REA Position Paper on the UK's implementation of the renewable transport elements of the Renewable Energy Directive (RED) and the Fuel Quality Directive (FQD) - June 2009

Introduction

The Renewable Energy Association is the largest renewable industry body in the UK, with over 570 corporate members. The Association and its members are active across the full range of renewable energy technologies including electricity, heat and transport fuels. The REA's Renewable Transport Fuels Group (RTFG) has some 50 members with direct and indirect interests in biofuels for transport.

This paper sets out the REA's preliminary position on a number of the key issues which need to be addressed in considering the implementation in the UK of the RED and the FQD. The paper covers:

- Scenario modelling to reach the 10% transport target in the RED. This will include REA views on the **trajectory** for renewable transport. A consequential view on the GHG saving trajectory for the FQD is also suggested.
- Consideration of the specific requirements for advanced biofuels.
- A proposed **market mechanism** for both the RED and the FQD under an amended RTFO.
- Principles against which any future **indirect land use change policy** at EU level must be assessed.

The REA understands that the European Commission will bring forward proposals after the summer break for consideration by Member States in the Committee on the Sustainability of Biofuels and Bioliquids (Article 25 of the RED) on the following issues:

- Definition of degraded land
- Definition of biodiverse grassland
- Changes to default figures set out in Annex V of the RED
- Reporting requirements on environmental and social criteria

The UK authorities also have to decide on the list of NUTS level 2 areas in which typical GHG emissions from feedstock production are as good as or better than those in the RED default values (Article 19.2)

We will return to these and any other outstanding issues in a later paper.

Section 1 – scenario modelling for the UK and the EU to reach the 10% target by energy set out in the RED[1]

The UK's task

The UK Government has signed up to the mandatory 10% target for renewable transport by 2020. As set out in the European Commission's Renewable Energy Progress Report of 24 April 2009, the UK's performance under the 2003 Biofuels Directive has been disappointing. Under the Renewable Transport Fuel Obligations (Amendment) Order 2009, our own national targets have been slowed down from those set out in the original RTFO Order. UK law now says we need only reach 5% by volume by 2013/14 compared to the 2003 Biofuels Directive indicative target of 5.75% by energy by 2010. Set against the RED mandatory target of 10% by energy for 2020, the task for the UK looks daunting.

Is the target reachable?

This question has to be answered in stages:

1. What estimate can be given for the contribution that could be made to the 10% target by renewable transport technologies other than biofuels by 2020?
2. What is the availability of sustainable feedstock for biofuels in the EU, the UK and globally?
3. What proportion of the biofuel contribution can come from advanced technologies and non-food feedstock?
4. What policy is required to enable estimates to become reality?

The REA carried out a carefully considered analysis, based on a number of possible scenarios, to attempt to reach a view on points 1-3. A synopsis of this work can be found in Annex 1. The model:

- Has been developed for EU and UK
- Examines the availability of feedstocks for bioethanol (sugar cane, wheat, maize, barley) and biodiesel (rapeseed, used cooking oil and tallow, sunflower seed, soybeans, palm oil)
- Is based on the mandatory requirement that these feedstocks must meet the core sustainability criteria of the RED and the FQD
- Takes into account:
    - Imports of feedstocks and finished fuel
    - Yield potential of key feedstock crops
    - Co-products
    - Land use change

[1] Article 3 (4) and Recitals 13, 14 & 16

Key conclusions from the REA analysis

Contribution from other renewable transport technologies by 2020

Electric vehicles - Work carried out for the Department for BERR and DfT by CENEX in October 2008 suggests that the up-take of electric vehicles in an extreme high level of deployment scenario would barely reach 0.1% of the vehicle market by 2020. The Government's document "Ultra low carbon vehicles in the UK" (April 2009) suggests that some developments may only begin to emerge in some selected cities from 2012, even with the positive policies laid out in the paper.

Biomethane-powered vehicles – Current up-take is negligible. While this is likely to change in the future, competition from the power and heat sectors is likely to mean that biomethane will not make a significant contribution in the transport sector by 2020.

The need for a stretching energy target

The RED (Article 3 (4)) states:

> "Each Member State shall ensure that the share of energy from renewable sources in all forms of transport in 2020 is **at least 10 %** of the final consumption of energy in transport in that Member State."

The REA believes that policies must be put in place to deliver the **10% target as a minimum** from current and future biofuel pathways. 10% should not be regarded as a ceiling. If electric vehicles using renewable electricity and biomethane-powered vehicles can make a further contribution, then 10% will be exceeded. This will act to reduce delivery risk.

In this context it should be noted that the Government has set an interim carbon budget under the Climate Change Act of 34% for 2020 (relative to 1990). Depending on the outcome of the Copenhagen Summit in December 2009 this could be increased. This re-inforces the need for policies that will result in the 10% target being exceeded.

