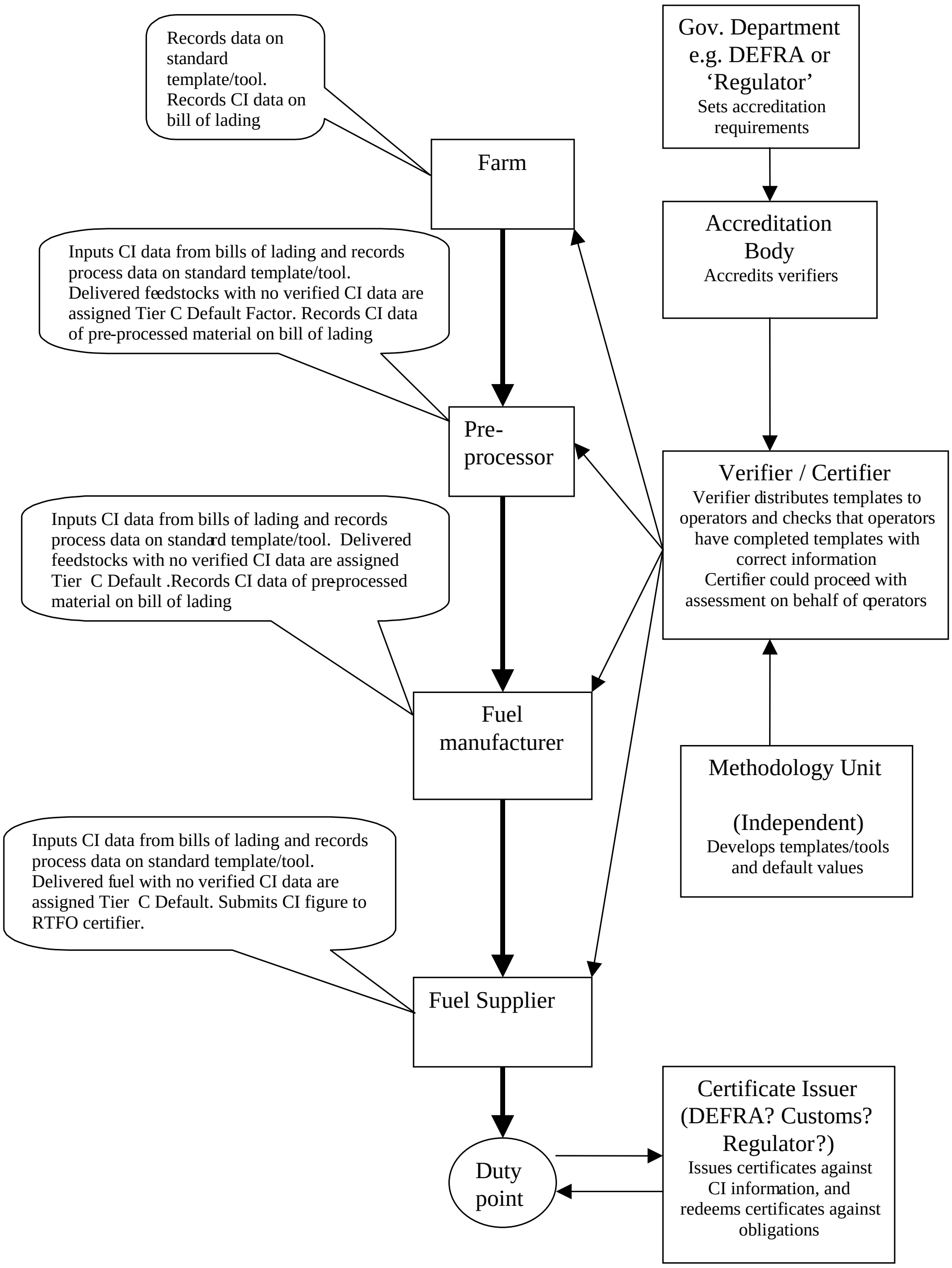


Figure 7 Illustration of the procedure for certifying carbon intensity of biofuels

