Biofuels

Standard Note: SN/SC/3691
Last updated: 19 October 2011
Author: Oliver Bennett
Section Science and Environment Section

Biofuels can be used as a substitute for fossil fuels to reduce greenhouse gas emissions from transport, to support the rural economy and promote energy security. However, depending on how they are made, some biofuels can lead to greater greenhouse gas emissions than fossil fuels and they can have serious environmental and social impacts. A report published by the Nuffield Council on Bioethics in 2011 indicated that current biofuels policy can be considered “unethical”.

Biofuels are supported by both European and UK legislation. Support for biofuels in the UK is mainly through the Renewable Fuel Transport Obligation (RTFO). This set a staggered target for the volume of “renewable fuels” in transport fuels to reach 5% by the period 2013/14. The EU Renewable Energy Directive requires 10% of transport fuel by 2020 to come from renewable sources—this is expected to be met predominantly with biofuels.

The Coalition Government has stated that the use of biofuels must be sustainable. Given concerns about the sustainability of biofuels it does not plan to increase biofuel targets in the short term, and it is reviewing biofuel policy. However, targets are likely to increase from 2014 to 2020 to meet European targets.

The European Commission is considering whether to introduce additional environmental safeguards. It was meant to report by July 2011, but this has been delayed. There is significant controversy surrounding the possible future direction of European biofuels policy.

Contents

1 What are biofuels?

The term biofuels normally refers to a liquid or gaseous fuel for transport produced from biomass.[1] Biofuels can offer emission savings over fossil fuels if the CO_2 that is emitted by their use is lower than if fossil fuels were burnt instead. For example, ethanol produced from sugar cane can deliver greenhouse gas savings of some 90%.[2]

To calculate whether using a biofuel leads to lower emissions than a fossil fuel, the energy used to cultivate, harvest, process and transport the biofuel has to be factored in. These are called its lifecycle emissions. Different biofuels have different lifecycle emissions. In certain cases these lifecycle emissions can be higher than fossil fuel emissions—particularly when land is deforested to provide farmland grow the fuel.

First generation biofuels are normally made from conventional food crops such as wheat, which are converted into a liquid or gaseous form. They are usually blended into conventional fuels such as petrol and diesel and are commonly known as biodiesel, bioethanol and biogas. The Department for Transport (DfT) explained how they are produced for use as transport fuel:

> **Biodiesel** can be made from any vegetable oil, with rape seed, palm and used cooking oil being the most common. Although chemically different, it has similar properties to mineral diesel when burnt in a compression diesel engine. However, at high blend levels certain types may harm parts of an engine and consequently engine manufacturers currently only warrant their vehicles for use with 5% blends in line with the CEN [European Committee for Standardisation] standards.
>
> **Bioethanol** can be made from wheat, corn or sugar cane / beet. As with potable alcohol, it can be made from virtually any organic substance (grass, wood, green bits of municipal solid waste), but the technologies for doing so are not proven at a commercial scale. In Europe it is used in a 5% blend in petrol (E5), allowing its use without any engine modification. At low blending levels of 5% or less, it is not

1 *Directive 2003/30/EC* on the promotion of the use of biofuels or other renewable fuels for transport, Article 1(a)

2 House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?,* First Report, session 2007-08, HC 76-I, 21 January 2008

anticipated that mechanical considerations are a significant obstacle to ethanol up-take. There are significant distribution issues for bioethanol which mean that it is usually blended with petrol at the time of loading into road tankers for distribution to forecourts.

Biogas is just like compressed natural gas (CNG), except that it is generally produced by collecting the methane which is naturally emitted from landfill sites or other forms of rotting vegetation. It is only suitable for use in CNG-powered vehicles (of which there are only 800 or so in the UK).[3]

1.1 Second generation biofuels

Second generation biofuels could be made from non-food feedstocks and residues from agriculture and forestry—such as straw, grass, algae and wood. They may have greater greenhouse gas savings and smaller land take compared to first generation biofuels.[4]

However, moving to second generation biofuels will require technological advances. A 2008 House of Commons Environmental Audit Committee report suggested that second generation biofuel technologies might be some 5 to 10 years or more from reaching the market.[5]

More information about second generation biofuels, in particular those derived from algae, will be available in a POSTnote to be published in the next few months.

