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Environment, Food and Rural Affairs Committee

Climate change: the role of bioenergy

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Summary

We have undertaken to examine various aspects of the climate change agenda, and to assess how the UK can best reduce its climate change impact. This report examines the role that bioenergy—in the form of biomass for heat and electricity generation, and biofuels for transport—can play in reducing carbon emissions from the UK.

We were disappointed to find that current Government policy on bioenergy is piecemeal and so lacking in ambition as to raise questions about the extent of the Government's commitment to its domestic climate change agenda. If it is to lead by example, the Government must renew and redouble its efforts to exploit the potential of bioenergy.

We are concerned about the multiplicity of Government bioenergy support schemes currently planned or already in place, and the attendant level of confusion that this causes. Government departments must work much more closely together on bioenergy to develop a more streamlined and coherent strategy, and to demonstrate a more convincing commitment to tackling climate change.

There is significant variation in the carbon savings enabled by different technologies, with 'first generation' biofuels typically generating lower savings than the use of organic waste for heat and electricity, for example. But across the range of technologies, the UK is not making the most of bioenergy as a means of reducing carbon emissions.

We are also concerned that biofuels are receiving a disproportionate degree of Government support, to the detriment of biomass. Biomass has significant potential to reduce the UK's carbon emissions. We therefore recommend that the Government increase its support for heat and electricity generation from biomass to a level that ensures the anticipated carbon savings from biomass and from biofuels are the same.

We accept that the Government may be reluctant to pick technology 'winners' and 'losers' at this stage, but it is vital that the Government examine the barriers to further progress on second generation biofuels, with their superior carbon savings and compatibility with current transport infrastructure, and—as a matter of urgency—establish the level of investment and policy support required to accelerate development of this technology.

We are deeply concerned that the terms of the Government's Renewable Transport Fuel Obligation (RTFO) have the potential to 'lock in' first generation biofuels, and in so doing, to damage the prospects for the commercial development of more advanced second generation biofuels. Concerted and sustained investment will be required if these fuels are to become commercially viable. Carbon savings must be linked to RTFO certification in order to facilitate such investment. There is also a potentially significant role for biomass-derived second generation aviation fuels in reducing the climate impact of aviation: the Government should actively support measures to develop this technology.

In conducting this inquiry we encountered a wide range of different units, measurements and terms that are used in calculations of energy and emissions. We recognise that different kinds of data are needed for different purposes, but the Government should ensure that its use of units and terminology is consistent across departments so that those

outside the science community can form a clearer view of the relative merits of different forms of energy in the context of climate change.

1 Overview

"*The fuel of the future is going to come from fruit … weeds, sawdust—almost anything…*" *Henry Ford*

1. Climate change is a long-term concern but action is needed today. Bioenergy is only one part of a many-faceted solution to the problem of climate change, but we must make use of all the measures available to us. If the UK is to be a credible leader, setting the global agenda for tackling climate change, the Government must take every opportunity to reduce domestic carbon emissions. Bioenergy represents one of the most significant such opportunities available today.

2. In undertaking this inquiry we did not set out simply to make an assessment of Government policy on bioenergy in relation to the current state of the bioenergy industry in the UK, although we do present a progress report on the UK's bioenergy output and a summary of the main components of the Government's policy. We also aimed to engage directly with a complex area of agri-environmental science at a crucial stage in its development, and to set out the relevant issues and the range of options available to the Government as it comes to decisions on the role bioenergy should play in reducing carbon emissions, and on how to support that role.

3. Biomass—as a source of heat and electricity—holds significant potential for carbon saving. Of all the available sources of bioenergy it offers the greatest carbon savings per hectare of land cultivated for these crops. The Government must exploit to the full the potential of biomass, particularly if it fails to establish second generation biofuels in the transport fuel market.

4. Carbon emissions from transport are increasing, and we recognise that biofuels represent one of the means of tackling this problem. However, in their current state of development and with the limitations on land capacity in the UK, these fuels do not present the most effective or efficient way of making a significant difference to the UK's carbon emissions in the long term. A clear path must be marked out for a move from first generation to advanced 'second generation' biofuels.

5. Whilst we urge the Government to exploit to the full the potential of a range of biofuels and biomass, we recognise that there are limits to this potential, given the availability of land for energy crops and the other demands on it—namely food production and the promotion of biodiversity. We highlight the difficulties associated with drawing definitive conclusions on the UK's potential as a generator and user of bioenergy. This position results from the dearth of quantifiable evidence of the best climate change mitigation strategies in terms of the cost per tonne of carbon. Such data are essential to informed policy-making; we look forward to the conclusions of the Stern Review on the Economics of Climate Change as a step towards addressing this problem.

6. We were disappointed to find that—even after the Energy Review—current Government policy on bioenergy is piecemeal and so lacking in ambition as to raise questions about the extent of the Government's commitment to its domestic climate change agenda. If it is to lead by example, the Government must renew and redouble its efforts to exploit the potential of bioenergy in the most effective way.

Definitions

Bioenergy is an inclusive term for all forms of biomass and biofuels.

In the context of this inquiry:

- Biofuels are renewable transport fuels:
    - Bioethanol is an alcohol-based fuel resulting from the fermentation of either sugar or starch crops that have been converted into simple sugars. Common feedstocks include sugar cane and beet, wheat, barley and maize. Bioethanol is blended with petrol.
    - Biodiesel is manufactured from virgin or waste vegetable oils—commonly palm oil and rapeseed, or from animal fats. It acts as a substitute for conventional diesel.
    - Biogas is made from landfill gas and other organic material.
    - Bioethanol and biodiesel, as defined above, represent 'first generation' biofuels. More advanced transport fuels—such as ligno-cellulosic ethanol and synthetic fuels produced using the Fischer-Tropsch process—are currently in various stages of pre-commercial development. These are described in further detail in the report (see page 26).
- Biomass is any biological mass derived from plant or animal matter (e.g. timber crops, miscanthus, straw, chicken litter and other waste material) used as a source of renewable heat or electricity.

Units and terminology

Comparison of energy sources

One litre of bioethanol contains less energy than one litre of petrol. Similarly, one tonne of wood does not contain the same amount of energy as one tonne of coal.

In order to be able to compare different energy sources, the unit Mtoe is often used.

- Mtoe = Mega tonnes of oil equivalent = 1,000,000 tonnes of oil equivalent.

This represents the amount of oil required to release the same amount of energy as another energy source, such as coal or bioethanol.

Emissions[1]

Carbon dioxide emissions are usually measured in kg or tonnes (1 tonne = 1000 kg).

- 1 megatonne (Mt) = 1,000,000 tonnes
- 1 gigatonne (Gt) = 1000 Mt

CO_2 emissions may also be expressed in tonnes of carbon equivalent (Ceq). Many policy discussions take place in terms of tonnes of carbon equivalent in order to compare different greenhouse gases, such as methane (CH_4) and CO_2.

3.7 tonnes of CO_2 is roughly equivalent to 1 tonne of carbon.

A typical (1GW) coal-fired power station emits around 7 Mt CO_2 per year.

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Throughout this report we have used 'carbon' as a non-specific term. We use CO_2 only when citing written or oral evidence which contains the term, or when referring to the Government's domestic climate change targets, which are set specifically in terms of CO_2. We refer to 'greenhouse gases' in the context of the Kyoto Protocol, where the term is defined (see paragraph 7). Elsewhere, we use 'greenhouse gases' only where this reflects terminology used in evidence.

1 House of Commons Science and Technology Committee, First Report of Session 2005–06, *Meeting UK Energy and Climate Needs: The Role of Carbon Capture and Storage*, HC 578, February 2006

2 Introduction

Aims of the inquiry

7. In April 2004 the Prime Minister declared climate change to be "the single most important issue that we face as a global community".[2] Defra says that "UK leadership is shaping the way other key players are considering the future of climate change policy".[3] Under the terms of the Kyoto Protocol, the UK is legally required to reduce its greenhouse gas emissions by 12.5% below 1990 baseline levels by 2008–2012.[4] In 1997 the Government pledged to reduce carbon dioxide (CO_2) emissions by 20% below 1990 levels by 2010.[5] Whilst the UK is 'on course' to meet its Kyoto target (despite the UK's greenhouse gas emissions *increasing* by 1% in the year 2003–2004[6]), the Government recently conceded that it is likely to fall short of its domestic CO_2 target by 2–5%.[7] One of the means by which the Government hopes to make up this shortfall is to increase the use of bioenergy.

8. Bioenergy has been the subject of several recent announcements at both UK Government and EU level. The Biomass Task Force, chaired by Sir Ben Gill, reported to Government in October 2005, and in November 2005 the Secretary of State for Transport announced a Renewable Transport Fuel Obligation (RTFO). This will require fuel providers to meet targets for biofuels sales or buy certificates to make up any shortfall. The 2006 Budget included measures to increase UK production and demand for biofuels and biomass, complementing the RTFO and the recommendations of the Biomass Taskforce. The European Commission has announced a biomass and biofuels action plan, outlining measures in the heating, electricity and transport sectors.

9. Against this background, in December 2005 we launched a series of linked inquiries into aspects of climate change policy. The first of these addressed the role of renewable energy in meeting the UK's climate change aims, with specific reference to bioenergy.[8] Our terms of reference were:

2 Speech by the Prime Minister at the launch of the Climate Group, 27 April 2004. Available at: http://www.number-10.gov.uk/output/page5716.asp

3 Defra website. '*Climate change: International action',* available at www.defra.gov.uk/environment/climatechange/internat/index.htm

4 The term 'greenhouse gases' as defined by the Kyoto Protocol includes carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). The Kyoto Protocol requires a percentage reduction in the total 'basket' of these six greenhouse gases. The UK's domestic targets are specifically to reduce emissions of CO_2.

5 The Department for Environment, Food and Rural Affairs (Defra) now shares the Public Service Agreement on greenhouse gas emission reductions with the Department for Transport (DfT) and the Department for Trade and Industry (DTI). PSA II: "*To reduce greenhouse gas emissions to 12.5% below 1990 levels in line with our Kyoto commitment and move towards a 20% reduction in carbon dioxide emissions below 1990 levels by 2010, through measures including energy efficiency and renewables*"

6 Defra, *Departmental Report 2006*, Cm 6827, May 2006; National Statistics, News Release, "Greenhouse gas emissions little changed since 1999", 23 May 2006

7 Defra, *Climate Change: The UK Programme 2006*, Cm 6764. March 2006

8 The second and third inquiries in the series will examine: the "citizen's agenda": actions which individuals can take in their daily lives to help tackle climate change, including micro-generation, local communities, schools and businesses; and "international climate policy post-2012": the operation of the "Kyoto rulebook" agreed at Montreal and future developments in preparing for Phase 2 of the Kyoto Protocol.

i. What is the real scope for biomass and biofuels to contribute to tackling climate change? What proportion of the UK's energy and transport fuel needs could they provide?

ii. How cost-effective are biomass and biofuels in comparison with other sources of renewable energy?[9]

iii. How do biofuels compare to other renewables, and with conventional fossil-fuels, in terms of carbon savings over their full life-cycle?

iv. Not all biomass is equal—potential carbon savings depend on, for instance, farming practice. What can be done to ensure energy crops are sustainably produced?

v. What impact will UK Government and EU actions have in increasing demand for, and production of, biomass and biofuels?

vi. What level of financial and policy support do bioenergy technologies require in order to achieve the Government's targets for renewable energy?

vii. What impact might an increase in energy crops in the UK and the rest of the EU have on biodiversity, production of food crops and land use and the environment more generally?

viii. Does bioenergy production constitute the best use of UK land for non-food crops? Should UK and EU policy focus on increasing domestic production of energy crops and biomass, or are there merits in importing biomass for energy production, or raw feedstock or refined biofuel, from outside the EU?

ix. What more can be done to make more efficient use, as an energy source, of the by-products of agriculture and forestry (e.g. wood waste and other organic waste)?

x. What lessons can be learned from other countries' experience in the production and use of bioenergy?