7.1.2 Institutional roles

7.1.2.1 Operators

Operators include farms, processors and fuel suppliers. Operators within the supply chain would use standard templates / tools to enter Tier A data or Tier B carbon intensity information. The resulting carbon intensity figure would be entered on the bill of lading[47] of products despatched to the next stage of the process. Operators receiving feedstocks or fuels at any stage of the supply chain would record carbon intensity data of inward products onto a standard template. Any inward goods not containing an authentic carbon intensity figure would be assigned a Tier C default factor.

[47] A document establishing the terms of a contract between a shipper and a transportation company. It serves as a document of title, a contract of carriage, and a receipt for goods.

7.1.2.2 Verifiers

Verifiers would undertake periodic[48] inspections to ensure that the correct data was entered in the prescribed templates. Verifiers would also have a role in distributing the templates and training companies in the collection, recording and archiving of relevant data. Verifiers would need to be accredited by an accreditation body.

7.1.2.3 Accreditation body

Accreditation bodies are responsible for ensuring that verifiers are competent to carry out the tasks assigned to them.

7.1.2.4 Methodology unit

The methodology unit would develop data entry templates and standard calculation tools to be used by the operators. These would be distributed to the operators via the verifiers and could also be downloaded from the internet / secure data exchange system[49]. GHG conversion factors, and default values would be embedded in these tools. The methodology unit would also be responsible for maintaining an evidence base (transparent information system) that would be periodically updated to ensure continued application of the Best Available Evidence principle, nationally and internationally.

7.1.2.5 RTFO certificate issuer / redeemer

An RTFO Certificate issuer would issue certificates on the basis of carbon intensity and volume of biofuels.

7.2 Technical capabilities for supply-chain traceability

The technical requirements for traceable supply chains are well established, and throughout industry, both nationally and internationally, traceability management systems are widely implemented. The agricultural sectors are no exception, and the majority of large-scale biofuel manufacturers have established systems in place as part of the normal contracting process. These guarantee the buyer a fully traceable source of supply from production, through processing and distribution.

Producers may implement traceability systems within a supply chain in response to legislation, as in the recent EU Regulation 178/2002. From January 2005, the ability to trace "food, feed, food producing animals and any other substance intended to be, or expected to be, incorporated in to a food or feed" through all stages of the supply chain, became EU law[50].

If no legislation exists, companies may self-impose traceability systems. Motivations include ensuring safety and quality, maintaining efficiency, to increase customer confidence in a product and for marketing a specific, undetectable characteristic of a product, for example, fair trade or organic status.

Traceability systems have to be able to track the movement or transformation of a predefined unit of product along a supply chain. The sophistication and thus the

[48] Frequency and intensity of inspections to be determined by accreditor, methodology unit and steering group.

[49] Such secure electronic data exchange systems are already being developed by verifiers / certifiers e.g. CMi, allowing real-time data gathering and verification to occur through 'self-input' data systems.

[50] Regulation EC number 178/2002 of the European Parliament and the Council. Available online at: http://europa.eu.int/eur-lex/pri/en/oj/dat/2002/l_031/l_03120020201en00010024.pdf

capabilities of the various technologies that are currently available vary (e.g. paper/ computer based systems, barcoding, smart-tagging). The amount of information that can be traced, the direction and the distance of traceability along the supply chain, and the precision, leading to the degree of confidence in the traced information, are all examples of elements that can be tailored to suit the application of the system in question.

7.3 Work programme for development and implementation of the assurance scheme

We expect that a functioning system for assuring the GHG benefits associated with biofuels under an RTFO could be developed and deployed within 18 months.