1.2 Biofuel support policies—How much is being spent in the EU?

Biofuels are supported by both European and UK policies. The EU Renewable Energy Directive included a statutory target that 10% of transport fuel by 2020 must come from renewable sources. All renewable energy sources can count towards this target, including renewable electricity and hydrogen, but it is expected to be met predominantly by first generation biofuels.

To meet the EU target the UK has adopted the Renewable Fuel Transport Obligation (RTFO). This set staggered targets for renewable fuels that fuel suppliers are required to supply—5% by the period 2013/14. The Coalition Government has said that this target will not be increased before 2014 (see below).

Biofuels also receive other forms of support, such as through research and development spending, fuel tariffs and capital funding. The Global Subsidies Initiative calculated that the EU and Member States spent approximately €3.1 billion on biofuel support in 2010.[6]

2 What are the pros and cons of biofuels?

A number of benefits might be forthcoming from the use of biofuels. These include: **lower carbon transport**;[7] **rural development**;[8] and **improved fuel security**.[9] In particular biofuels

---

3 DfT, *Impact Assessment of proposals for amending the Renewable Transport Fuels Obligation Order*, January 2009

4 Euractiv, *Biofuels: The Next Generation*, 13 July 2009

5 House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?,* First Report, session 2007-08, HC 76-I, 21 January 2008

6 Global Subsidies Initiative, *Biofuel Subsidies in the European Union: 2010 Update* , July 2010

7 The Royal Society, *Sustainable biofuels: prospects and challenges*, January 2008

8 DfT, *Renewable Transport Fuel Obligation (RTFO) feasibility report*, 2005, para 3.5

9 House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?* First Report of Session 2007–08, HC 76-I, para 88

might have an important role to play in reducing emissions from transport modes in which it will be difficult or impossible to move to electrification—such as road freight and aircraft.

In the UK, biofuels policy has primarily been seen as a measure to reduce carbon emissions.[10] However, a number of reviews have indicated that current biofuels policy may undermine this primary objective. The policy may have a number of other negative impacts:

- **Higher carbon emissions**. In certain circumstances the use of biofuels may lead to higher emissions than if fossil fuels were used. This is particularly the case where forests and other carbon-storing land types are converted into farmland to grow biofuel. This can happen indirectly when other crop production is displaced by biofuels into carbon-storing land types. The release of carbon from the conversion of carbon-storing habitats can far exceed any carbon savings from the use of biofuel produced on that land.[11]

- **High cost.** The cost of biofuels policy can be much higher than other carbon reduction policies.[12] The Environmental Audit Committee concluded that biofuels policy did "not deliver good value for the taxpayer".[13]

- **Higher food prices**. The use of food crops to make biofuels may contribute to global food price increases.[14] [15]

- **Biodiversity loss.** Land use change associated with biofuels may lead to biodiversity loss.[16] For example, demand for biofuel is associated with deforestation in South-east Asia. In that way biofuels may contribute to the extinction of a number of species, such as the orang-utan.[17]

- **Less efficient use of biomass resources**. Some have argued that converting biomass to biofuels may not be the most efficient use of biomass to power transport. Burning biomass to produce electricity for battery driven cars may power more travel overall.[18] [19]

- **Less efficient use of land to reduce emissions**. Some have suggested that replanting forests, or leaving idle land to regenerate, may be a more cost-effective climate change mitigation policy than growing biofuels on the land.[20]

---

10 DfT, *Renewable Transport Fuel Obligation (RTFO) feasibility report*, 2005, para 3.3

11 Renewable Fuels Agency, *The Gallagher Review of the indirect effects of biofuels production*, July 2008 p26

12 House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?* First Report of Session 2007–08, HC 76-I

13 ibid

14 "Secret report: biofuel caused food crisis", *Guardian*, 4 July 2008

15 "Placing the 2006/08 Commodity Price Boom into Perspective", blogs.worldbank.org, 26 July 2010