10. We received 32 written submissions and took oral evidence between March and May 2006 from: the National Farmers Union (NFU); the Renewable Energy Association (REA); the Biofuels Corporation; the Energy Crops Company; the Society of Motor Manufacturers & Traders (SMMT); the UK Petroleum Industry Association (UKPIA); Sir Ben Gill, President of the Biomass Task Force; the Biosciences Federation and the Royal Society of Chemistry (RSC); English Nature; Shell; Ford; Rolls-Royce; Officials from Defra and HM Treasury; and Ian Pearson MP, Minister of State (Climate Change and the Environment). We are grateful to all those who gave evidence to our inquiry.

9 Little evidence was received on this point and so it has not been addressed as part of this report. We note that the Stern Review on the economics of climate change is examining "The costs and benefits of actions to reduce the net global balance of greenhouse gas emissions from energy use and other sources, including the role of land-use changes…" as part of its investigation. The final report is due to be published by autumn 2006.

11. In March 2006 we visited Washington DC and California in the United States, and Beijing and Changchun in China, to discuss various aspects of the climate change agenda, including bioenergy. We have also drawn on information gathered on visits to Brussels and to Paris and Berlin in connection with other inquiries. We would like to thank all those, including Foreign and Commonwealth Office staff, who facilitated these visits. We are grateful to all those who took the time to meet us.

Background

12. In 2004, UK energy use totalled 247 million tonnes of oil equivalent (Mtoe). Oil constituted 102 Mtoe, some 42 Mtoe of which were used for road transport alone. A similar amount of natural gas (97 Mtoe) was used, predominantly for heating, with only 30% (some 29 Mtoe) of this amount used for electricity generation. Bioenergy and waste provided 3.5 Mtoe (1.4% of the total UK energy use). Of this, 2.6 Mtoe was used to generate electricity, and a further 0.6 Mtoe to generate heat.[10] Bioenergy currently provides 69 Mtoe in the EU, equivalent to around 4% of the EU's total primary energy consumption.[11] In 2005 petrol and diesel road fuel sales totalled around 49,000 million litres. Of this, biofuel sales comprised only 118 million litres, or 0.25% (see Figure 1 below).[12] It is difficult to find comparative data—in Mtoe—for the quantity of biofuels used for transport but in 2004 total road fuel sales were approximately 48,000 million litres, which loosely equates with 42 Mtoe.[13] **In conducting this inquiry we encountered a wide range of different units, measurements and terms which are all used in calculations of energy and emissions. We recognise that different kinds of data are needed for different purposes, but the Government should ensure that its use of units and terminology is consistent across departments so that those outside the science community can form a clearer view of the relative merits of different forms of energy in the context of climate change.**

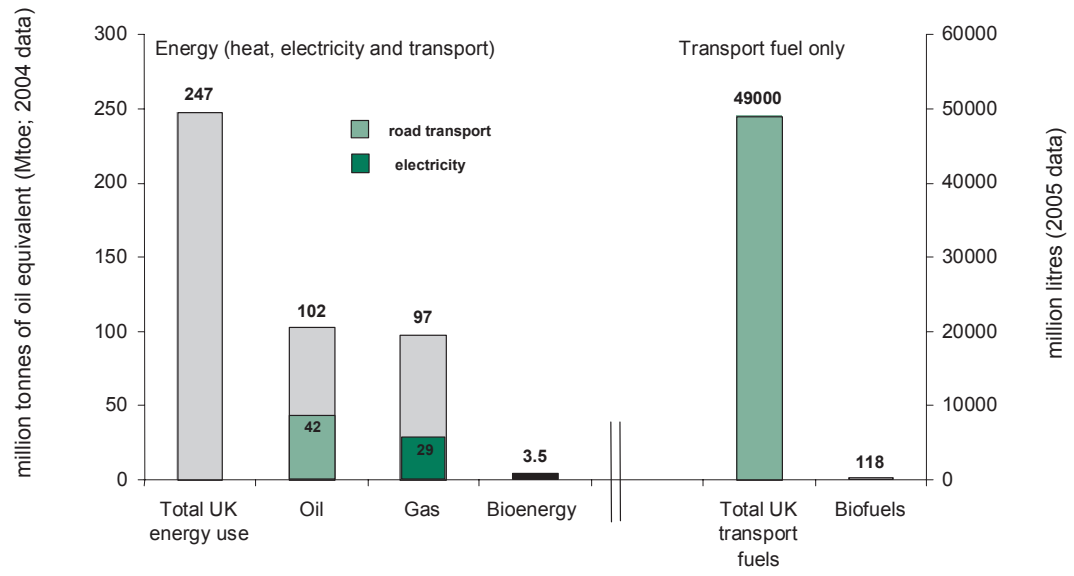
10 House of Commons Environmental Audit Committee, Sixth Report of Session 2005–06, *Keeping the lights on: Nuclear, Renewables and Climate Change*, HC 584; based on DTI Dukes 2005.

11 European Environment Agency, *How much bioenergy can Europe produce without harming the environment?*, 2006

12 Department for Transport, *Promotion and Use of Biofuels in the United Kingdom*, report to the European Commission, June 2006

13 Department for Transport, *UK report to the commission on biofuels 2005*

Figure 1: UK total energy mix 2004, and UK transport fuel use 2005



Data source: Environmental Audit Committee, Sixth Report of Session 2005–06, Keeping the lights on: Nuclear, Renewables and Climate Change, HC 584; based on DTI Dukes 2005; Department for Transport, UK Report to the European Commission on Biofuels 2006, June 2006

13. The Government suggests that bioenergy could provide:

- 5–6% of the UK's electricity supply by 2020;
- 7% of the heat market by 2015;
- and 5% of the UK's transport fuel demands by 2010.[14]

14. **The Government has estimated the contribution that bioenergy could make to the UK's energy mix by sector as percentages of the total, and using different dates for each sector. This does not facilitate useful comparison and suggests a lack of consistency in approach across Government departments. We recommend that the Government recast its estimates, settling on one target date and indicating what the relative percentages, in million tonnes of oil equivalent (Mtoe), actually represent.**

Biomass

EU Biomass Action Plan

15. Around 64% of the EU's total renewable energy—equivalent to 4% of the EU's total energy needs—comes from biomass, most of which is used to generate heat.[15]

14 Ev 152 [Defra]; DTI and Defra, *The Government's Response to the Biomass Task Force Report*, April 2006; Biomass Task Force, *Report to Government*, October 2005—study commissioned by Government

15 Ev 218 [Scottish Renewables Forum]; European Commission communication, *Biomass action plan*, COM (2005) 628 final

16. In December 2005 the European Commission adopted an Action Plan on Energy from Biomass, intended to increase the amount of energy derived from forestry, agriculture and waste materials. The aims of the Plan are to establish European standards for solid biomass fuels, to promote the use of waste as a fuel, and to encourage bioenergy schemes at Member State level. The Plan outlines more than 20 actions to promote biomass in heating, electricity and transport. From this starting point, the Commission will work towards proposals for EU legislation on renewable heating and cooling by the end of 2006, to complement existing EU rules on renewable electricity and transport biofuels.[16]

17. On 8 June 2006 EU energy ministers—in a series of "Council Conclusions on Biomass"—emphasised the "importance of promoting the cost-efficient and sustainable use of biomass in the three areas of heating and cooling, electricity production and transport" but also stated that "a balance should be sought between energy uses of biomass, non-energy uses of biomass and nature conservation".[17]

18. If all the measures set out in the Action Plan are implemented, the Commission estimates that biomass energy production could more than double from the current 69 Mtoe to 150 Mtoe by 2010, thus eliminating some 209 million tonnes CO_2-equivalent in greenhouse gas emissions per year.[18]

Current situation in the UK

19. Recent Government figures show that the burning of biomass, excluding energy from waste, currently makes a small contribution to the UK's energy balance—about 1.5% of electricity and 1% of heat.[19] According to the Government's Climate Change Programme 2006 "biomass provided 2.6 million tonnes oil equivalent (Mtoe) of electricity and 0.64 Mtoe of heat in 2004". A Government-commissioned report by Future Energy Solutions suggests that the renewable proportion of total heat generation could increase to 1.8% by 2010 and to 5.7% by 2020.[20] The Biomass Task Force is more ambitious, arguing that it should be possible to increase the renewables share of the heat market to 3% by 2010 and 7% by 2015 provided that the measures it suggests are adopted.[21]

Biofuels

EU targets and the Biofuels Directive

20. In March 2005, Andris Piebalgs, European Commissioner for Energy said:

16 *ENDS Environment Daily*, "EU governments warm to biomass energy plan", Issue 2073, 4 April 2006

17 Council of the European Union, Council Conclusions on Biomass, 2735th Transport, Telecommunications and Energy Council meeting, Luxembourg, 8–9 June 2006

18 *ENDS Environment Daily*, "European biomass energy action plan released", Issue 1998, 7 December 2005

19 HM Treasury, *Budget 2006*, March 2006, para 7.28

20 Future Energy Solutions from AEA Technology *Renewable Heat and Heat from Combined Heat and Power Plants – Study and Analysis*, September 2005

21 Biomass Task Force, *Report to Government*, October 2005

> The transport market is today almost entirely dependent upon oil-based fuels. It is now urgent that all Member States live up to their commitments to develop an alternative fuel strategy for transport and to tackle this over-dependence which is a significant source of environmental and supply concerns for the European Union.[22]

21. A European Directive was adopted in 2003 to promote the use of biofuels to replace conventional diesel or petrol for transport purposes.[23] This requires Member States to set national indicative targets in line with a recommended target of 2% inclusion of biofuel within transport fuels by December 2005, increasing to 5.75% by 2010.[24] The Directive does not stipulate what the national indicative targets should be but Member States are obliged to justify any departure from the recommended target. Member States must set their indicative targets for 2010 by July 2007.

22. European Commission statistics suggest that by 2010 total transport fuel use in the EU-25 will be some 330 million tonnes. In relation to 2004 figures, this would represent an increase of around 10%.[25] If 5.75% of the total is to be supplied by biofuels, as recommended by the Directive, there would be demand for some 25 million tonnes of bioethanol equivalent, considerably more than current production levels. Since the Directive specifies only sales rather than production, any shortfall caused by a nation being unable to meet demand locally can be made up through imports.

EU biofuels production

23. Together German, French and Italian biofuel production is some eighteen times greater than that of the US; Europe is the global leader in biodiesel production.[26] European biofuel production in 2004 was 2.45 million tons (see Figure 2 below).[27] This total represents a 26.6% increase on 2003 production.[28]

22 EUROPA, European Commission press release IP/05/318 "The European Commission notifies Member States on delays in implementing European legislation on biofuels", 16 March 2005

23 Directive 2003/30/EC of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport

24 This is determined by energy content, rather than by volume. Accordingly, 5.75% by energy content equates to approximately 9% by volume for bioethanol.

25 EUROPA, Biofuels Strategy: Background memo, MEMO/06/65, February 2006

26 *Biodiesel: Growing a New Energy Economy* by Greg Pahl, Pub. Chelsea Green (2005)

27 1 imperial ton=1.016 metric tonnes

28 European Commission, New and Renewable Energies http://ec.europa.eu/energy/res/sectors/bioenergy_en.htmaccessed June 2006

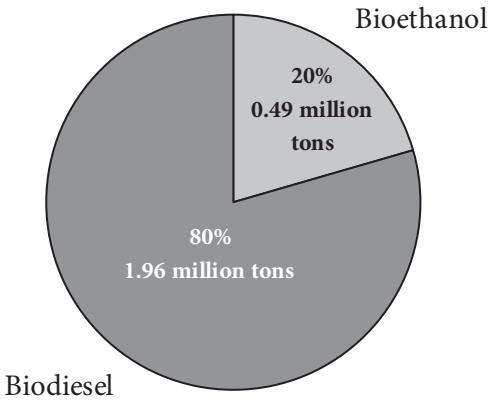


Figure 2 European biofuel production, 2004

UK biofuel production

24. The UK is lagging behind some other EU countries in biofuel production. In 2003, the combined biofuel output of Germany and France was more than one million tonnes. By comparison, in the same period the UK produced fewer than 0.01 million tonnes,[29] and achieved only 0.24% inclusion of biofuels in transport fuels in 2005.[30] Consequently, the UK has failed to meet the 2% reference target set out in the Directive.