Finally, BERR's Consultation paper on the Renewable Energy Strategy of June 2008 demonstrates (Fig. 1.4, Page 36) that the resource cost of renewable transport (largely based on biofuels) is low compared to other renewable technologies. McKinsey & Company in their 2009 report "Pathways to a Low-Carbon Economy" also concluded that the cost of CO_2 reduction from first generation biofuels is negative. Advantage must be taken of this.

There is sufficient availability of sustainable feedstock for biofuel demand in the EU for 2020

Demand - A 10 % target for the EU will require some 55.6 billion litres of biofuel. Assuming a 60/40 split between diesel and petrol and an increase in fuel use of 0.9% by 2020, the demand for bioethanol will be 28.5 billion litres and for biodiesel 27.1 billion litres.

Supply – Brazil is, by a large margin, the biggest exporter of ethanol to the world market. Ethanol is traded internationally and the USA, EU and Japan are major importers. UNICA, Brazil's sugarcane industry association, has estimated that Brazil's available surplus for export of ethanol in 2020 will be 15.7 billion litres. This may be an optimistic estimate, but assuming that the EU imports one third of this (5.2 billion litres), and a further 0.5 billion litres from non-Brazilian sources, reaches the projected yield potential of domestic feedstocks and land use availability, and maintains EU cereal exports at current levels, there will be a minimum estimated supply of 54.2 billion litres (42.7 billion litres of bioethanol and 11.5 billion litres of biodiesel).

For bioethanol, the combination of increases in domestic feedstock production and imports could significantly exceed the projected demand for 2020. The same could be true of biodiesel, although the REA model has not included a figure for projected biodiesel imports through to 2020. Biodiesel feedstock sourcing will be more dependent on imports, but overall there is no reason why the EU and UK should not easily reach the projected target for biodiesel.

There is sufficient availability of sustainable feedstock for biofuel demand in the UK for 2020

The REA has modelled 6 scenarios, depending on the petrol/diesel split in the market and on the projected growth in energy.

Demand –The model shows that UK biofuel demand for 2020 will be between 6 and 6.7 billion litres (3.2 – 3.6 billion litres for bioethanol, and 2.8 – 3.1 billion litres for biodiesel).

Supply – Even assuming that the UK takes as much as 20% of the EU's imports from Brazil (1 billion litres), reaches the projected yield potential of domestic feedstocks and land use availability, and maintains cereal exports at recent levels, there will be an estimated supply of 6.1 billion litres (4.3 billion litres of bioethanol and a minimum 1.8 billion litres of biodiesel).

EU and UK should play a major role in supplying sustainable biofuels

Given the uncertainty in the amount of sustainable imports that would be available, we believe that EU production should be encouraged to play a major role (probably 70-80% of the overall target). Given the competitive nature of feedstock costs and the underlying industrial infrastructure and capability, UK production should also play a significant role, providing the correct policy map is in place for the UK.

Indirect effects

These conclusions do not take fully into account the indirect effects of biofuel production, as the parameters for introducing such a policy have not been agreed. However, the analysis shows that by bringing into production current unused agricultural land and focusing on yield improvements, targets can be met with land use change minimised.

It is essential that the RED and FQD sustainability criteria are scrupulously observed for both domestic and imported product.

REA biofuel producing members have invested considerable resource into ensuring that their supply chains and processing facilities produce to RTFO environmental and social standards. When the RED comes into effect obligated suppliers will no longer have the option to submit "unknown" in carbon and sustainability reports - a practice that has been very damaging to those biofuel producers who have delivered high standards as reported to the RFA. We believe that the UK and EU authorities should be very firm in ensuring that standards are met and procedures, including international schemes or bilateral agreements, should be transparent and open to public scrutiny.

The contribution from advanced technologies and non-food feedstock

The REA analysis has estimated that the UK's likely production of "second generation" biofuels by 2020 will be 0.2 billion litres each for bioethanol and biodiesel. However, the specific characteristics and requirements for advanced biofuels is considered separately in Section 3.

The trajectory for the RED and the need for positive investor engagement

- The REA's concerns about the slow down in UK targets following the publication of the Gallagher Review in July 2008 are well-known.[2]
- As stated in Recital 14 of the RED "the main purpose of mandatory national targets is to provide certainty for investors and to encourage continuous development of (renewable) technologies".
- Without positive investor engagement from today the 10% target will be difficult to meet and the benefit to the UK economy minimal.
- If transport fails to meet its target this will impose greater demands on the UK's power and heat sectors to reach the UK's overall mandatory 15% RED target.
- A linear trajectory from the date of introduction of the RED to 2020 and annual targets should be set.