The development programme would consist of the following essential steps:

1. Development of the carbon certification worksheets and default values (methodology unit; month 0 to month 10; approx cost £300,000):
    - compilation and ranking of available evidence from existing studies and industry information
    - calculation of default factors
    - publication of methods (and external peer-review process)
    - production of worksheet / calculation tools
    - writing of guidelines / user help sheets
    - production of website to download tools and access information.

2. Development of system for verifying GHG emissions from land use change (appointed institute or methodology unit: month 0 to month 10; approx cost £150,000):
    - collection of Landsat TM / other satellite data
    - development of sampling regime
    - testing and review of standard change detection methodology
    - deployment.

3. Accreditation of Verifiers (month 4 to month 12; cost internalised by industry):
    - agreement of competency requirements and accreditation procedures
    - training of verifiers
    - accreditation of verifiers.

4. Pilot implementation (month 12 to month 18; cost internalised by industry):
    - test implementation of system
    - review and adjustment.

5. Full deployment (from month 18):
    - formal linkage to RTF certificate issuance.

7.4 Costs of implementation and GHG Benefits

We estimate the costs of developing the system for GHG assurance to be of the order of £0.5 million. These costs could be borne by the government, should the government decide to take a lead role in the development of the system; alternatively the industry could take on the role of developing the system and cover the majority of these costs. The RTFO timetable will be dictated by government and so it may be logical for the system development to be dictated in parallel. In either case a significant level of industry involvement will be essential.

The running costs of the scheme should be low and possibly limited to costs related to a periodic review of the scheme. The costs could be covered from the buy-out fund or penalties linked to an RTFO.

It is worth considering what could happen if GHG certification is not implemented. In the absence of GHG assurance, the carbon intensity of biofuels supplied in the UK is likely to increase. With incentives based purely on production and supply cost, as demand rises, supplies from less efficient producers will be drawn in, quite possibly encouraging direct land conversion, particularly in developing countries. By contrast, with GHG assurance, the carbon intensity is expected to fall as suppliers and producers respond to the economic signal provided by the system. Direct land use change would also be avoided. We expect the difference between GHG assured and non-GHG assured scenarios to be at least 1.5 million t CO_2 by 2010 and rising thereafter. Based on the cost estimates for establishing and running the scheme and likely amounts of GHG savings produced, the contribution to CO_2 abatement costs is likely to be negligible.

8 Conclusions and recommendations

This study has examined the feasibility of linking sustainability assurance schemes to a Renewable Transport Fuels Obligation. Specifically, the study has addressed 6 key questions:

1. Why should environmental and social assurance be considered in relation to an RTFO?
2. Can environmental and social assurance be incorporated within an RTFO without amending the Energy Act or leading to challenge under EU Single Market or international trade rules?
3. Should environmental and social assurance be a key component of an RTFO?
4. How could greenhouse gas assurance be linked to an RTFO?
5. What are the implications of not linking greenhouse gas assurance to an RTFO?
6. Can an effective assurance scheme be implemented in a reasonable timescale and at a reasonable cost?

1. Why should environmental and social assurance be considered in relation to an RTFO?

Growth in the use of RTFs as a result of an RTFO and growing global demand requires consideration of the sustainability of their production. Both the EU Biofuels Directive and the UK Energy Act 2004 stress the importance of understanding and considering climate and other environmental and sustainability implications in incentivising the uptake of RTFs.

Biofuels could lead to GHG emissions savings compared with fossil fuels ranging from negative to over 100% depending on the type of feedstock, the method of cultivation and the biofuel production processes employed. The uncertainty in emissions from different biofuels and the unpredictability of sources of biofuel supply as global demand grows, result in significant uncertainty as to the level of GHG emissions reductions that could be achieved by an RTFO.

Other sustainability concerns include the effects of intensification and expansion of agricultural activities associated with energy crops, which could lead to negative environmental impacts on biodiversity, water resources, soil quality, air quality and landscape character.