25. However, UK biofuel production and use is on the increase. In 2004, biofuels contributed 0.04% of total UK road fuel sales (equivalent to 20.9 million litres per annum), in comparison with a contribution of 0.24% in 2005, when the UK achieved biodiesel sales of 33 million litres, and bioethanol sales—from overseas imports—of 85 million litres.[31] The UK's 2005 target was 0.3% use of biofuels.[32]

26. Britain's first large-scale biodiesel plant opened in Scotland in March 2005, with the capacity to produce 50 million litres of biodiesel per year from waste cooking oil and animal fats.[33] Currently, the UK has the capacity to produce over 350 million litres of biodiesel per annum—equivalent to 1.5% of 2005 total diesel sales[34]—using a combination

29 European Biodiesel Board, 2005

30 Department for Transport, *Promotion and Use of Biofuels in the United Kingdom*, report to the European Commission, June 2006

31 Department for Transport, *UK report to the commission on biofuels 2005*, June 2005; Department for Transport, *Promotion and Use of Biofuels in the United Kingdom*, report to the European Commission, June 2006

32 Ev 155 [Defra]

33 HC Deb, 16 March 2005, col 256W

34 Department for Transport, *Promotion and Use of Biofuels in the United Kingdom*, report to the European Commission, June 2006; 23,233 million litres of diesel (including biodiesel) were sold in 2005

of virgin vegetable oils, including oilseed rape and imported palm oil, and recycled vegetable oil. A further 114 million litres of biodiesel should be on line by the end of 2006 and further expansion of capacity is planned.[35]

27. Plants to supply a total UK annual capacity of over 450 million litres of bioethanol—equivalent to 1.75% of 2005 total petrol sales[36]—are either already under construction, or in the planning process. One biomethane plant—using organic waste as the feedstock—is under construction, with a second plant, using landfill gas, planned.[37]

28. British Sugar and Associated British Foods recently announced a collaboration with BP and DuPont to produce biobutanol from sugar beet at the British Sugar plant in Wissington. We discuss the use of biobutanol below at paragraph 53. Subject to completion of a feasibility study, production is expected to begin in 2007.[38]

3 Potential carbon savings from bioenergy

Overview

29. We begin by examining the potential of bioenergy—biomass, biofuels and biogas—to contribute to the UK's effort to reduce its climate change impact. Quantifying the carbon saving potential of any source of bioenergy is a complex process and the end result is influenced by a range of factors which are in themselves difficult to evaluate as emissions are incurred over the life cycle of energy generation and use. We call for further work to allow policy makers to take informed decisions on bioenergy, based on accurate calculations of the environmental benefits of the various sources of bioenergy.

30. During our inquiry we were made aware of a number of important developments in bioenergy technology, principally 'second generation' biofuels for road transport and synthetic kerosene for aviation. We call on the Government to increase its investment and intensify its research into new production processes and hitherto neglected areas, particularly the use of biomass for heat, and the use of different parts of the same energy crop for different purposes. We recognise, however, that 'first generation' biofuels from traditional crops are currently the only biofuels that are available on a commercial scale.

Biomass for heat and electricity

31. Research by the Energy Saving Trust has found that "biomass heating could reduce household carbon emissions by 3% or around 720,000 tonnes".[39] WWF has also

35 Ev 182 [Defra]

36 Department for Transport, *Promotion and Use of Biofuels in the United Kingdom*, report to the European Commission, June 2006; 25,693 million litres of petrol (including bioethanol) were sold in 2005

37 Ev 182 [Defra]

38 Associated British Foods plc, press release, "Associated British Foods announces a collaboration with BP and DuPont on UK biofuel production", 20 June 2006

39 Ev 207

emphasised the advantages of using biomass, in particular that it can be stored and then used when needed.[40]

32. Evidence from Sheffield Hallam University and the Low Carbon Vehicle Partnership shows that the greatest percentage greenhouse gas savings can be gained through the gasification of biomass to produce electricity, and the burning of woodchip to generate heat, as set out in Table 1. This is supported by the Biosciences Federation and the Royal Society of Chemistry.

Table 1: Potential greenhouse gas savings from a range of bioenergy technologies compared with their conventional fossil fuel equivalents

Electricity generation	% saving in GHG v fossil fuel reference
Grid electricity	–
Electricity from straw	59%
Electricity from miscanthus	84%
Electricity from SRC (short-rotation coppice) wood chip	84%
Electricity from forest residue	86%
Gasification of forest residue wood chips	95%
Gasification of SRC wood chips	95%
Small scale heating	% saving in GHG v fossil fuel reference
Oil fired heating boiler	–
Combustion of woodchip	93%

Data source: Defra[41] from: 'Carbon and energy balances for a range of biofuels options', Sheffield Hallam University 2003; and 'WTW evaluation for production of ethanol from wheat', Low Carbon Vehicle Partnership, 2004

33. There are several barriers to increasing the uptake of biomass for producing heat and electricity, despite its apparent superiority over biofuels in terms of potential carbon savings. These barriers are described by the Renewable Energy Association (REA):

> the significance of biomass in contributing to our carbon abatement targets, our climate change targets and also, increasingly, to the question of fuel security has simply failed to be recognised and given the significance that it probably deserves … there is an inflexibility when it comes to biomass in that it does not recognise some of the other benefits … in being able to present base load capacity at the end of transmission lines. It helps reinforce the system and so on. Those benefits are not valued in it.[42]

34. In its submission to our inquiry Powys County Council focuses on the untapped potential of biomass for heat, citing "a general lack of awareness of the opportunities and a seeming fixation on electricity. Even where woodfuel, or other biomass for combustion

40 Ev 246

41 Ev 153

42 Qq 43, 52 [Mr Meeks, Mr Stowell]

crops, have entered the thinking of government it has usually been in the context of generating electricity."[43]

35. **Current Government policy focuses on renewable electricity generation at the expense of the prospects for the development of renewable heat. We note that in its response to the Biomass Task Force Report the Government has undertaken to increase the use of biomass heat and electricity. We recommend that the Government build on this commitment by setting out clear and quantifiable targets for biomass heat in its forthcoming Biomass Strategy. We further recommend that the Strategy redress the balance between biofuels, renewable electricity and renewable heat, to reflect the greater potential carbon savings offered by biomass heat.**

36. **Reflecting on the conclusions of the Biomass Task Force, and acknowledging that the Government has already published its response to the Task Force report, we are disappointed that the Government has failed to take the opportunity offered by the Energy Review properly to address the issue of biomass heat, and has only committed to producing the Biomass Strategy "over the coming year". Given the urgent need for concrete measures to support biomass heat, we should not have to wait until 2007 for the Biomass Strategy, and recommend that the Government make clear in its response exactly when it anticipates publishing this strategy, and further suggest that it does so at the earliest possible opportunity.**

Marine biomass

37. The Biosciences Federation and Royal Society of Chemistry are enthusiastic proponents of the potential benefits of marine biomass—seaweed—as a source of bioenergy. They highlight research by the Scottish Association for Marine Science which demonstrates that seaweed—which is easily cultivated and can increase in mass by up to 10% per day—sequesters carbon. The research also suggests that producing marine biomass could have a beneficial impact on biodiversity by removing nitrogen from seawater, thus mitigating the effects of sewage effluent or nitrogenous waste from fish farms, and could be coupled with offshore wind farms around the coast of Great Britain.[44]

38. Seaweed is already farmed for food in large quantities in China, Japan and the Philippines. Japanese research proposals put forward in 2005 suggested that vast nets of fast-growing seaweed could also be a valuable source of bioenergy. The seaweed would also absorb CO_2 while it was growing. However, the Japanese research proposal suggested that the equivalent of £2.8 billion would be needed to implement the project at full scale.[45]

39. Earlier research into the potential of seaweed as a source of renewable energy was conducted in the US in the 1970s as part of its response to an energy crisis. Although the amount of biogas produced by mass of kelp was found to be greater than many other sources of biomass, the research project fell foul of passing ships, winter storms and grazing fish. Later research confirmed the potential of marine biomass as a source of

43 Ev 190

44 Ev 92

45 *The Times*, "Seaweed to breathe new life into fight against global warming", 14 May 2005

energy, but again the project was deemed to have been unsuccessful, owing to a lack of communication between engineers and biological scientists. Funding for the project—some $20 million—was terminated in 1986.[46] Early research into the commercial viability of marine biomass as a source of energy, conducted in the US in the 1970s, was also fraught with difficulty and was ultimately deemed to have been unsuccessful.

40. Dr Kelly, of the Scottish Association for Marine Science, notes that on the global scale seaweed mariculture is a thriving industry, with 11.6 million tonnes produced in 2002—equivalent to a value of US$6.2 billion. Whilst the vast majority of this is for food, Dr Kelly points out that "the technology for the large scale culture, harvest and processing of seaweeds is well advanced". Trials have found seaweed to be a good source of biogas, and Dr Kelly argues that further research into using anaerobic digestion (see below at paragraph 78) of seaweed to produce methane as a renewable source of energy should be undertaken.[47]

41. The Biosciences Federation and Royal Society of Chemistry state in their submission that "the opportunity to expand the possibilities presented by bioenergy into the substantial marine resource governed by the UK should not be overlooked". [48] In its oral evidence English Nature struck a note of caution, emphasising the significance of the environmental impact of an increase in cultivation of energy crops. English Nature acknowledged that further research into the potential of marine biomass was needed, but insisted that this should not be undertaken at the expense of research into land-based biomass production.[49]

42. **We agree with the Biosciences Federation and Royal Society of Chemistry that the potential of marine biomass as a source of energy should not be overlooked. We recommend that the Government conduct a scoping study to investigate the potential for and anticipated carbon savings from the use of marine bioenergy, and to establish the likely up to date costs associated with developing this technology. We emphasise, however, that any research in this field must be carried out in addition to—and not instead of—research and development into land-based bioenergy production.**

Biofuels

UK transport emissions

43. In 2004, 51.3 million tonnes of petroleum were used for transportation fuels,[50] which loosely equates with CO_2 emissions of more than 40 MtC.[51] UKPIA asserts that "due to their low cost, availability, and ease of use petrol and diesel will remain the dominant road

46 UN Atlas of the Oceans, *Marine Biomass Energy* by Dr Peter Neushal, University of California, June 2002

47 Ev 108

48 Ev 92

49 Q 266

50 Department for Trade and Industry, *UK Energy in Brief*, July 2005

51 Defra, *Climate change: the UK Programme 2006*, March 2006; 2004 transport emissions, by end user

transport fuels globally to 2030 and beyond".[52] Shell notes that the UK road transport sector is almost entirely dependent on petroleum products as its energy source.[53]

44. Research by the UK Tyndall Centre for Climate Change Research shows that the transport sector is the largest source of carbon dioxide (CO_2) emissions in the UK. Road transport alone accounts for 21% of total CO_2 emissions in the UK.[54] The Government's Energy Review 2006 found that between 1990 and 2000, CO_2 emissions from road transport grew by 8%, even though the average fuel efficiency of new cars has improved by 10% since 1997. This increase in emissions comes despite advances in hydrocarbon fuel formulations and an increase in the use of diesel. Transport is also the only sector in which emissions are predicted to be greater in 2020 than in 1990.[55]

45. The 2003 Energy White Paper indicated that in order for the UK to meet its domestic targets, a 5–10% reduction in CO_2 emissions from road transport in the UK would be required by 2020.[56] UKPIA argues that this reduction can be achieved through a combination of new technology and improved fuel economy from conventionally fuelled vehicles, as well as an eventual need for lower carbon fuel sources and "major change in consumer choices/behaviour".[57] Currently biofuels are the only source of renewable power commercially suitable for road transport.