16 The Royal Society, *Sustainable biofuels: prospects and challenges*, January 2008, p46-7

17 House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?* First Report of Session 2007–08, HC 76-I

18 "Driving on Biomass", *Science* (2009), Vol 324, p1019, 22 May 2009

19 "Greater Transportation Energy and GHG Offsets from Bioelectricity Than Ethanol", *Science* (2009), Vol 324, p1019, 22 May 2009

20 House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?* First Report of Session 2007–08, HC 76-I

3 Is biofuel policy unethical?

Biofuels policy has been reviewed by a variety of bodies[21]. Generally these reviews have recognised the potential benefits of biofuels—in particular second generation biofuels—but have also raised serious concerns about the environmental and social impacts of current policy.

A 2011 review, published by the respected Nuffield Council on Bioethics, indicated that current biofuels policy can be considered "unethical". It made the following recommendations:

> • Current European and national biofuels targets should be replaced with a more sophisticated target-based strategy that considers the wider consequences of biofuel production.
>
> • The strategy should incorporate a comprehensive ethical standard for all biofuels developed in and imported into the EU, enforced through a certification scheme. This standard should be based on the following ethical principles:
>
> Biofuels development should not be at the expense of human rights
>
> Biofuels should be environmentally sustainable
>
> Biofuels should contribute to a reduction of greenhouse gas emissions
>
> Biofuels should adhere to fair trade principles
>
> Costs and benefits of biofuels should be distributed in an equitable way
>
> • The EU should provide financial support and advice to countries that might find it difficult to certify biofuels in this way.
>
> • The ethical standard and associated certification scheme should ideally be applied to all similar technologies and products to guide decision making in a wider policy context.
>
> • More research should be carried out on the economic and social impacts of intellectual property related to the development of biofuels.
>
> • Biofuels policies and future sustainability initiatives should not discourage local, small-scale biofuel production, particularly in developing countries that experience fuel poverty.
>
> • Policy makers should incentivise research and development of new biofuels technologies that need less land and other resources, avoid social and environmental harms, and reduce greenhouse gas emissions.[22]

Other reviews have made various suggestions about the reform of biofuels policy, including:

- the abandonment or reduction of biofuel targets under certain circumstances;

---

[21] Nuffield Council on Bioethics, *Biofuels: Ethical issues*, April 2011; The House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?* January 2008; The Royal Society, *Sustainable biofuels: prospects and challenges*, January 2008; Renewable Fuels Agency, *The Gallagher Review of the indirect effects of biofuels production*, July 2009

[22] Nuffield Council on Bioethics, *Biofuels: Ethical issues summary*, April 2011

- a comprehensive analysis of how biofuels could sit within future energy options, taking into account issues such as cost, alternative uses for biomass and whether regulations can be applied effectively;
- stronger environmental and social safeguards;
- a global agreement on deforestation and land use change; and
- policy reforms promoting second generation biofuels over first generation biofuels.[23]

4 How have the Government and EU responded to these concerns?

4.1 The Labour Government—the Gallagher Review

In a parliamentary statement the then Secretary of State for Transport, Ruth Kelly MP, described how the Government had sought to address the potential environmental implications of biofuels policy:

> The UK has… been at the forefront of global efforts to develop robust - and workable - sustainability standards for biofuels.
>
> As part of the RTFO, we introduced a requirement that transport fuel suppliers should report on the environmental performance of their biofuels. This will give us evidence on the impacts of biofuels as well as creating an incentive on suppliers to source the best biofuels.
>
> We also committed to introducing at the earliest opportunity legally enforceable standards which will ensure biofuels are produced in a sustainable way.[24]

However, following growing criticism of biofuels policy, the then Government decided to launch the independent *Gallagher Review of the indirect effects of biofuels production*.