Concerns are also voiced in relation to potential social impacts, in particular in developing countries. These relate mainly to issues such as child labour, forced labour, poor working conditions, and health and safety risks.

2. Can environmental and social assurance be incorporated within an RTFO without amending the Energy Act or leading to challenge under EU Single Market or international trade rules?

Conclusion: Linking GHG certification to an RTFO could be legally justifiable in the UK, European and WTO context.

Legal advice sought during this study indicates that linking GHG certification to an RTFO is believed to be legally justifiable in the UK context, as the Energy Act 2004 indicates GHG emissions reductions as a principal objective of an RTFO and states that provisions can be made to differentiate RTFs based on the GHG implications of their production, supply or use. Therefore, the Energy Act would be unlikely to require modification to accommodate certification and linking it to an RTFO.

This is also compatible with the requirements of the EU Biofuels Directive – indeed certification will enable quantification of GHG savings (a reporting requirement of the Directive) in a manner not otherwise possible.

Also, it might be feasible to construct a GHG certification scheme which would be compatible with international trade rules, but this would require further careful thought in relation to the detailed design and implementation of such a scheme. It might also be possible to include provisions related to biofuels produced from deforested areas under a GHG certification scheme, as no GHG saving would result from crops grown in these areas.

This report emphasises the importance of GHG certification in relation to the effective operation of an RTFO and its compatibility with Government and RTFO objectives. It also provides recommendations on the design of a GHG certification scheme taking into consideration the requirements of international trade rules, in particular non-discrimination of like products from different countries.

Conclusion: Linking other environmental and social certification to an RTFO would be more susceptible to legal challenge internationally.

As avoiding other environmental impacts of RTFs is also a policy objective of both an RTFO and the Biofuels Directive, a case could be made for linking an environmental assurance scheme to an RTFO. However, for several environmental areas, mandatory pass/fail criteria, rather than voluntary criteria linked to incentives, would be necessary (e.g. implementation of conservation plans, exclusion of GMO crops). Linking mandatory environmental criteria to an RTFO would greatly increase the risk of international legal challenge to the policy as a whole. It would be more difficult to demonstrate that broader environmental certification is necessary for the effective functioning of an RTFO, compared with the need for GHG certification. It is also more difficult to define precise criteria based on scientific evidence which would be regarded as non-discriminatory and internationally acceptable.

Linking trade measures to compliance with social assurance schemes is an area of considerable sensitivity within the WTO and other international fora. At present, we consider linking the operation of the RTFO to a mandatory or voluntary certification scheme requiring compliance with social criteria is not essential to satisfy the policy objectives being pursued. We believe that at the present time the introduction of such a scheme would be contentious and would add considerable complexity to the RTFO, which might render it susceptible to challenge. The legal position on linking social standards to an RTFO may evolve in time, in particular following the outcome of the international consensus building activities currently underway through ISO 26000 and other bodies.

3. Should environmental and social assurance be a key component of an RTFO?

Recommendation: GHG certification should be a key component of an RTFO, to ensure that the policy objective of reducing greenhouse gas emissions is met –

assuming the scheme can be developed in a manner consistent with international trade rules.

GHG certification is the process by which a product or service is delivered with a formally declared carbon intensity, which is a measure of the amount of GHGs produced expressed in units of CO_2 equivalent. The declared carbon intensity of each could be linked to the number of RTFO certificates issued.

GHG certification should be a key component of an RTFO for four principal reasons:

1. The uncertainty over GHG emissions from different biofuel sources and production processes means that without GHG certification it would be difficult to quantify the GHG savings resulting from the increase in biofuel use. It also means that it would be difficult to assess the contribution of RTFs to national GHG emissions reductions targets, and fulfil the reporting requirements under the EU Biofuels Directive.
2. The uncertainty over the level of emission reductions means that there is a risk of the RTFO being discredited if it were found not to deliver significant GHG emissions reductions.
3. In the absence of a policy mechanism linked to GHG certification, there would be no incentive to supply RTFs with lower GHG balances as opposed to RTFs with higher GHG balances, which will in many cases be cheaper.
4. Cheaper fuels may correspond to higher GHG abatement costs. The LowCVP Wheat to Ethanol Report shows that more efficient and renewably fuelled plants result in lower GHG abatement costs. Therefore, incentivising biofuel volumes alone may be a particularly inefficient way of achieving GHG emissions reductions.