Potential carbon savings from biofuels

46. Bioenergy is often said to be carbon neutral, on the basis that the carbon released on burning the fuel is equal to the carbon removed from the atmosphere when the crop is growing. However, carbon savings are affected by agricultural practice, production and processing methods, and transportation of the feedstock.[58] Consequently, the carbon savings offered by biofuels may be reduced to varying degrees by the emissions incurred over the lifecycle of the fuels. Critics of bioethanol have argued that the energy used in its production—by machinery, fertilisers, transport and the fermentation process—can be greater than the energy actually contained in the resulting fuel.[59]

47. Such claims are vigorously disputed. The potential greenhouse gas savings from different biofuels are summarised in Table 2, below.

52 Ev 55

53 Shell, consultation response to the Energy Review

54 Tyndall Centre for Climate Change Research, *Decarbonising the UK: Energy for a Climate Conscious Future*, 2005, p31

55 Tyndall Centre for Climate Change Research, *Decarbonising the UK: Energy for a Climate Conscious Future*, 2005, p46

56 Department for Trade and Industry, *Our energy future - creating a low carbon economy*, Cm 5761, February 2003

57 Ev 59

58 Ev 231 [Environment Agency]

59 *New Scientist*, "Biodiesel beats ethanol in biofuel battle", 10 July 2006; Institute of Science in Society, *Which Energy?* March 2006

Table 2: The range of potential greenhouse gas savings from biofuels compared with their fossil fuel equivalents

Transport fuels	% saving in GHG v fossil fuel reference
Ultra Low Sulphur Diesel	–
Biodiesel from OSR (oilseed rape)	53%
Biodiesel from recycled veg oil	85%
Ultra Low Sulphur Petrol	–
Ethanol from wheat grains	49-67%
Ethanol from sugar beet	54%
Ethanol from wheat straw (cellulose ethanol)	85%

Data source: Defra from 'Carbon and energy balances for a range of biofuels options', Sheffield Hallam University 2003; and 'WTW evaluation for production of ethanol from wheat', Low Carbon Vehicle Partnership, 2004[60]

48. However, the Renewable Energy Association (REA) argues that considerable care needs to be taken in comparing the results of different studies conducted to ascertain the potential reduction in greenhouse gas emissions from any one biofuel.[61] The European Commission recently compared studies which had been conducted to determine the potential carbon savings from biofuels. The Commission's analysis showed considerable variation in savings according to the methodology used and assumptions made. This is supported by a recent study commissioned by the Government, the findings of which are summarised in Table 3, below.

Table 3: The range of potential greenhouse gas savings from biofuels compared with their fossil fuel equivalents

Transport fuels	% saving in GHG v fossil fuel reference
Ultra Low Sulphur Diesel	–
Biodiesel	38–57%
Second generation synthetic diesel	94%
Ultra Low Sulphur Petrol	–
Ethanol from sugar cane	88%
Ethanol from sugar beet	32–64%
Ethanol from wheat	7–77%
Ligno-cellulosic ethanol	73–94%

Data source: E4tech, 'UK carbon reduction potential from technologies in the transport sector' for the UK Department for Transport and Energy Review team, May 2006

49. In July 2005 the Chancellor of the Exchequer announced the establishment of the Stern Review on the Economics of Climate Change. Led by Sir Nicholas Stern, the review will examine, among other things, "the costs and benefits of actions to reduce the net global balance of greenhouse gas emissions from energy use and other sources, including the role of land-use changes". The report to Government is due to be published by autumn 2007.[62]

50. **No analysis of the relative benefits of different forms of energy is complete without consideration of the cost, in both financial and sustainability terms, of reducing**

60 Ev 153

61 Ev 19

62 www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm

emissions. The difficulties of making reliable calculations—owing to the volatility in oil prices, and consequently biofuel prices, as well as cost differences in feedstocks and processing methods—are well understood. We seek confirmation from the Government that the Stern Review on the Economics of Climate Change will provide clarity in this area.

Second generation biofuels

51. There are limits to the extent to which conventional biodiesel or bioethanol can be combined with fossil fuels without requiring alterations to the current distribution infrastructure or engine requirements.[63] However, the 'second generation'—or advanced—biofuels, which we describe below, should provide a solution to this problem, as they are designed to be "entirely compatible [with] conventional hydrocarbon fuels".[64] They offer a means of exploiting sources of biomass other than dedicated energy crops such as wheat or oil seed rape.

52. The Society of Motor Manufacturers and Traders (SMMT) states that, while commercially available biofuels such as bioethanol can reduce 'well-to-wheel' emissions by between 7 and 77%, second generation biofuels—which will become available within the next five years—can exceed these carbon savings.[65] This is endorsed by the Biosciences Federation and the Royal Society for Chemistry (RSC) who maintain that, although 'first generation' biofuels are necessary in the short-to-medium term, greater carbon savings can be achieved from second generation biofuels produced from biomass.[66]

Biobutanol

53. Use of biobutanol represents a possible step between existing 'first generation' bioethanol, and more advanced biofuels which are still in pre-commercial development. Biobutanol exhibits distinct advantages over conventional bioethanol, such as a greater energy density (providing improved fuel economy as a result), and greater compatibility with existing infrastructure and distribution networks. Produced from the same feedstocks as bioethanol (wheat or sugar beet, for example), biobutanol can also be blended with petrol at levels of up to 10% by volume without requiring vehicle modification or invalidating warranties (this is discussed in more detail at paragraph 194).[67]

54. Preliminary data suggest that well-to-wheel carbon savings from biobutanol are at least comparable to those from bioethanol. DuPont and BP are currently carrying out a detailed analysis of the potential carbon savings from biobutanol.[68] The fact that a major fuel

63 Q 137 [UK Petroleum Industry Association]

64 Q 208 [Biosciences Federation and Royal Society of Chemistry]

65 Ev 61

66 Ev 91, 95; Qq 212, 231–245

67 Associated British Foods plc, *Press release announcing a collaboration with BP and DuPont on UK biofuel production*, June 2006; DuPont and BP, *Biobutanol fact sheet*

68 DuPont and BP, *Biobutanol fact sheet,* available at: *http://www.bp.com/liveassets/bp_internet/globalbp/STAGING/global_assets/downloads/B/Bio_biobutanol_fact_sheet_jun06.pdf*

company such as BP is directly involved in this project indicates that it has now properly recognised the growing importance of biofuels to the transport sector.

Ligno-cellulosic ethanol

55. The Canadian Iogen Corporation has developed an enzymatic process by which bioethanol can be produced from agricultural waste such as straw; the end product is often known as ligno-cellulosic ethanol. Studies show that this system can elicit a net carbon reduction of around 90% when compared with conventional petrol. Independent feasibility studies suggest that, based on existing straw supplies alone,[69] there is potential within the UK for at least two 150 million litre plants (equivalent to 0.6% of 2005 total petrol sales).[70] Shell has formed a "strategic partnership" with Iogen, "to bring this technology to the benefit of consumers."[71]

The Fischer-Tropsch process

56. The Biosciences Federation and the RSC told the Committee about the potential for second generation transport fuels produced from any carbon-based material—ranging from coal to wood waste—using the Fischer-Tropsch process. Developed in Germany in the 1920s, the Fischer-Tropsch process uses catalytic reactions to synthesise complex hydrocarbons from more basic organic chemicals. Such fuels are chemically identical to conventional fossil fuels, so use of these biofuels would not require engine modifications or changes to the delivery infrastructure. They have the added advantage of lower sulphur and contaminant levels.[72]

57. The process has been used commercially in South Africa since the mid-1950s, where the Sasol plant now converts over a million tonnes of coal a year into a range of transport fuels, including a large proportion of their aviation fuel (see below at paragraph 69), and chemicals using a combination of gasification and the Fischer-Tropsch process. The technology is generically referred to as coal-to-liquid—or CTL—technology but it is equally suitable for use with natural gas (gas-to-liquid, or GTL) or biomass (biomass-to-liquid, or BTL) as the feedstock.[73] Supported by Shell, Choren Industries in Germany is developing processes for gasifying woody biomass, such as short rotation coppice, and converting the gas produced into "high quality diesel fuel" using the Fischer-Tropsch process.[74]

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69 House of Commons Environment, Food and Rural Affairs Committee, Ninth Report of Session 2004–05 *Climate change: looking forward* HC 130-II, written evidence from Iogen, Ev 265

70 Department for Transport, *Promotion and Use of Biofuels in the United Kingdom*, report to the European Commission, June 2006; 25,693 million litres of petrol (including bioethanol) were sold in 2005

71 Shell, www.shell.com/biofuels

72 Q 248

73 Written evidence from Professor Bridgwater (Biosciences Federation and the Royal Society of Chemistry) [not printed]

74 Ev 122

Potential carbon savings

58. The potential carbon savings offered by second generation biofuels are substantial. Shell states that the well-to-wheel CO_2 emissions of such fuels (i.e. the amount of CO_2 that they produce compared to conventional gasoline or diesel) amount to "about 90 per cent less than conventional gasoline or diesel…".[75]

59. This assessment is supported by the Society of Motor Manufacturers and Traders (SMMT), which notes that, in addition to the greater potential carbon savings offered by second generation biofuels, they have the advantage of generating a significantly higher yield per hectare of land as the whole crop (as opposed to part of 'traditional' energy crops) can be used.[76] According to Volkswagen, the estimated yield per hectare from second generation feedstock is at least three times greater than that of rapeseed biomass.[77]

Barriers to production

60. The most obvious barrier to commercialisation of second generation biofuel technologies is cost. The SMMT notes that:

> The cost of developing that [second generation] technology is still largely unknown and there is still work to be done on that. We are talking really about 2010 being an important time period for when that technology may well come along. There will always be a role ongoing, we believe, for first generation within the mix …."[78]

61. The cost of producing the necessary enzymes for manufacture of ligno-cellulosic ethanol is high. We visited Codexis in Silicon Valley, California, which is primarily a pharmaceutical company. Its Chief Executive Officer is enthusiastic about the potential of creating 'designer' enzymes for the synthesis of highly specific transport fuels from organic material, but told us that the technology is still some years away and will require substantial financial investment. Other technologies for producing second generation biofuels—for example, using either bacteria or platinum/ruthenium catalysts in the place of enzymes—are being investigated.

62. One of the three main aims of the EU Strategy for Biofuels, launched on 8 February 2006, is to increase research into second generation biofuels. Defra also recognises the carbon saving potential offered by second generation technologies, stating in its written submission to our inquiry that "with prevailing high oil prices, biofuels become more cost effective and, in the future, advanced technologies should see higher carbon savings and lower costs".[79] However, there is little evidence of the Government's commitment to development of advanced technologies. For example, as Professor Bridgwater, representing

75 Q 301

76 Qq 125–126

77 Ev 71; about 15 tonnes per hectare as opposed to 3–5 t/ha

78 Q 122

79 Ev 152–153

the Biosciences Federation and the RSC, told us, although the BTL process is "attracting considerable interest in Europe … there is little activity in the UK".[80]

63. **Defra does not say when in the future it expects second generation biofuels to become cost-effective, or what contribution the Government intends to make in terms of research and development in this field. While we accept that the Government may be reluctant to pick technology 'winners' and 'losers' at this stage, it is vital that the Government examine the barriers to further progress on second generation biofuels, and—as a matter of urgency—establish the level of investment and policy support required to accelerate development of this technology.**

Second generation biofuels for aviation

64. Aviation currently represents 11% of the UK's total climate impact and 5.5% of the UK's CO_2 emissions. Air traffic is growing rapidly throughout the EU and greenhouse gas emissions from aviation in the EU rose by 73% between 1990 and 2003. The 'greening' of air transport—including research into alternative fuels—is a priority under the European Commission's Seventh Framework Programme for research, technological development and demonstration activities.[81]

65. The Department for Transport estimates that aviation could contribute about a quarter of the UK's climate change impact by 2030 and a third of its impact by 2050.[82] The UK Tyndall Centre for Climate Change Research has concluded that if the climate change impact of aviation continued to grow at current rates, all householders, motorists and businesses would have to reduce their CO_2 emissions to zero in order for the UK Government to meet its 2050 target.[83]

Synthetic kerosene

66. A 2003 feasibility study into the Potential for Renewable Energy Sources for Aviation (PRESAV) assessed a range of possible alternative aviation fuels. The study found that hydrogen, synthetic kerosene and biodiesel offered the greatest potential benefits as alternative aviation fuels. Synthetic kerosene can be produced by the gasification of any carbon-containing material, such as coal or biomass. The gases produced are then converted using the Fischer-Tropsch process to manufacture synthetic biofuels such as diesel and kerosene which are chemically identical to their fossil-fuel counterparts.