[2] See, for example our response to the Gallagher Review (http://www.r-e-a.net/document-library/policy/consultationresponses/) and the consultation on the RTFO (Amendment) Order 2009 (http://www.r-e-a.net/policy/REApolicy/)

- The REA model shows that the renewable transport target and a linear trajectory can be met for both the UK and the EU. There should therefore be no changes to the targets or the trajectory as a consequence of the "Review" specified in Article 23 (8) of the RED.
- The REA stands ready to assist in the process of drawing up the transport element of the UK's National Action Plan which has to be submitted by June 2010.

The trajectory for the FQD

- Member States have the option to introduce intermediate targets on GHG savings and the REA recommends that the UK takes this option.
- As explained in Section 2 below, the REA supports a GHG emission savings trajectory to 2020 above that suggested in the FQD. A scenario based on the RED modelling work is given in Annex 2.
- To ensure that appropriate focus is given to achieving targets, as with the RED, annual GHG reduction targets should be set to 2020.

Policy requirements

- Having set out the trajectories under the RED and FQD, the Government (UK and EU) should maintain a stable policy environment through to 2020 and beyond. Changes in policy, or even the prospect of change, has already seriously damaged investor confidence.
- The production of UK domestic feedstock and biofuels should be encouraged. This will provide additional green jobs, enable civil society to keep sustainability standards under scrutiny, and contribute to fuel security.
- The Government should provide specific support for UK-produced advanced biofuels. The requirements of this sector are detailed in Section 3 below.
- The Government should adopt a range of policies aimed at encouraging the use of biofuels, including Pure Plant Oil, in high blends (above E10 and B10) under its own "Alternative Fuels Framework".
- The Government should encourage OEMs to "future proof" their vehicle technology in line with the RED and beyond, to eliminate any further barriers to targets. Cars with the capability to take blends such as E20 and B11 may well be needed to ensure that the 10% target is met.
- The UK Government should ensure that EU trade policy is not applied in the UK in a way that disadvantages UK feedstock and biofuel production. It should also ensure that EU trade policy is applied consistently in keeping with the operation of a single EU market. Recent application of tariff policy by some EU Member States, particularly for ethanol imports, has been inconsistent and is leaving the UK industry at a disadvantage.
- Government should review its level of support for R & D in agriculture in the light of the need to manage climate change generally, and the need to improve productivity of biomass in particular.

Section 2 - a proposed market mechanism for both the RED and the FQD under an amended RTFO

Background

It has been consistently repeated that the basis for the UK's biofuels policy is to deliver GHG savings. This was re-inforced in a Ministerial statement in June 2007 which said that from April 2010 the Government would aim to reward biofuels under the RTFO according to the amount of carbon they saved.

The REA was an active member of the Low CVP group set up to examine the feasibility of linking reward to carbon saved (carbon linkage). This group has concluded that it would be possible to introduce carbon linkage within the RTFO. Furthermore, the group has expressed a preference for a 2-certificate system that would make it possible to implement both the energy target under the RED and the GHG saving target under the FQD within an amended RTFO. While the REA agrees with these conclusions, it has been suggested that the implementation of the RED and the FQD would require separate legal instruments. If that proves to be the case, the REA would suggest that the application of GHG targets is delivered under the Climate Change Act. In the Budget 2009, the Government announced an interim GHG reduction target of 34% for 2020 relative to 1990, which could rise to 42% if a global agreement is reached in Copenhagen in December 2009. Transport must contribute to this target. Building on the work of the Low CVP, we would propose the following:

RED (energy target for the Member State)

- Establish a linear trajectory to 2020 starting from the date of implementation of the RED (end 2009).
- Set targets on an annual basis from the date of the implementation and specify these targets in legislation. Once specified, these targets should not be changed.
- Change the basis for the RTFO targets from volume to energy, if this meets with general industry support.
- Obligation to remain with current obligated suppliers who should be designated the "economic operators" referred in the RED.
- Obligated suppliers to report on what they have put on the market, accompanied by C & S reports.
- The REA is very concerned that under the RTFO as it operates currently, value is not returned down the fuel chain to those who both contribute to the carbon and sustainability scoring of the biofuel put on the market and are in a position to drive better behaviour. RTFO sustainability reporting allows obligated suppliers to report "Unknown" if they do not know the origin of the biofuel they put on the market and this may be the reason that players further down the fuel chain do not get value. Once "unknown" reporting is removed under the RED, the situation may change.

- One way to return value for C & S performance would be to issue RED energy certificates to biofuel producers. However, this option would need further study in the light of the application of the RED rules.
- Certificates should be tradable.
- RTFO Technical Guidance should be amended in line with the RED sustainability criteria.
- A buy-out price should be set at a relatively high level to provide a floor to the market in the event of extreme market conditions and to put a ceiling on potential costs to consumers.