Recommendation: Other environmental and social criteria should be covered by a separate voluntary scheme, developed by industry stakeholders, but not directly linked to the RTFO.

Environmental issues, such as biodiversity impacts, and social issues, such as labour practices, whilst recognised as being important would add considerable complexity to the scheme, making it potentially more onerous for trading partners to comply with, and would be difficult to justify as essential to the operation of an RTFO. A voluntary scheme could draw upon existing environmental assurance schemes, and upon the results of the emerging international consensus on social assurance currently being developed through ISO 26000 and other bodies. To ensure that an RTFO does not lead to sustained negative environmental and social impacts, a timetable should be set for review of this area to determine whether some of these environmental and social criteria could be linked to an RTFO in the future.

4. How could greenhouse gas assurance be linked to an RTFO?

Recommendation: RTFO certificates should be issued based on GHG savings determined though a standardised GHG certification system.

The recommended methods for GHG certification involves developing accepted industry standards for fuel carbon intensity, where the fuel's carbon intensity is calculated from a combination of verified process data, provided by the fuel producer/supplier, and of default values, developed by an independent methodology unit. Such a system provides flexibility in the amount of information and data to be provided. At the same time it would reward the provision of information and data demonstrating GHG emissions reductions relative to default values. Tools would be developed to enable suppliers to readily calculate the carbon intensity of the specific production chain. RTFO certificates would then be issued based on the GHG saving relative to appropriate fossil fuel baselines.

Linking RTFO certificates to GHG savings has a number of important benefits:

1. It provides a direct link between the policy mechanism and the policy objective of GHG reductions, ensuring that the latter is met
2. It provides an efficient market based mechanism for achieving GHG reductions through the introduction of RTFs – this will result in the lowest GHG abatement costs in relation to RTFs
3. It stimulates the development and implementation of techniques and technologies that reduce GHG emissions (e.g. efficient use of agrochemicals, efficient conversion processes, use of lower carbon intensity fuels in processing, new feedstocks and conversion technologies with higher yields and greater GHG savings) and result in additional environmental benefits e.g. reduced emissions of other pollutants.

Furthermore, stakeholders such as NGOs and oil companies are interested in assessing the environmental performance of biofuels, in particular in relation to GHG reductions. A GHG certification scheme linked to an RTFO will provide a standardised and transparent way of quantifying these impacts.

Recommendation: A criterion on avoiding deforestation should be considered for inclusion as part of GHG certification – assuming this can be done in a manner consistent with international trade rules. This could exclude fuels produced from feedstocks that have been grown on land deforested within a defined timescale.

Avoiding deforestation and the negative impacts of other land use changes are also priorities in ensuring that biofuels are produced sustainably. Calculation of the release of carbon stored where land use is changed is complex, and the subject of significant scientific uncertainty. This uncertainty makes these emissions difficult to robustly quantify within carbon intensity calculation. However, it is known that emissions from certain land-use changes (such as deforestation) may be considerably greater than those from the rest of the fuel chain, and so could negate the benefits of biofuel production for many years. On this basis it may be legitimate to exclude fuels that have been grown on land deforested within a defined timescale. The proposed approach would be to define a base-year and require suppliers to certify that fuels had not been produced upon land deforested since the defined date. Verification that land use change has not occurred can be effectively carried out using data from satellite images. A sampling regime could be devised to ensure that a sufficiently high proportion of producer areas were covered to avoid any significant incidence of fraudulent reporting. Most sources of current biofuel production are not likely to be affected by the introduction of a reasonable cut-off date, but the approach would ensure that biofuel production does not lead to deforestation as demand grows.