67. Synthetic kerosene, when produced from biomass feedstock, offers carbon savings of around 90% compared with conventional fossil kerosene, and would not require any engine modification. However, the PRESAV study calculated that the cost of synthetic

80 Written evidence from Professor Bridgwater (Biosciences Federation and the Royal Society of Chemistry) [not printed]

81 Communication from the European Commission *Reducing the Climate Change Impact of Aviation*, COM (2005) 459 final, 27.9.05

82 House of Commons Environment, Food and Rural Affairs Committee, Ninth Report of Session 2004–05, *Climate change: looking forward,* HC 130, April 2005

83 UK Tyndall Centre for Climate Change Research, *Growth Scenarios for EU & UK aviation* and *Decarbonising the UK: energy for a climate conscious future* 2005

kerosene ranged between $5 and $35 per unit of energy, compared with the established cost of around $5 per unit for conventional kerosene in 2003.[84]

68. There is a substantial degree of resistance to the idea of using synthetic kerosene in aviation. According to figures from Rolls-Royce, aviation accounts for only 12% of all fossil fuel consumption by the transport sector whilst road transport accounts for 75%. Rolls-Royce also raises concerns about the use of alternative fuels for aviation due to "safety, energy density, cost, global availability and environmental impact", arguing that biofuels for aviation are "unrealistic in the short and medium term".[85] On our visit to Washington DC, we heard from Boeing that research into hydrogen, ethanol and soy had yet to deliver a viable bioenergy alternative to kerosene.

69. Rolls-Royce argues that "it is unclear whether the impact of alternative fuelled aircraft … would be better (or worse) than kerosene fuelled aircraft".[86] However, chemically-identical synthetic kerosene could be produced from biomass using the Fischer-Tropsch process. Synthetic kerosene from a coal feedstock is already being manufactured by Sasol in South Africa, and has been approved for use by Rolls-Royce at a 50% mix with conventional kerosene. As the synthetic kerosene can be tailored to meet particular specifications, it could be designed to produce fewer particulates than conventional Jet A1 fuel.

70. While biodiesel blends have a lower energy content than fossil fuel equivalents, thus requiring a greater volume of fuel—a significant consideration for aviation—the density of second generation biofuels could be increased, rendering them comparable to conventional aviation fuels in terms of energy output by fuel volume.[87] Rolls-Royce acknowledges that any organic material could be used as the feedstock and that "the use of this fuel will become increasingly attractive if the price of oil remains at a high level".[88]

71. Both Shell and Rolls-Royce voiced concerns over fuel standards. They emphasised that safety was of paramount importance; in this respect we heard that it was essential that the same high specification of fuel was available at all destinations. Shell and Rolls-Royce also pointed out that jet fuel specifications are subject to international agreements, which could complicate the process of introducing an alternative fuel.[89]

72. **Although we recognise the valid safety concerns raised by witnesses regarding second generation aviation fuels, we note that synthetic kerosene is already being used in aircraft departing from Johannesburg. We are puzzled as to why the Government does not appear to be pursuing the option of second generation Fischer-Tropsch kerosene—as used in South Africa—to deal with the rapidly growing climate impact of aviation. If a biomass-derived process for producing synthetic kerosene can be made**

84 Imperial College, London, *The Potential for Renewable Energy Sources in Aviation*, August 2003

85 Rolls-Royce informal briefing paper on Aircraft Emissions, October 2005

86 Ev 140

87 Q 389

88 Ev 140, Q 384

89 Qq 311, 381

economically viable, the UK Government must support its development. We recommend that the Government take immediate steps to investigate the economic viability of using biomass as the feedstock for synthetic kerosene.

Biogas

Biogas for transport

73. Gasification is the breakdown of organic material at high temperatures in an oxygen-restricted environment to produce a mixture of combustible gases. Gasification of biomass can be used to generate power in engines and turbines. The Biosciences Federation and Royal Society of Chemistry (RSC) suggest that utilising landfill gas and the energy potential of waste in microgeneration schemes merit "immediate consideration" although they note that "larger projects are unlikely to gain sufficient capital in the current investment climate in addition to compromising optimal carbon dioxide savings by sourcing material from wide catchment areas".[90] Landfill sites constitute one of the main sources of methane in the UK.[91] Methane, also the main component of natural gas, is a greenhouse gas some 21 times more powerful than carbon dioxide.[92]

74. According to the Energy Saving Trust "all the usable biogas [currently] generated in the UK is used to substitute for natural gas in local households". Several of the organisations who submitted evidence to us are generally supportive of biogas as a renewable transport fuel; the Energy Saving Trust, for example, describes it as an "untapped resource" in this respect.[93] The Trust suggests that biogas can offer life-cycle CO_2 savings of around 95% compared to conventional fossil diesel, although it also points out that the savings may actually be greater than this estimate because capture of the waste gas prevents the emission of methane into the atmosphere.[94]

75. In Sweden some biogas-fuelled bus fleets are already in operation. However, evidence we received suggests that using biogas as a transport fuel may not be as efficient as using liquid biofuels, owing to additional infrastructure requirements.[95] To use gas as a transport fuel the gas must be compressed, with vehicles in turn requiring modifications to be able to run on compressed gaseous fuel. Consequently, biogas-fuelled vehicles are more expensive to purchase than conventionally fuelled vehicles.[96] Ford raised concerns about the "far greater infrastructure challenge" posed by biogas in comparison with bioethanol or

90 Ev 92

91 Written answers, 25 Jan 2006 : Col 2115W

92 Environment Agency, *UK Emissions of greenhouse gases;* www.environment-agency.gov.uk

93 Ev 208

94 Energy Saving Trust, http://www.est.org.uk/fleet/Vehicles/Alternativefuels/Biogas/

95 Ev 92 [Biosciences Federation and the Royal Society of Chemistry]

96 Energy Saving Trust, www.est.org.uk/fleet/Vehicles/Alternativefuels/Biogas/

biodiesel.[97] The NFU told us that it was "a pain in the neck to find a petrol station to fill it [an LPG car] up".[98]

76. The Government is supporting a pilot project which will facilitate the capture and storage of landfill gas to be used to power Local Authority vehicles in Albury, Surrey, as part of the 'Green Fuels Challenge'.[99]

77. **We recognise the carbon saving potential of biogas as a transport fuel, but acknowledge that the necessary adjustments to transport infrastructure represent an obstacle to biogas uptake. We note the Government's acknowledgement of the need to assess the feasibility of using biogas as an alternative to diesel and welcome the Government's Surrey-based pilot project to examine the use of landfill gas as a transport fuel. We recommend that a feasibility study be undertaken in time for the results to contribute to the Government's Biomass Strategy, expected in the coming year.**

Anaerobic digestion

78. The Biomass Task Force Report highlights other options for using waste as a source of renewable energy. The implications of using waste as a source of bioenergy are discussed in greater detail below at paragraph 103. Using anaerobic digestion to generate energy from organic waste is one such option. In addition to burning dry biomass directly in a boiler or in a Combined Heat and Power plant, anaerobic digestion provides the opportunity to use 'wet' biomass such as livestock slurries, sewage sludge and food wastes. Those members of the Committee who visited China heard about projects for developing biogas production there, particularly in rural areas.

79. Anaerobic digestion (AD) is the breakdown of organic matter by micro-organisms to produce biogas—comprising 40% CO_2 and 60% methane—as well as liquid and solid by-products (digestate). The methane and solid digestate can be used to generate heat and electricity. The remaining liquid digestate can be used as fertiliser.[100]

80. According to the Natural Gas Vehicle Association (NGVA), "the most versatile process for converting biomass to a biofuel is anaerobic digestion as it produces bio-methane which is equally suitable as a vehicle fuel, a source of heating, or to create electricity."[101] The carbon saving potential of using anaerobic digestion as an energy source was highlighted by English Nature:

> some forms of bioenergy can be carbon-neutral or even carbon-negative – for example anaerobic digestion of organic wastes may approach or even exceed 100% GHG saving due to avoided landfill emissions of methane.[102]

97 Ev 137

98 Q 18

99 HM Treasury, *2005 Pre-Budget Report*, Cm 6701, para 7.58, December 2005

100 Biomass Task Force, *Report to Government*, October 2005

101 Ev 225

102 Ev 112

81. Concerns have been raised, however, about the danger of methane leaking from AD systems, as well as the production of additional methane from the solid and liquid digestate (which will continue to break down once it has been spread on the land).

82. The Biomass Task Force noted that some earlier-stage AD technologies were potentially less efficient than others, and that care should be taken to invest in newer, more efficient technologies as they become available.[103] The Biomass Task Force recommended that the Government review its current strategy for the anaerobic digestion of 'wet' biomass, and conduct an economic and environmental assessment of the potential for biogas as a renewable alternative to diesel.[104]

83. In its response to the Biomass Task Force report, the Government agreed to "renew [its] approach to anaerobic digestion … to identify the optimum systems for biogas production and methane mitigation … and the assessment of the feasibility of using AD biogas as an alternative to diesel".[105]

84. **We recognise the potential of anaerobic digestion significantly to increase the use of waste as a source of renewable energy. We reiterate the point made by the Biomass Task Force that care must be taken in selecting the most efficient anaerobic digestion technologies. We note that the Government has committed to reviewing its current approach to anaerobic digestion by April 2007. This is too late. Defra's current review of the Waste Strategy—which is due to be published later this year—provides a more suitable opportunity to fulfil this commitment and we recommend that the Government use the review to bring forward all of its work in this area.**

4 Land use

Overview

85. In this section we explore the resource implications of bioenergy generation in the UK. Again, these implications are difficult to quantify: some of those who submitted evidence to our inquiry used different data in different ways in support of opposing arguments. There is compelling evidence that using biomass crops to generate heat or electricity renders up significantly greater carbon savings per hectare than using land to grow crops for transport fuel. But we learned of key concerns about the cost of bioenergy in terms of the impact of growing energy crops on biodiversity and food security. These concerns preclude any straightforward choice of one source of bioenergy over another.

Domestic biomass production

86. UKPIA cites figures which show that the amount of CO_2 saved per hectare is considerably greater for biomass (either single-rotation coppice or miscanthus) used to

103 Q 196

104 Biomass Task Force, *Report to Government*, October 2005

105 DTI and Defra, *The Government's Response to the Biomass Task Force Report*, April 2006

generate heat or electricity, than it is for either bioethanol or biodiesel. This is the basis for UKPIA's argument that producing liquid transport fuels is "not the best use of land in terms of reducing CO_2 emissions" and that using the land to grow biomass crops for heat and electricity generation would be more effective.[106] The Carbon Trust, the Biosciences Federation and the Royal Society of Chemistry provide further evidence in support of this stance.[107]

87. Sheffield Hallam University and the Low Carbon Vehicle Partnership have shown that the greatest percentage carbon savings are gained through the gasification of biomass to produce electricity, and the burning of woodchip to generate heat.[108]

88. Evidence from the Biosciences Federation and the Royal Society of Chemistry (RSC) categorically states that "Electricity or heat from short rotation coppice provides between three and six times the CO_2 reduction per pound that can be obtained from … bioethanol from cereal crops".[109] Later in this section we note other factors that have to be taken into account when making a choice between biomass and biofuels.