FQD (GHG savings target for the "supplier")

- The basis of this mechanism must be to maximise the delivery of GHG savings by ensuring that supply chains work hard to improve their carbon footprint driven by the incentives in the mechanism.
- Establish annual carbon saving targets.
- The Low CVP carbon linkage work has demonstrated that an energy (RED) target and a GHG saving (FQD) target can never be fully aligned.
- Ensure that the GHG saving target is consistently the higher target.
- The GHG targets to be set annually at stretching levels above the indicative targets set out in the FQD to drive a short market. This will set a value for carbon/certificates that can be shared through the supply chain and thereby drive better GHG saving behaviour.
- Certificates to be awarded to biofuels on a linear basis depending on the GHG savings made against the FQD/RED baseline (35%).
- As stated above, the REA is very concerned that improved GHG performance receives no reward under the current RTFO. That is why carbon linkage and a short carbon market are the key to getting a commercial return for better environmental performance.
- GHG saving certificates to be tradable.
- UK authorities to designate "suppliers" under Article 7a as the "obligated suppliers" currently in the RTFO.
- Obligated suppliers to report on what they have put on the market, accompanied by C & S reports.
- A buy-out price to be set at a relatively high level consistent with stretching targets
- The interaction between the RTFO and policy instruments for power and heat needs to be considered

Section 3 – "second generation"/advanced biofuels support in the UK

At present, "first generation" biofuels are produced from high energy parts of plants which require relatively simple and/or conventional processes to produce a useable biofuel. The RED[3] states that the contribution made by biofuels produced from wastes, residues, non-food cellulosic material, and ligno-cellulosic material shall be considered to be twice that made by other biofuels. These feedstocks are preferred due to the perceived higher availability and reduced competition with food production.

There will be a continual evolution in the development of biofuel production processes. Support mechanisms should therefore continue to encourage new developments, rather than require further changes to legislation for "third generation", "fourth generation' biofuels etc. As such, the term 'Advanced Biofuels' is used in general below rather than "second generation" as each new development step will face similar issues.

Advanced biofuel technologies face the following key issues:

- Unpredictable benefit from biofuel support mechanisms
- Competition from heat and power producers for feedstock
- Uncertainties on fuel prices due to crude oil price linkage
- High cost of R&D and commercialisation
- Higher capital costs than current technologies

These factors lead to considerable uncertainty for developers attempting to bring advanced biofuel technologies to a commercial scale operation.

The overall requirements are:

- Direct financial support for R&D
- Grant support for demonstration plants

Commercial implementation will require:

- Predictable revenue stream
- Loan guarantees
- A production incentive that delivers a minimum return to producers

Without adequate support the UK will not be a sufficiently attractive market for the development of Advanced Biofuels and we will miss out on both technological development and the establishment of domestic production. The best way to drive innovation is to create a market opportunity that is attractive to investors and one in

[3] Article 21(2)

which they can be reasonably confident of a return. Using traded certificates alone provides too much uncertainty. A mechanism is needed to provide a minimum return to investors during development and commercialisation. Potential options are outlined below.

Discussion and recommendations

A general recommendation that the UK Government establishes a research activity to examine the particular needs of Advanced Biofuels and determine a viable support mechanism. The key points are discussed in more depth below.

Unpredictable benefit from biofuel support mechanisms

The requirement in the RED that biofuels made from specified feedstocks are to count double, could imply double financial rewards. However current UK proposals are that carbon and renewable fuel certificates will be tradable. Recent history has shown that the value of such certificates can be low or zero, so even doubling their value provides no security of revenue for Advanced Biofuel producers. On the other hand, it is possible for these certificates to achieve a very high value – potentially leading to excess profits for Advanced Biofuel producers. What is required is a support mechanism that ensures a minimum return for investors in Advanced Technologies through at least the first 5 years of development and implementation. At the end of that period the technology should be competing on similar terms to mature technologies.

R&D and commercialisation costs

The best way to drive both R&D and commercialisation forward is to provide both direct financial support (e.g. grants & loan guarantees) together with a clear and stable market opportunity (as outlined above). These would provide security for investors in new technology.

Thus, in addition to ensuring a return on investment the UK Government should also provide grants and/or loan guarantees help to support R&D and pilot commercial implementations. The provision should be sufficient to support several technical solutions.

Higher capital costs than current technologies

This factor exacerbates the above issues. The high capital cost of Advanced Biofuel technologies results in a greater barrier to entry and a greater need for adequate returns on investment.

Interaction between the RTFO and other policy instruments

The interaction between the RTFO and policy instruments for power and heat needs to be considered.