5. What are the implications of not linking greenhouse gas assurance to an RTFO?

Conclusion: Not linking GHG certification to RTFO certificates is likely to have important negative effects on: i) the GHG emissions reductions achieved by an

RTFO, ii) the development and use of efficient and low-GHG feedstocks, cultivation methods and conversion processes, and iii) the value and cost effectiveness of an RTFO as a policy mechanism.

As previously mentioned, if RTFO certificates are not linked to GHG savings, there will be no incentive to supply fuels with lower GHG emissions as opposed to those with higher emissions, which will in many cases be cheaper. Furthermore, as demand for biofuels increases, the unpredictability of the sources of biofuels and the probability of pulling high carbon intensity biofuels into the supply will also increase.

Fuel suppliers would source RTFs from the lowest cost sources. Initially, this is likely to be Brazilian bioethanol, which has a generally good GHG balance. However, with increasing competition for Brazilian bioethanol, bioethanol will be sourced from a variety of alternative low cost sources, with comparatively low GHG savings. Most biodiesel use in the UK to 2010 could be supplied from domestic production plants, giving a reasonable degree of certainty on the emissions from the conversion process. However, a large fraction of production is already based on imported vegetable oils and future production will increasingly depend on these, with uncertain implications for GHG emissions levels.

In the absence of GHG certification, there will be no incentive to adopt practices and technologies to produce RTFs with low GHG emissions. This means that in the short term, there will be no incentive to improve cultivation practices, or use energy efficient processes or low-carbon fuels to fuel them. Competition on price alone will not provide any advantage to companies and countries developing and investing in low-carbon processes and technologies, which is likely to hinder their introduction. For the longer term, it would be difficult to justify investment in new technologies such as lignocellulosic ethanol production, Fischer-Tropsch biodiesel production, waste to RTF routes, and renewable hydrogen. The introduction of these technologies is important since they: i) achieve higher greenhouse gas savings, ii) enable more fuel to be produced from the same land area and with a potentially lower impact upon the environment, and iii) may enable a higher content of renewable transport fuels to be used in vehicles.

Without GHG certification, it will not be possible to quantify accurately the GHG savings achieved from an RTFO. It will not be possible to determine the contribution of an RTFO to reducing emissions from road transport and its contribution to national GHG emissions reductions targets. Also, not developing a link between GHG certification and RTFO certificates will forego an efficient mechanism for minimising the cost of GHG abatement from RTFs.

It has been suggested that an alternative option for monitoring GHG emissions reductions from an RTFO would be to require each supplier to report on the overall emissions of their biofuels portfolio. The priority of suppliers under this alternative option would be the supply of biofuel volumes to meet the obligation, irrespective of their GHG emissions. GHG reporting would impose a separate and possibly conflicting requirement on suppliers. Separating GHG reporting and targets from certificate allocation will result in a less economically efficient mechanism for reducing GHG emissions. Inflicting penalties on suppliers, and in the extreme case rejecting the suppliers’ certificates, based on reporting requirements would impose a very high risk on the suppliers. Also, the alternative option would not be any simpler to manage as it is likely to require a standardised reporting and verification system similar to that for certificate allocation based on carbon intensity.

6. Can an effective assurance scheme be implemented in a reasonable timescale and at a reasonable cost?

Conclusion: A simple, transparent and verifiable GHG certification scheme can be developed in relation to an RTFO. The cost of the system would be low for government and fuel suppliers, and negligible for the consumer. The timescale for development of a GHG certification system would be consistent with that for the introduction of an RTFO.