Domestic biofuel production

89. The Government has announced a Renewable Transport Fuel Obligation (RTFO) which requires transport fuel suppliers to ensure that by 2008–09, 2.5% of their sales come from renewable transport fuels. This target proportion is to increase to 3.75% in 2009–10 in order to achieve a renewable contribution of 5% by 2010–11, loosely in line with the EU Biofuels Directive.[110] We discuss the RTFO in detail below at paragraph 135.

90. Defra—supported by the NFU and the Biosciences Federation—claims that the UK could meet the 5% Renewable Transport Fuel Obligation target solely through domestic production. It states that "the UK has the land capacity to supply 5% of road fuels today … by 2050 the UK could produce as much as one third of its transport energy needs" from renewable sources.[111]

91. The NFU also argues that, for biodiesel in particular, the 5% RTFO target for 2010 is well within the current capacity of domestic production:

> Diesel consumption estimates for 2010 suggest the requirement would be 1.15–1.35 billion litres. If this were to be produced solely from oilseed rape (OSR) this would require 2.4–2.8 million tonnes (680–800,000ha). Current UK OSR area of 557,000ha and set-aside area of 560,000ha could easily provide this.[112]

106 Ev 57

107 Carbon Trust, *Biomass sector review for the Carbon Trust*, October 2005; Ev 90–91

108 See table 2, pg 20

109 Ev 91

110 Defra, *Climate Change: The UK Programme 2006*, Cm 6764. March 2006

111 Ev 152

112 Ev 2

92. UK farmers are used to growing traditional annual crops such as wheat, sugar beet and oilseed rape. The UK is a net exporter of some 2.5–3 million tonnes of wheat every year.[113] As these crops are also used as feedstock for the biofuel industry, the NFU argues that UK farmers are ideally placed to provide energy crops, without any need to acquire new specialist machinery, skills or knowledge.[114]

93. The UK is currently lagging behind some other EU countries in biofuel production, only managing to make up around 0.24% of its fuel supply from biofuels.[115] Arguing that the UK is not optimising its potential as a biofuels producer, British Sugar cites Defra's own figures:

> the UK has a total of 5.8 million hectares of land under arable production, with an additional 0.6 million hectares under set-aside. If just 10% of this combined total were reserved for energy crops, (a reasonable long-term target) then an additional 640,000 hectares could be made available, generating another 2 million tonnes of bioethanol.[116]

94. A recent Committee visit to the Organisation for Economic Co-operation and Development (OECD) in Paris highlighted the considerable resource implications of a substantial commitment to 'first generation' fuel from energy crops. The OECD estimates that, in order for first generation biofuels to provide 10% of the fuel, only 3% of the area in southern countries such as Brazil would be required. But in most OECD countries around 30–50% of the available crop area would be needed.[117] This suggests that there may be serious global land-use implications if the Government increases the 5% RTFO target and expects first generation biofuels to meet the increasing demand.

Biodiversity

95. In addition to the potential carbon savings from energy crops, there are other sustainability and environmental considerations to be taken into account in making a decision on the most appropriate source of bioenergy; biodiversity a key factor. English Nature states that uncropped set-aside land supports a greater degree of biodiversity than intensively cropped arable land. It expresses concern that increased use of set-aside land for domestic biofuel production could result in loss of biodiversity. English Nature goes on to say that biomass crops such as short-rotation coppice willow show higher levels of biodiversity in comparison with intensive arable and grassland crops.[118] This argument is supported by the RSPB, although the RSPB acknowledges that little is known about the impact on biodiversity of other biomass crops such as miscanthus and switchgrass.[119]

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113 Ev 15 [NFU]

114 Ev 2

115 Department for Transport, *Promotion and Use of Biofuels in the United Kingdom*, report to the European Commission, June 2006

116 Ev 219

117 OECD presentation to the Committee, *Agricultural Market Impacts of Increased Biofuel Production*, 20th June 2006

118 Ev 113

119 Ev 213

96. Despite the clear advantages of short rotation coppice (SRC), both in terms of carbon savings and biodiversity implications, the NFU, Biosciences Federation and Royal Society of Chemistry all point out that SRC is less favourable from a financial perspective, being costly to establish and providing no output for the first four years.[120]

97. English Nature concludes that increasing energy crop production would have a significant effect on UK land use, and that the possible environmental impacts of this—such as biodiversity loss, and increases in pesticide and nutrient consumption—need to be considered before any programme of expansion is developed.[121]

Food security

98. Another important consideration in any discussion of the comparative merits of different sources of bioenergy is the impact of converting agricultural land in the UK from food to energy crop production. The Food and Drink Federation raises concerns that financial incentives to encourage the development of biofuel production could adversely affect the food industry by "indirectly disrupt[ing] agricultural commodity markets", leading to shortages of agricultural raw materials and increased costs for UK food manufacturers.[122] These concerns are reinforced by the Margarine & Spreads Association, whose main edible oil feedstocks, such as oilseed rape, are the same feedstocks used by biodiesel producers. The Association puts the other side of the argument advanced by the NFU (see above at paragraph 91): producing enough biodiesel to meet the 5% target set by the RTFO would result in a shortfall in supply, so driving up prices and consequently increasing imports.[123]

99. The Margarine & Spreads Association cites research which suggests that there is insufficient set-aside land available in the EU to meet the RTFO target through domestic production. Consequently, if the target is to be met through internal production, some arable land currently used for food production would have to be used to grow energy crops.[124]

100. The NFU admits that meeting the 5% RTFO target for biodiesel inclusion through domestic production will have an impact on the supply of oil-seed rape currently available for food production. However, it states that:

> Production of food crops will not be adversely affected; movement into energy cropping will remove some of the UK's exportable surplus and will help to create a more balanced market. The crops used for biofuels are mainly dual purpose and so can be used for fuel or food.[125]

120 Ev 15–16, 92

121 Q 258

122 Ev 222

123 Ev 233

124 Ev 233

125 Ev 4

101. The advantages of 'dual-functionality' of crops—whereby a single crop could provide both food and biomass—were highlighted in submissions to our inquiry. The Renewable Energy Association told us that "in general food crops are no more than 50% efficient, in that for every tonne of food produced a further tonne of potential biomass is produced".[126]

102. As noted in paragraphs 55–57 above, second generation biofuels such as the ligno-cellulosic ethanol produced by Iogen, and the Biomass-to-Liquid Fischer-Tropsch transport fuels, can use waste organic materials such as straw and woody waste. Consequently **we conclude that second generation biofuel production is less likely to have the same impact on world commodity markets as first generation biofuel production, which competes with the food industry for corn and oil feedstocks, further pointing to the desirability of investing in the necessary technologies.**[127]

Energy from waste

103. Organic material such as waste vegetable oils from the food industry, forestry thinnings, brash, arboricultural arisings from landscape maintenance and sawdust all constitute potential sources of biomass for heat and electricity generation. The Biomass Task Force estimates that in 2004, of the total 5–6 million tonnes (Mt) of wood waste generated, only 1.4 Mt was recovered. The Task Force report argues that a further 1.5 Mt of high quality wood waste and approximately 2–3 Mt of contaminated wood waste could also be recovered, which could generate up to 8.5 terawatt hours (TWh) of heat, equivalent to approximately 1% of the total UK heat demand.[128] This could save 0.85 Mt carbon.[129] The Task Force told us that one of the most significant findings to emerge from its extensive study was the ready availability, as a source of biomass, of at least three million tonnes of wood waste which currently goes into landfill.[130]

104. The Government provides a more conservative estimate, claiming that only 0.7 million tonnes of woodfuel a year could be provided "without serious disruption to existing wood-using industries", leading to carbon savings of 0.25 MtC. According to the Government's Climate Change Programme 2006, a great many woodlands are currently overstocked and are not being actively managed. The Government claims that:

> If barriers to active management were removed, up to an additional one million dry tonnes per annum of woodfuel could be sourced from existing English woodland between now and 2020, corresponding to savings of 0.12 MtC in 2010 and 0.4 MtC in 2020.[131]

105. Several contributors to our inquiry emphasise that large amounts of organic waste material suitable for use as an energy source are being sent to landfill. English Nature cites

126 Ev 17

127 Q 301 [Shell]

128 Calculated using figures from Future Energy Solutions from AEA Technology *Renewable Heat and Heat from Combined Heat and Power Plants – Study and Analysis*, 2005; total UK heat demand = 737.5 TWh_{th}/y

129 Biomass Task Force, *Report to Government*, October 2005

130 Q 192

131 Defra, *Climate Change: The UK Programme 2006*, Cm 6764. March 2006

research from 2003 which estimates that waste oils from the food industry could be used to produce around 100,000 tonnes of biodiesel, effectively replacing 90,000 hectares of oilseed rape.[132] As the Environment Agency argues, using waste material as a source of bioenergy also diverts the waste away from landfill or incineration, and so bioenergy from waste could play a key role in a sustainable waste strategy.[133] Sir Ben Gill illustrated the point:

> it is just plain crass stupid the way we use our raw materials. We waste as much heat as we could use. We make the point in here in terms of reclaimed timber; we are currently putting into landfill four to five million tonnes per annum. That is the equivalent to the output from half a million hectares of land that we are putting into landfill … This needs to change.[134]

106. Inetec, a company based in Bridgend, Wales, provides on-site technology to enable industrial-scale food producers to convert food waste into heat and electricity. Inetec highlights a number of barriers to the commercialisation of their technology. Concerns about planning and permitting, including the length of time required to gain planning permission, are cited as key barriers.[135] These are discussed in greater detail in our recent report on the Environment Agency.[136]

107. Other barriers to the use of waste as a source of bioenergy include a "lack of awareness, few secure supply chains, perceived risk and a lack of skilled engineers" as well as the classification of potential sources of bioenergy as 'waste', which Scottish Renewables describes as "the biggest 'own goal' to have yet been scored by Government". [137]

108. **It was made clear to us that organic waste material—much of which currently goes to landfill—represents an untapped source of energy. We support the work of the Biomass Task Force and its leader Sir Ben Gill in highlighting the energy potential of waste, and trust that this line of thinking will be fully integrated into the Government's forthcoming new strategy for waste. We see the generation of heat and electricity as an important part of any effective waste strategy. The contribution of waste to energy production could be substantial. However, this should be made alongside, and not instead of, efforts in other areas.**

General conclusions on land use

109. The UK's wheat surplus is currently exported (see paragraph 92 above). According to the Biosciences Federation and the Royal Society of Chemistry, the UK could meet the 5% RTFO target solely through domestic production by using this surplus to produce bioethanol, and by growing oilseed rape on all UK set-aside land to produce biodiesel.[138]

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132 Ev 112

133 Ev 230

134 Q 164

135 Ev 250

136 Environment, Food and Rural Affairs Committee, Seventh Report of Session 2005–06, *The Environment Agency*, HC 780, May 2006

137 Ev 218

138 Ev 91

This is supported by the NFU.[139] The Biosciences Federation and the Royal Society of Chemistry go on to say, however, that ultimately "UK capacity to produce biofuels is limited to 5–10% of the total transport fuel demand". They maintain that the 'best use' of land in terms of carbon savings is in growing crops for heat and electricity generation rather than for transport fuel.[140] As Dr Woods (representing the Biosciences Federation and the Royal Society of Chemistry) explained, emissions from the transport sector need to be addressed in the short term, and biofuels are currently the only available means to do so. However, in terms of the bioenergy mix, he stated that:

> … it is really too early to start picking between the sectors and to say, yes, we should in effect abandon one of the sectors in preference for the other. … at the moment we are not anywhere near the limits of the resources … .[141]

110. This stance is supported by Graham Hilton from the Energy Crops Company, who argued that extracting biofuels and biomass from the same crop was a distinct possibility:

> The first is that it is not either or; there is actually a very heavy interplay between the two. For instance, there is a significant amount of straw generated by growing wheat for bio-ethanol, and the varieties of wheat that produce the highest starch and therefore the highest alcohol yield also have the longest straw, also have the lowest nitrogen fertiliser input, so there is a real win-win available in this.[142]

111. The NFU concludes in its supplementary evidence that the "synergy between biomass crops and other renewables such as biofuels has yet to be fully explored in this country. These two markets should not be viewed as competing uses but as complementary parts of the renewable energy package".[143]

112. Defra acknowledges the complex relationship between the costs and benefits of prioritising one source of bioenergy over another:

> it is recognised that if you take the comparisons in terms of the given amount of land that you have available for use for either of these purposes, the consensus would be that using the land to produce biomass for energy generation, and in particular heat, is significantly better than using the same amount of land for biofuel. … [but] it is necessary … to consider the state of development … the potential uptake and the results of using different types of policy mechanisms … the RTFO in the transport sector will have … an immediate and dramatic effect across the economy.[144]

113. **Questions over land use are at the heart of bioenergy policy. We are concerned by the implications of the Government's claim that "by 2050 the UK could produce as much as one third of its transport energy needs" from renewable sources. We**

139 Ev 2

140 Ev 90

141 Qq 212, 219

142 Q 89

143 Ev 16

144 Q 465

recommend that the Government make clear in its response to our report the evidence—and assumptions made in relation to land use—to support this claim. Biofuels for transport currently offer an important way to reduce carbon emissions from the growing transport sector, but increased production may have an adverse effect on food production and biodiversity. If the Government goes ahead with the increase in the Renewable Transport Fuel Obligation beyond 5%, as proposed in the Energy Review, there may be serious UK land use implications. Exploiting the 'dual-functionality' of crops to provide both food and bioenergy may go some way to mitigating this.