Potential support mechanisms

If a two certificate system is adopted (see Section 2 above) and all biofuels are treated in the same way for carbon abatement, then support for Advanced Biofuels could be provided either through an additional incentive for these biofuels, or the application of a lower limit on certificate values. Options for this include:

- A 'feed in' tariff for Advanced Biofuels – applied at the duty point
- Higher duty relief for Advanced Biofuels – applied at the duty point
- A separate certificate for Advanced Biofuels with independent targets and minimum value
- The same certificate system for all biofuels – but again with a minimum value

Whichever mechanism is used, certainty on revenues is a key factor in underpinning investment.

Section 4 - principles for modelling to account for GHG emissions from indirect land use change

Background

The REA agrees that stronger policies are needed to slow down the global rates of deforestation and loss of grassland. We agree with the recommendation in Chapter 6 of the Gallagher "Review of the indirect effects of biofuels production" that the extension of carbon and sustainability certification used for biofuels to all agricultural activities globally would be the most effective way forward. Since one product's indirect effect would be another product's direct effect, the overall GHG emission effects would be captured within such a policy. However, we recognise that this outcome would be difficult to achieve within a sensible timeframe.

The RED (Article 19(6)) states that the European Commission must:

> "submit a report to the European Parliament and to the Council reviewing the impact of indirect land-use change on greenhouse gas emissions and addressing ways to minimise that impact. The report shall, if appropriate, be accompanied, by a proposal, based on the best available scientific evidence, containing a concrete methodology for emissions from carbon stock changes caused by indirect land-use changes, ensuring compliance with this Directive".

The European Commission has made a number of public policy statements that give some guidance on a methodology to address indirect land use change (ILUC), for example:

DGTREN (Ewout Deurwaarder 29/1//09, 24/2/09[4])

ILUC calculation models must :

- account for co-products
- relate increased biofuel demand growth and increased agricultural yields
- relate regional supply and demand effects
- determine which type of land is converted to agriculture
- take account of agricultural land that would otherwise be abandoned
- allocate lost carbon from deforestation between timber logging and agriculture

in a way that:

- can be used to lead a reduction in land use change
- address issues in a transparent way that can be reviewed

DGENVI (Ariane de Dominicis 31/3/09[5])

Policy makers want:

- To compare a world with and without biofuels
- To differentiate the ILUC impact of different crops

Principles of Methodology

The debate on the best model to account for GHG emissions from ILUC has been shown to be very complex. A fully independent view has not yet emerged that would enable the REA to put its weight behind any one methodology over another. Nevertheless, it is important that we state for the benefit of policymakers the principles on which an ILUC methodology should be based and on which we would judge its efficacy.

- The model / assessment method must be made fully transparent to public, and parameters used must be able to be peer reviewed.
- The predictive ability of the model must be able to be tested e.g. by empirical modelling or back-testing elements of the model.
- Accounting should be done on the basis of land use changes caused by increased biofuel use, according to crop and fuel type.
- Land use changes as a result of biofuel co-products substituting for other cops or crop products should be accounted for, according to co-product use.
- Account should be taken of changes in biomass yield growth with increased demand growth for food, feed and fuel.
- Account should be taken of the magnitude and timing of biofuel policy targets.
- Account should be taken of changes in trade flows and biomass supply across regions to identify where ILUC is likely to occur.

[4] Biofuels in the EU's new RED: questions for researchers, Ewout Deurwaarder, EC DGTREN, Feb 2009, DfT-Defra international expert workshop on biofuels research, ,

[5] Indirect land use change – where are we and what we need to know, Ariane de Dominicis, Land Use Change Workshop, Helsinki 31/3/09 Task 38 Workshop

- Account should be taken of the type of land for where ILUC is likely to occur and the carbon stocks associated with that land.
- Account should be taken of agronomic effects delivered by preceding or following crops or intercropping.

The REA looks forward to participating as the ILUC debate continues, both the in the UK and in the EU.

ANNEX 1

Background to Scenario modelling for the EU and the UK to reach the 10% target (by energy) set out in the RED

EU

Assumptions

- EU petrol share – 59.7%; EU diesel share – 40.3% (Source : PRIMES)
- Estimated share in renewable transport of electric vehicles and biomethane – powered vehicles – 0.1% (Source: adaptation of PRIMES and CENEX)
- Land transport fuel use increase 2010-2020 - 0.94% (Source: PRIMES)
- EU grains demand increase by 2020 - 15m tonnes (Source: Extrapolation of trend in DG AGRI Prospects for Agricultural Markets and Income in the EU 2007-14, March 2008))
- EU cereal exports in 2020 - 15.6m tonnes (Source: USDA FAS Grain Markets and World Trade, May 2008)

EU model

- 10% target will need 55.5 billion litres of biofuel (46 million tonnes)

Bioethanol

2020 EU bioethanol demand

- **28.5 billion litres** (22 million tonnes)

2020 EU bioethanol supply

Total EU feedstock production

Cereals

- 2008 - 310 million tonnes
- 2020 – 357 million tonnes (Source: REA estimate using FAO, USDA and ADAS data)