A methodology, tools and guidance would need to be developed to ensure consistency of calculation and certification of GHG emissions. Companies would be expected to self-report using such tools and have records audited to demonstrate claims are valid. Calculation tools should be designed so as to assist with verification. The initial cost of establishing the tools and default factors is likely to be in the range of £200 to £300k. The overall establishment cost could be of the order of £0.5m. However, once established the annual cost of reviewing and updating evidence would be substantially reduced; to perhaps around £50k per year.

The annual cost to government for administering the scheme could be minimal and limited to a periodic review of the scheme and spot checks on compliance. The administrative and compliance costs could be minimised by development of standard tools, requirements for self-reporting, automatic data checking and penalties for misreporting to discourage fraud.

The costs of data collection and verification are not expected to have a significant impact on the economics of biofuels operations in the UK or abroad. Assuming fuel suppliers passed verification costs onto the consumer, the cost to the consumer of linking GHG certification to an RTFO would be imperceptible, estimated to be of the order of 0.02p/l of biofuel (equivalent to 0.001p/l of petrol with a 5% biofuel blend).

A scheme could be developed and piloted within 18 months - a timescale consistent with introduction of an RTFO. Therefore, it is recommended that if GHG certification is to be linked to an RTFO, this should be done from inception. This would send the correct policy signals and avoid later disruption of the RTFO certificate market when GHG certification was introduced.

9 Appendix

Procedure for evaluation of evidence sources and identification of best available evidence for carbon certification of fuels

Taken from Section P2 of the Greenergy Carbon Certification Standard, copyright Greenergy©

For each emitting process, the availability of the following potential evidence types shall be assessed:

- Direct instrumental measurements of gaseous emissions, or calculations based on instrumental measured of mass-balances;
- Estimates based on direct measurements quantities of fuels or electricity consumed;
- Estimates based on 3rd party or supplier approximations of fuels or electricity consumed;
- Published literature based source of data or evidence

The sources of this evidence (3rd party, operator, supplier or study) shall also be considered, taking into account the potential for bias and operator error.

Then, taking into account the factors listed in table P2.1, the evidence shall be rated as either “excellent”, “high”, “good”, “fair” or “poor”. Operators may develop specific criteria using the factors in table P2.1 as a guide. The indicative uncertainty ranges for each of the qualitative ratings are given in table P2.2. Where possible, it is recommended to use quantitative sensitivity analysis to inform the evaluation process.

If two or more sources of evidence have the same rating then the most direct evidence type shall be preferred (highest row in table P2.1).

Table P2.1 Factors to consider when rating the quality of evidence for GHG emissions.

Evidence Type	**Factors to consider**
Direct instrumental measurements of gaseous emissions, or calculations based on instrumental measurements of mass-balances	• Type and make of instrument used • Expected level of precision and accuracy • Reliability of stoichiometric assumptions, given knowledge of operational conditions • Appropriately qualified staff • Reliability of record keeping • Reliability of calibration and verification procedures • Consistency of data record • Processes for error-correction
Estimates based on direct measurements quantities of fuels or electricity consumed	• Reliability of data source for conversion factors • Reliability of source of data for quantity of energy consumed • Reliability of verification or checking procedures used
Estimates based on approximations of	• Reliability of data source for activity levels

fuels or electricity consumed	and conversion factors • Validity of assumptions on which approximation is based • Reliability of any verification or checking procedures used
Published literature based source of data or evidence	• Quality of evidence used in the study • Geographic and temporal relevance • Major assumptions or qualifications used in the study • Type of literature and potential for bias or error: - "grey" industry literature - peer reviewed journal - governmental report - statistic provided by a national or international agency - other published document
Other unpublished information within suppliers management system	• Reliability of data source for conversion factors • Validity of assumptions on which approximation is based • Reliability of any verification or checking procedures used

Table P2.2 Indicative uncertainty ranges for qualitative evidence ratings

Ranking	Indicative uncertainty range
Excellent	+/- 1%
High	+/- 5%
Good	+/- 15%
Fair	+/- 30%
Poor	+/- 50%