114. **Biomass crops used for heat and electricity can have a positive impact on biodiversity, and offer greater carbon savings per hectare, but in the case of short rotation coppice, are costly to establish and yield no output for four years. They therefore require considerable investor confidence. Whilst we recognise that the complex matrix of advantages and disadvantages relating to the various uses of arable land precludes any simple choice between sources, the Government must act now to help reconcile and rationalise these apparent inconsistencies in order to maximise carbon savings.**

5 Government policy on bioenergy

Overview

115. We acknowledge in our analysis of Government policy on bioenergy that there are no easy choices: although early appraisals of new production techniques indicate that these advanced technologies render much greater carbon savings at lower cost in terms of capital and land use, we cannot afford to delay taking other action to tackle climate change while researching such techniques further. We were disappointed to find that despite a growing sense of urgency, the effect of Government support for attempts to harness the bioenergy technology that is commercially available today, is diluted by delivery through a disparate set of piecemeal incentives, allowances and grants schemes, and by a lack of cross-Government focus. At the same time, **Government policy does not leave room for newer, more efficient technologies to develop and become commercially viable because it does not link incentives to carbon savings. We recommend that the Government begin to remedy this initially in implementing the Renewable Transport Fuel Obligation.**

116. There is a wide range of Government schemes to provide support for bioenergy. Some of the main instruments are discussed below (see also the Annex to this Report).

Biomass support schemes

117. One of the most striking features of the evidence we received in this inquiry was the concern expressed at what was perceived to be a distinct lack of recognition of the potential of the renewable heat sector and at the level of confusion surrounding the apparent multiplicity of biomass support schemes. According to Defra's evidence, there are some

eight support schemes for biomass alone. In terms of renewable heat, the Biomass Task Force Report describes the Government's approach as "no targets; no concerted policy; no strategy; and, limited support for development".[145]

Renewable Heat Obligation

RO—Renewables Obligation

The RO was introduced in 2000 and defines the amount of electricity energy suppliers must provide from renewable sources of energy. The original target was 10.4% by 2010–11 but the Government announced in December 2003 that the RO would be extended, with a new target of 15% of electricity to come from renewables by 2015.

ROCs—Renewables Obligation Certificates

ROCs tie in with the RO (see above). Compliance with the RO is demonstrated by presenting ROCs to Ofgem (the Gas and Electricity Markets Authority). ROCs are issued to accredited generators for eligible renewable electricity generated within the UK (including its territorial waters and Continental Shelf), and supplied to customers in Great Britain. They can be traded to allow electricity suppliers to meet their targets at the lowest cost.

118. Current renewables targets focus mainly on the generation of electricity, and not on the production of heat. However, according to the Biomass Task Force, energy consumption in the UK divides almost equally into one third electricity, one third transport, and one third heat. Only around 1% of this heat is generated from renewable sources, with a further 8% coming from combined heat and power (CHP) systems.

119. The Royal Commission on Environmental Pollution, in its 2004 report *Biomass as a Renewable Energy Source*, was supportive of a Renewable Heat Obligation akin to the existing Renewables Obligation (RO) for renewable electricity. After the publication of this report, Defra and DTI commissioned an analysis of the market for renewable heat and the potential carbon savings associated with it. This analysis concluded that the Government should consider support mechanisms similar to the RO, as well as capital grant schemes.[146]

120. Conversely, the Biomass Task Force, while strongly supportive of a single capital grant scheme for biomass heating boilers and the heat element of CHP biomass-fuelled plants, concluded that a renewable heat obligation would be "unworkable". This was because the obligation would rest with "a supplier who had no control over the many, varied and often small users and producers of heat". The Task Force was also concerned that, given the

145 Biomass Task Force, *Report to Government*, October 2005

146 Future Energy Solutions from AEA Technology, *Renewable Heat and Heat from Combined Heat and Power Plants – Study and Analysis*, September 2005

urgency with which climate change must be addressed, such an obligation would take too long to prepare and implement.[147]

121. Media coverage of the Task Force Report highlighted the feeling of disappointment amongst farm leaders at the omission of a Renewable Heat Obligation (RHO). The farming industry was reported as seeing an RHO as "the stick required to get the biomass industry going".[148]

122. The Energy Crops Company supports the Biomass Task Force's stance on a Renewable Heat Obligation, citing the fragmented nature of the delivery of heat; the Company argues that the correct support mechanisms for renewable heat are "a combination of duty concession and obligation for Biofuels, and capital infrastructure grants for biomass". Graham Hilton from the Company told us that "the other reason I am not sure it is entirely necessary … is that we believe biomass heating can be cost competitive."[149]

123. The Biomass Task Force report acknowledges the fact that, owing to the limited time available, it was unable to carry out a detailed feasibility analysis of a Renewable Heat Obligation.[150] The Renewable Energy Association (REA) told us that it was keen that an analysis of a Renewable Heat Obligation be carried out. "Our big concern at the moment is that the Royal Commission certainly did not do any research, the Biomass Task Force did not do any research, the Defra/DTI joint report … did not do any research, so we are dismissing this without the intellectual capital or time to assess whether it could work or not".[151]

124. The Government's response to the Biomass Task Force report notes the Task Force's recommendation that a renewable heat obligation should not be pursued, and states that the Government will instead look at other support mechanisms.[152] However, Defra told us that it would keep the prospect of a Renewable Heat Obligation "under review".[153]

125. **We are pleased that Defra is keeping the prospect of a Renewable Heat Obligation under review: this option should not be ruled out altogether without further consideration. We recommend that Defra undertake a full analysis of such an Obligation, but emphasise that such an analysis should not be the cause of any delay to other Government measures in support of biomass heat.**

Bio-energy Capital Grants Scheme

126. The Bio-energy Capital Grants Scheme is a UK-wide programme to provide grant funding to project developers and organisations investing in biomass-fuelled electricity or

147 Biomass Task Force, *Report to Government*, October 2005; Q 170

148 *Farmers Weekly*, "Unearthing the biomass benefits", 4 November 2005

149 Ev 45, Q 101

150 Biomass Task Force, *Report to Government*, October 2005

151 Q 64

152 DTI and Defra, *The Government's Response to the Biomass Task Force Report*, April 2006

153 Q 555

heat generating technologies. A total of £66 million was made available, to be committed by March 2006 and spent by March 2010. Of this, £30 million was made available by DTI to encourage the efficient use of biomass—particularly energy crops—for energy production by stimulating the early deployment of biomass fuelled heat and electricity generation projects. The New Opportunities Fund also provided some £33 million for energy crops power generation and at least £3 million for small-scale biomass/Combined Heat and Power (CHP) projects. A further round of the scheme—focussing on biomass heat and CHP—was announced in April 2006. A minimum of £2 million will be made available for new projects.[154]

127. In the recently published UK Climate Change Programme 2006, the Government announced that it would build on the new round of the Bioenergy Capital Grant Scheme by "introduc[ing] a support scheme for biomass heat in the industrial, commercial and community sectors. The scheme will run for five years and will be worth at least £10–£15m in England over the next 2 years. … in developing the scheme, account will be taken of the recommendations of the Biomass Task Force on how the support can best be delivered".

128. The Biomass Task Force strongly supports a single capital grant scheme for biomass heating boilers and the heat element of CHP biomass-fuelled plants. But the Renewable Energy Association expressed concerns about the possibility of a series of short-term capital grants, which, it asserted, would foster uncertainty within the industry: "We do not have a track record of the Treasury supporting long-term capital grant support."[155]

Energy Crops Scheme

129. In 2000 the Government introduced the Energy Crops Scheme to provide establishment grants for short-rotation coppice (SRC) and miscanthus, and aid to help SRC growers to set up producer groups. The scheme, which provides £17.9 million over six years, is still open for establishment grants but closed to producer groups on 30 June 2006. Establishment grants are one-off payments of between £920–1000 per hectare (depending on the crop) to help cover the costs of buying, planting and maintaining the crops during their first year. Producer groups are established groups of SRC growers who "work together to harvest their crops and supply them, after processing and storage if necessary, to one or more energy end-uses". Only growers of SRC are eligible under the producer groups section of the scheme. The scheme is being closed as part of Defra's Rural Strategy 2004.[156] Under the EU Rural Development Regulation, the Government is consulting on further measures which will apply from 2007.[157]

Barriers to biomass heat

130. Sir Ben Gill, leader of the Biomass Task Force, told us that:

154 DTI and Defra, *The Government's Response to the Biomass Task Force Report*, April 2006

155 Q 64

156 Defra: http://www.defra.gov.uk/erdp/schemes/energy/default.htm

157 Defra, *Climate change: the UK Programme 2006*, March 2006

> the key element of all that came out of our work: the lack of coordination, the lack of understanding, and, when I do presentations I use one word, "ignorance"—ignorance not to be confused with ignorant, the pejorative meaning of it, but ignorance (which in the OED means lack of knowledge or awareness) about where we are in regard to all these issues. Irrespective of all these grants, which confuse people as to what they should apply for, some are switched on, some are switched off, some come from different bodies that will interlink and some do not, there is a confusion of advice, which is quite frightening, and there is confusion amongst the experts in the industry.[158]

131. The Minister of State sympathised with Sir Ben's frustration at the degree of ignorance surrounding biomass, and conceded that "we are still very much early days in terms of trying to promote biomass".[159]

132. In the Foreword to the Government's response to the Biomass Task Force Report, the Secretaries of State for Defra and DTI acknowledge that the contribution from biomass in terms of carbon savings "can be very significant" and state that the Government's response sets out "plans for moving forward towards optimum use of this resource". According to the UK Climate Change Programme 2006, however, the new subsidy for biomass heat is predicted to save 0.1 MtC in 2010, as is the strategy for non-food crops, whereas the Renewable Transport Fuel Obligation is predicted to save 1.6 MtC.[160]

133. The REA is concerned that "Government has recognised neither the potential scale nor the immediacy of the opportunity presented by biomass heat, and as a consequence has not sought to reinforce these growth prospects with adequate levels of grant funding."[161] In its response to the Biomass Task Force report, the Government announced its intention to publish a fuller Biomass Strategy within the coming year that proposes to take account of other Government consultations such as the Energy Review.