Imports

Finished fuel

- Brazil ethanol export potential 2020 - 15.7 billion litres (Source : UNICA)
- USA requirement for "undifferentiated advanced biofuel" (non-corn starch and over 50% GHG saving) by 2022 - 18 billion litres (Source: RFS)
- Estimated availability for EU for 2020/21 - 5.2 billion litres
- Estimated supply from other imports - 0.5 billion litres (Source: REA estimate - a conservative view that rest of world must start producing and exporting – although it does not today)

Feedstocks

- Potential imports from the FSU (not calculated in this model)

Cereal yield potential to 2020 (with no additional land use)

- Range - 0.86% - 2.14% per annum growth. Assume 1.64% (Sources: ADAS input to the Gallagher report and Ensus internal analysis)

Co-product land use effect

DDGS will replace a certain % of grains fed to animals and still deliver a balanced nutritional diet. As a result that wheat **being already grown** will not have to enter animal diets and will be available for production as DDGS (this assumes crop rotation as it is today). A tonne of wheat DDGS displaces wheat grown on 0.19 ha of land, a tonne of maize DDGS displaces maize grown on 0.23 ha of land and a tonne of barley DDGS displaces barley grown on 0.26 ha land. This displaced grain is then used in bioethanol production.

NB: Additional rape meal created by additional rape production will displace some wheat used today in animal diets. This will leave that wheat that has been grown (in the same rotation) available for bioethanol production as well. This has not been accounted for in these numbers.

Land use change

- Additional land availability:
  - Usable set aside and fallow - 7.18 million ha (Source: Strategie Grains and Sylvester Bradley et al Jan 2008)
  - Of which cereals - 4.16 million ha (Assumed yield per ha in 2020 = average of 6.4 tonnes/ha)
- Mainly rotational set-aside – minimises GHG loss

Second generation bioethanol availability

- Not calculated in this model

2020 EU bioethanol supply – summary

Imports		5.7 billion litres
Existing bioethanol use	?	?
Cereal yield potential	63.7 million tonnes	
Additional land use	32.2 million tonnes	
Co-product land use effect	24.2 million tonnes	
Bioethanol volume potential (after food and export demand met)	110.3 m tonnes	37 billion litres
Second generation		Further upside
Feedstock imports		Further upside
Total bioethanol potential		**42.7 billion litres (plus?)**

Biodiesel

2020 EU biodiesel demand

27.1 billion litres (24 million tonnes)

2020 EU biodiesel supply

Total EU vegetable oil production and consumption (2004 -2006 average)

- Production - 9.78 million tonnes (Source : USDA)
- Consumption - 19.92 million tonnes: (Source: USDA)
- Net vegetable oil imports - 10.5 million tonnes (Source : USDA)

Yield potential to 2020

- Range - 1.3% - 2.1% per annum growth. Assume 2% (Sources: ADAS input to the Gallagher report and EU Impact Assessment March 2007)

Co-product land use effect

NB: Not calculated in here but as above rape meal could replace wheat in diet and this will leave wheat grown for animal feed available for bioethanol production.

There is a piece of optimisation work that farmers will do to work out the balance of rape to wheat in their rotation given prices to ensure they are achieving best value. This work has not been completed as part of this process to date.

Land use change

- Additional land availability:
  - Usable set aside and fallow - 7.18 million ha (Source: Strategie Grains & Sylvester Bradley et al Jan 2008)
  - Of which oilseeds - 2.1 million ha (Assumed yield per ha in 2020 - rape @ 4.2 t/ha, sunflower @ 2.3 t/ha and soybeans @ 3.58 t/ha)
- Mainly rotational set-aside – minimises GHG loss

Second generation biodiesel availability

- Not calculated in this model

2020 EU biodiesel supply – summary (vegetable oils)

Existing biodiesel use	4.5 million tonnes	4.8 billion litres
Yield potential	3.1 million tonnes	3.3 billion litres
Additional land use	3.2 million tonnes	3.4 billion litres
Co-product land use effect	?	Further upside
Second generation	?	Further upside
Imports of certified palm oil	8.1 million tonnes	?