The Gallagher Review came to similar conclusions as previous studies, although it rejected a moratorium on biofuel targets. Instead the review recommended lower biofuel targets and stronger sustainability standards. It also said that "targets higher than 5% by volume (4% by energy) should only be implemented beyond 2013/14 if biofuels are shown to be demonstrably sustainable". It went on that "current evidence suggests that the proposed EU biofuels target for 2020 of 10% by energy is unlikely to be met sustainably and the introduction of biofuels should therefore be slowed while we improve our understanding of indirect land-use change and effective systems are implemented to manage risks."[25]

The Labour Government accepted some of the report findings, and slowed the rate of RTFO targets:

> So I intend to consult formally on slowing down the rate of increase in the RTFO, taking the level to 5%, as Gallagher recommends, by 2013/14.
>
> And this would be subject to further confirmation in 2011/12.

---

[23] Nuffield Council on Bioethics, *Biofuels: Ethical issues*, April 2011; The House of Commons Environmental Audit Committee, *Are Biofuels Sustainable?* January 2008; The Royal Society, *Sustainable biofuels: prospects and challenges*, January 2008; Renewable Fuels Agency, *The Gallagher Review of the indirect effects of biofuels production*, July 2008

[24] HC Deb 7 July 2009 c1169

[25] Renewable Fuels Agency, *The Gallagher Review of the indirect effects of biofuels production*, July 2008

> Professor Gallagher's findings are particularly significant in the context of ongoing debates about biofuel targets across the EU.
>
> To help ensure that the issue of sustainability is put at the heart of those debates, the Environment Secretary and I are today jointly sending a copy of the Gallagher report to the relevant European Commissioners and to all EU Environment and Transport Ministers.
>
> And in response to those concerns - including over rising global food prices - the Prime Minister has today been pushing for the G8 to work to develop new global benchmarks for sustainable biofuel production and use.

However, it rejected Gallagher's recommendation about the EU target, with certain conditions:

> The Government believes the EU target of 10% renewable transport fuels by 2020 can remain an overall objective but subject to clear conditions…
>
> First, the EU level sustainability criteria currently being negotiated must address indirect, as well as direct, effects on land use.
>
> Second, the 10% target must be subject to rigorous review, in the light of the emerging evidence, so that we can make an informed decision at EU level in 2013/14 about whether the target can continue in place.
>
> As Professor Gallagher also suggests, I agree that we should aim to target support on the development of lower carbon and other so-called 'second generation' biofuels.[26]

The Government also stated that it was pursuing an international approach to preventing deforestation as part of the December 2009 Climate Change Conference in Copenhagen:

> The Government believes that biofuels policy can be progressed, provided that it is accompanied by strong sustainability standards in conjunction with wider action for the protection of forests and other carbon sinks. Since 2005, the UK has been working actively with other negotiating partners under the UN Climate talks to develop a mechanism on the Reduction of Emissions from Deforestation and Degradation (REDD) in developing countries. In Bali in December last year it was agreed that deforestation should be included in a post-2012 climate agreement. There will be a process under the Bali Action Plan for establishing how to achieve this before the Climate Change conference in Copenhagen in 2009.
>
> In addition to deforestation (carbon stock reduction associated with land use conversion from forest to non-forest), the decision at Bali includes the gradual damage caused by degradation (carbon stock reduction below the threshold for deforestation), as well as further consideration of how to reward the sustainable management of forests.[27]

There was no agreement on deforestation at Copenhagen, although negotiations are progressing.

---

[26] HC Deb 7 July 2009
[27] ibid

4.2 The European Union

An EU target that 10% of transport fuel used by 2020 must come from renewable sources is likely to be met predominantly by first generation biofuels.[28] Gallagher stated that this target "is unlikely to be met sustainably and the introduction of biofuels should therefore be slowed while we improve our understanding of indirect land-use change and effective systems are implemented to manage risks."[29]

Gallagher's recommendation was rejected by the Labour Government, with certain conditions. Following discussions at the EU, the Renewable Energy Directive target was maintained at 10%.