Imports of certified soy	?	Further upside
Imports from FSU	?	Further upside
Biodiesel volume potential		**11.5 billion litres (plus?)**

UK

Assumptions

- Estimated share in renewable transport of electric vehicles and biomethane – powered vehicles – 0.1% (Source: PRIMES)
- UK fossil fuel market = 40.65 mtoe (Source: HMRC data. PRIMES model - 41.6 mtoe in 2010)

UK model

- Energy basis for ease of analysis
- 3 scenarios (by energy) based on:
  - High petrol: 44% to 56% diesel
  - Medium petrol: 42% to 58% diesel
  - Low petrol: 40% to 60% diesel
- 2 scenarios on growth by energy from 2007/08 base number:
  - 0%
  - 0.25%

Results (based on the RTFO target slowdown from 2009)

- **Bioethanol** requirement for 2020 will be 3.2 to 3.6 billion litres
- **Biodiesel** requirement for 2020 will be 2.8 to 3.1 billion litres

BIOETHANOL

2020 UK bioethanol demand

3.2 – 3.6 billion litres

2020 UK bioethanol supply

Current UK feedstock production

- Cereals - 14.23 million tonnes
- Sugar beet - 1.2 million tonnes (sugar)

Imports

- 1 billion litres - assumes the UK imports 20% of Brazil's export potential in 2020

Cereal yield potential to 2020 (with no additional land use)

- Wheat: range - 0.7% - 1.8% per annum growth. (Sources: ADAS input to the Gallagher report and Ensus internal analysis)
- The model assumes no increase in the use of sugar beet for ethanol in the UK

- However, increased sugar beet productivity has released 65,000 ha in the last 10 years = 6 times the area needed to "grow" the current bioethanol production from sugar beet

Co-product land use effect

- Model assumes same effects as the EU model

Land use change

- Additional land availability
  - Usable set aside (80%) and fallow - 0.525mha (Source: Sylvester Bradley et al Jan 2008)
- No additional land from current grassland – unacceptable GHG release
- No increase in crop rotation – risk of indirect effect of displacement

Second generation bioethanol availability

- Assumes a single 150,000 tonne plant by 2020

2020 UK bioethanol supply – summary

Existing bioethanol use		0.075 billion litres
Current cereal production	14.23 million tonnes	
Imports		1 billion litres
Cereal yield potential	0.95 million tonnes	1.8 billion litres
Additional land use	2.01 million tonnes	0.9 billion litres
Co-product land use effect	0.62 million tonnes	0.3 billion litres
Genetic improvement	0.25 million tonnes	?
Second generation	0.15 million tonnes	0.2 billion litres
Bioethanol volume potential (after food and export demand)		**4.275 billion litres**

Biodiesel

2020 UK biodiesel demand

- **2.8 – 3.1 billion litres**
- 2.8 billion litres could be met by:
  - 5.78 million tonnes rapeseed; or
  - 12.4 million tonnes palm fruit; or
  - 14.6 million tonnes soybean
- 31. billion litres could be met by:
  - 6.42 million tonnes rapeseed; or
  - 13.8 million tonnes palm fruit; or
  - 16.2 million tonnes soybean

2020 UK biodiesel supply

Current UK vegetable oil production (2002-06 average)

- 1.7 million tonnes oilseed rape (OSR)
- UK imports c 50% of its current demand

Yield potential to 2020

2% per annum growth for UK OSR (Source: ADAS work for Gallagher & EU impact assessment)

Land use change

- Additional land availability
  - Usable set aside (80%) and fallow - 0.525mha (Source: Sylvester Bradley et al Jan 2008)
- No additional land from current grassland – unacceptable GHG release
- No increase in crop rotation – risk of indirect effect of displacement

Second generation biodiesel ('renewable diesel') availability

- Assumes 150,000 tonne production capacity by 2020

2020 UK biodiesel supply – summary (vegetable oils)

Existing biodiesel use (includes imports)		1 billion litres
Yield potential of UK OSR		0.35 billion litres
Additional UK land use		0.23 billion litres
Second generation		0.2 billion litres
Imports of certified palm oil	?	?
Imports of certified soy	?	?
Imports from FSU	?	?
Biodiesel volume potential		**1.78 billion litres (plus?)**

ANNEX 2

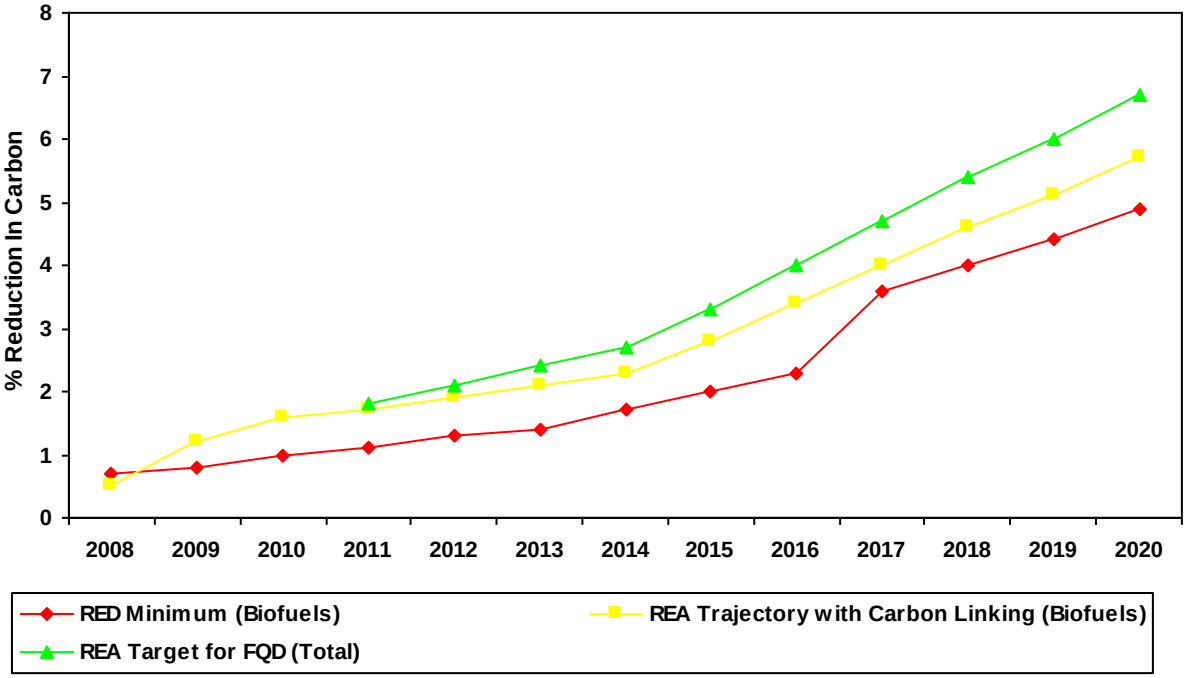
Possible FQD GHG saving trajectory

(based on REA modelling for the UK to reach the 10% RED target)

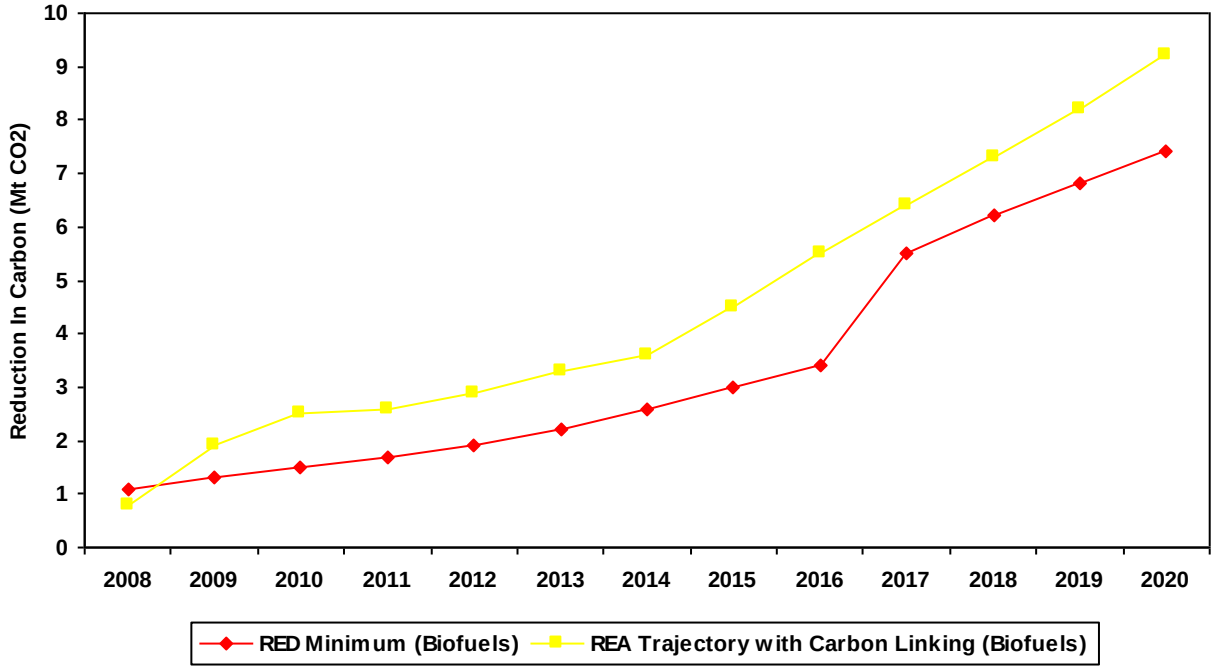
Basis for calculations

- 2008 petrol share – 42%
- 2008 diesel share – 58%
- 0.25% growth in energy to 2020
- RED – 35% GHG saving to 31 December 2016, 50% thereafter
- REA target for FQD (Total) - above 6% to include either better GHG delivery through biofuels, or other mechanisms (e.g. reduction in flaring)

Percentage Reduction in Carbon Vs Total Fossil Fuel



Actual Reduction in carbon Vs Total Fossil Fuel



June 2009