To respond to concerns about the potential environmental impacts of the target, sustainability criteria were included in the Renewable Energy Directive. The European Commission described the environmental safeguards:

> **Sustainable Biofuel Certificates**: The Commission encourages industry, governments and NGOs to set up "voluntary schemes" to certify biofuel sustainability – and explains the standards these must meet to gain EU recognition. One of the main criteria is that they have independent auditors which check the whole production chain, from the farmer and the mill, via the trader, to the fuel supplier who delivers petrol or diesel to the filling station. The Communication sets standards requiring this auditing to be reliable and fraud-resistant.
>
> **Protecting untouched nature**: The Communication explains that biofuels should not be made from raw materials from tropical forests or recently deforested areas, drained peatland, wetland or highly biodiverse areas – and how this should be assessed. It makes it clear that the conversion of a forest to a palm oil plantation would fall foul of the sustainability requirements.
>
> **Promote only biofuels with high greenhouse gas saving**s: The Communication reiterates that Member States have to meet binding, national targets for renewable energy and that only those biofuels with high greenhouse gas savings count for the national targets, explaining also how this is calculated. Biofuels must deliver greenhouse gas savings of at least 35% compared to fossil fuels, rising to 50% in 2017 and to 60%, for biofuels from new plants, in 2018.[30]

Nevertheless, these safeguards fail to tackle the potential negative impacts associated with indirect land use change. In order to address this, the Directive required the European Commission to report on the issue by December 2010.[31] When it was published the report acknowledged "that indirect land use change can reduce greenhouse gas emissions savings associated with biofuels, but also identifie[d] a number uncertainties associated with the available models".[32]

The Commission announced that it would "conduct an impact assessment [regarding] potential changes to the existing legislation". The impact assessment would consider the following policy options:

---

[28] European Commission, *Impacts of the EU biofuel target on agricultural markets and land use: a comparative modelling assessment*, viewed 25 May 2011

[29] Renewable Fuels Agency, *The Gallagher Review of the indirect effects of biofuels production*, July 2008

[30] European Commission, *Commission sets up system for certifying sustainable biofuels,* 10 June 2010

[31] ibid

[32] European Commission, *Impacts of the EU biofuel target on agricultural markets and land use: a comparative modelling assessment*, viewed 25 May 2011

(1) take no action for the time being, while continuing to monitor,

(2) increase the minimum greenhouse gas saving threshold for biofuels,

(3) introduce additional sustainability requirements on certain categories of biofuels,

(4) attribute a quantity of greenhouse gas emissions to biofuels reflecting the estimated indirect land-use impact.[33]

The impact assessment and a possible legislative proposal were to be published by July 2011, but publication has been delayed for an uncertain period.

There is growing controversy surrounding what might be proposed by the Commission.[34] A number of science groups and experts have recently stressed their significant and growing concerns about the policy.[35] [36]

4.3 The Coalition Government

The Government consulted on transposing the requirements of the Renewable Energy Directive, including on how it will meet the 2020 10% renewable fuel target. It stated that it wished to use the RTFO to do this, and that "the majority of the target is expected to be met through the increased supply of biofuels with some contribution from renewable electricity".[37]

However, in recognition of the concerns surrounding biofuel policy, the Government said in the consultation that it does "not propose to make any changes" to biofuel targets before 2014. This move has been criticised by some fuel companies.[38]

The Government stated that biofuels "must lead to a worthwhile reduction in carbon emissions and be sustainable".[39]. Norman Baker MP, Parliamentary Under Secretary of State for Transport, said that the Government was conducting a review of biofuels policy:

> I have initiated a cross-departmental process to examine biofuel policy. In addition, work is under way across Whitehall to develop a UK Government strategy for sustainable bio-energy to meet GHG emissions targets, renewable energy and energy security goals cost-effectively.[40]

However, RTFO targets may need to increase from 2014 to 2020 to meet the requirements of the Renewable Energy Directive, depending on the outcome of the European Commission's impact assessment.

---

33 ibid
34 *Exclusive: EU to delay action on biofuels' indirect impact*, Reuters, 8 September 2011
35 *EU in fresh row over biofuels' 'green' claims*, EurActiv.com, 19 September 2011
36 *Top scientists condemn EU land use values for biofuels*, EurActiv.com, 7 October 2011
37 Department for Transport, *Consultation on the implementation of the transport elements of the Renewable Energy Directive*, March 2011
38 *DfT biofuel proposals 'will backfire'*, ENDSReport, 29 June 2011
39 HC Deb 17 May 2011 c139W
40 HC Deb 24 May 2011 c573W