134. **Biomass heat has great potential to generate significant carbon savings. But we do not believe that the Government has properly positioned itself to exploit this potential. The Government must also quantify what it means by the "optimum use" of biomass. Despite the Government's acknowledgement that the contribution from biomass "can be very significant", we note that the Renewable Transport Fuel Obligation is predicted to save 16 times more carbon than the new subsidy for biomass heat. The Government should publish the evidence base—including the basis for its calculation of the carbon savings anticipated to be made from the RTFO—for its current policies. We recommend that financial and policy support for biomass-derived heat be increased to a level that ensures associated carbon savings are at least on a par with those anticipated from the Renewable Transport Fuel Obligation. We further recommend that the Government take the opportunity provided by its long-term Biomass Strategy to make these changes.**

158 Q 154

159 Q 548

160 Defra, *Climate Change: The UK Programme 2006*, Cm 6764. March 2006

161 Ev 34

Renewable Transport Fuel Obligation (RTFO)

135. The Renewable Transport Fuel Obligation (RTFO), which was announced in November 2005, will require fuel providers to meet targets for biofuels sales or buy certificates to make up any shortfall. The UK target, as set down by the RTFO, is that by 2010 biofuels should constitute 5% (by volume) of the total road fuels supply. The RTFO will be introduced in 2008–09 with the level of obligation starting at 2.5%, rising to 3.75% in 2009–10, reaching the target level of 5% in 2010–11.

136. The Government claims that meeting the 5% target will result in a reduction in emissions of over 1 million tonnes of carbon (MtC) a year, a figure which represents more than 2.5% of total road transport emissions, equivalent to taking one million cars off the road.[162] In February 2006 Stephen Ladyman, Minister of State for Transport, said "We have to look at increasing the proportion to far more than 5 per cent after 2010".[163] However as HM Treasury makes clear, any increase beyond 5% is subject to the European Commission changing EU fuel quality standards.[164] We discuss this in more detail below at paragraph 194. The UK is currently only managing to make up around 0.24% of its total fuel supply from biofuels.[165]

137. The RTFO target of 5% *by volume* falls short of the EU Biofuels Directive indicative target for 2010 of 5.75% *by energy* content.[166] 'Inclusion levels' of biofuels can refer either to the volume of conventional fossil fuel that has been replaced by biofuels, or to the proportion of energy of the fuel that is provided by biofuels. One litre of biofuel contains less energy than one litre of conventional fossil fuel. Therefore, to achieve a 5.75% inclusion by *energy* content for bioethanol—as recommended by the Biofuels Directive—approximately 9% inclusion by *volume* would be required.

138. Much of the evidence we received indicated that in general terms the RTFO has met with approval. Concerns were raised, however, about the duration of the Obligation, with several witnesses suggesting that the current timescale is too short to inspire the level of investor confidence required to establish the necessary infrastructure for a viable biofuels industry.[167] The Energy Crops Company maintains that the RTFO targets—whilst they represent a good "first step"—are "unambitious", and argues that the Government should extend the Obligation beyond 2010.[168] Shell explained that:

> you have to take a 25-year view on its economics and its lifetime, and if the financial incentives for the product disappear after three years and you are left with a product

162 Ev 155

163 *The Times* "Drive one of these? You're crass and irresponsible, says minister on warpath", 27 February 2006

164 Q 423

165 Department for Transport, *Promotion and Use of Biofuels in the United Kingdom,* report to the European Commission, June 2006

166 The Biofuels Directive requires Member States to set national indicative targets in line with a recommended target of 2% inclusion of biofuel within transport fuels by December 2005, increasing to 5.75% by 2010. This is determined by energy content, rather than by volume. Accordingly, 5.75% by energy content equates to approximately 9% by volume for bioethanol. The Directive does not stipulate directly what the national indicative targets should be.

167 Qq 13, 205 [NFU, Dr Woods]

168 Qq 76, 115

that costs more to produce than conventional gasoline, then the business case for that investment is hard to substantiate[169]

139. An official from Defra told us that, by virtue of the fact that the RTFO will be applicable to all road transport, it offers a mechanism for incentivising uptake of biofuels by which a "dramatic step change in market penetration" can be achieved; he noted that no similar mechanism is currently available for biomass heating.[170] Volkswagen also highlighted market penetration as a serious consideration in any decision on new technology: "the greatest CO_2 benefit to the environment from using biofuels or other CO_2 reduction technology is accrued when the largest numbers of vehicles in the vehicle fleet are using them".[171]

140. Recent announcements in the Energy Review suggest that the Government is considering increasing the RTFO to 10% by 2015, subject to "three critical factors" being met:

- development of robust sustainability and carbon standards for biofuels to ensure that they are delivering high levels of carbon savings without leading to biodiversity loss or endangering sensitive habitats;
- development of new fuel quality standards at EU level to ensure existing and new vehicles can run on biofuel blends higher than 5%; and
- costs to consumers being acceptable.

The Review claims that this will "save a further million tonnes of carbon a year, equivalent to taking another million cars from our roads", effectively doubling the carbon savings anticipated from achieving the 5% target by 2010.[172] The Energy Review does not set out the assumptions and evidence base underpinning this conclusion. However, it implies that the Government is not expecting to achieve greater carbon savings from biofuels in 2015 than in 2010, suggesting that it does not anticipate a move to, for example, second generation biofuels before 2015.

141. **We note that the 2010 Renewable Transport Fuel Obligation target of 5% biofuel inclusion *by volume* falls far short of the indicative target of 5.75% *by energy* as set down by the EU Biofuels Directive. We support the recent announcement made in the Energy Review that the Government is considering increasing the level of the Obligation. However, the Government must take action to ensure its three "critical factors" are met. The Government must also outline specific—rather than hypothetical—targets beyond 2010 as soon as possible, in order to encourage the level of investment necessary for the Obligation to be a success. In addition, the Government should set out the assumptions and evidence base that underpin the Energy Review's**

169 Q 319 [Mr Messem]

170 Q 464

171 Ev 70

172 Department for Trade and Industry, *The Energy Challenge*, Cm 6887, June 2006

conclusion that doubling the level of the Obligation will prevent the emission of a further million tonnes of carbon a year.

Duty derogation and RTFO buy-out penalty

142. Pending the implementation of the RTFO, the Government is supporting biofuels predominantly through duty incentives, with a 20p per litre duty derogation for both biodiesel and bioethanol. The Chancellor announced in the 2006 Budget that the fuel duty differentials would remain in place until 2008–09, the first year of the RTFO.[173] According to the Government, the 20 pence per litre cut in the duty for biodiesel and bioethanol has "led to a significant increase in the production of biofuels".[174] The fiscal encouragement provided by the derogation for biodiesel and bioethanol should remain as an important ingredient in helping to keep biofuels competitive, notwithstanding the fact that higher pump prices for road fuels have themselves helped to increase returns to biofuel producers. However, this situation means that biofuels should be competitively priced.

143. The RTFO will require fuel providers to meet targets for biofuels sales or buy certificates to make up any shortfall. The revenue generated from the 'buy-out' will then be recycled back to support the biofuel producing industry. In his 2006 Budget the Chancellor announced that the RTFO buy-out price for 2008–09 will be set at 15ppl, with the combined duty derogation and buy-out price set at 35ppl in 2009–10. When we sought clarification, the Treasury told us that this means that "where companies fail to meet their obligation they will have to pay a 15p per litre penalty. That means that not only do you have a 20p reward but you also have an additional 15p disincentive".[175] The combined value of the derogation and buy-out price will then be reduced to 30ppl in 2010–11 with the expectation that "the emphasis will move from the duty incentive towards the buy-out price as the principle support mechanism in future years".[176]

144. The duty derogation does not apply to pure unprocessed cooking oil. The sulphur-free duty rate of 47p applies to rape seed oil which has not been processed for use as a transport fuel but which is being used as a direct substitute. Most diesel engines need a conversion kit to be able to use this pure unprocessed vegetable oil and only when the oil is processed to convert it into a fuel specifically suitable for a diesel engine does it become eligible for the reduced rate of duty. HM Revenue and Customs states that this is to acknowledge the additional costs and "to reflect the environmental benefits" of processing.[177]

145. The NFU voiced concerns that oil companies could opt to pay the buy-out penalty and not invest in the infrastructure required to incorporate biofuels,[178] while Dr Woods, representing the Biosciences Federation and the Royal Society of Chemistry, suggested that

173 HM Treasury, *Budget 2006*, HC 968, March 2006

174 Ev 155

175 Q 410

176 HM Treasury, *Budget 2006*, HC 968, March 2006

177 HM Revenue and Customs, Notice 179E, October 2005

178 Q 14

large oil companies could meet the RTFO target by "putting raw vegetable oil through a hydrogenation unit at the front end of an oil refinery". This would mean that they would not be purchasing processed biofuels from biofuel suppliers—creating uncertainty for those suppliers in relation to the value of their fuel—and that no money would accrue in the buy-out fund.[179]

Carbon assurance schemes

146. As we discuss above at paragraph 46, there is considerable variation between estimates of the reduction in greenhouse gas emissions from biofuel use. It was strongly argued in evidence to our inquiry that this variation creates a need for carbon assurance schemes to support and secure production of those advanced energy crops which have the greatest potential for reduction of carbon emissions. Some contributors to our inquiry also saw the need for a certification scheme which would guarantee sustainability of production.

147. The importance of a carbon certification scheme was emphasised in much of the evidence we received, including submissions from English Nature, the RSPB and D1 Oils, to ensure that—in addition to maximising carbon savings—the energy crops have been grown sustainably, safeguarding biodiversity and the wider environment.

148. Defra and the NFU state that the UK would be capable of meeting the 5% target set by the Renewable Transport Fuel Obligation (RTFO) by 2010 through domestic production alone. However, if this target is extended, or if the use of 'virgin' biomass for heat and electricity is to increase significantly without impinging upon arable land currently used for the production of food, it is likely that the UK will have to import sources of bioenergy.

149. Defra acknowledges that:

> biomass and biofuels are internationally traded commodities and the Government recognises that imports are likely to continue to take a share as the UK market develops. It is important to ensure that both imported and domestically sourced fuels do provide greenhouse gas savings and are produced sustainably.[180]

The UK is to be part of a Global Bioenergy Partnership, first conceived by the G8 countries under the auspices of the UK Presidency in 2005.

150. The Government is currently developing a carbon and sustainability assurance scheme as part of the RTFO. Companies subject to the RTFO will be obliged to report on the carbon savings they achieve and the sustainability of their biofuel supplies. The Government aims to publish draft regulations for the RTFO by early 2007.[181] According to Defra, "the Home-Grown Cereals Authority is setting up a carbon accreditation scheme for bioethanol from wheat and sugar beet which will help to ensure that participating farmers use environmentally-friendly techniques to grow their crops".[182]

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179 Q 250

180 Ev 157

181 Defra, *Climate Change: The UK Programme 2006*, Cm 6764. March 2006

182 Ev 154

151. Evidence from the RSPB cites sugar cane expansion in Brazil as one of the main factors in the destruction of the Cerrado, a savannah-like habitat with a high level of biodiversity. The RSPB also argues that a key factor in the loss of lowland forest in South-east Asia is the establishment of oil-palm plantations.[183] WWF expresses concerns about the impact of palm oil plantations on forests and biodiversity.[184] The Biofuels Corporation uses palm oil as a significant feedstock in the production of biodiesel, and is a member of the Round Table on Sustainable Palm Oil. This sets out agreed principles and criteria relating to sustainable production to which members of the Round Table must adhere. The Corporation argues that its relationship with the palm oil industry in South East Asia means that it is ideally placed to "influence palm production techniques and ensure much more sustainable practices are adopted".[185]

152. Both English Nature and the Environmental Industries Commission argue that sustainability criteria *and* carbon saving should be linked to RTFO certification, so that the better performing biofuels in terms of carbon savings receive more certificates, providing a financial incentive to invest in more advanced technology and production techniques.[186] In line with this argument, the NFU calls for a "banding system to reward the most efficiently produced biofuels". The NFU asserts that such a scheme "must be applicable throughout Europe and compare with world imports" but voices concern that there "would be over complication and over accreditation of UK produced crops, just simply because it is easy to do, and almost a disregard or lack of interest in the imported products because it is too complicated".[187]

153. The Renewable Energy Association (REA) supports such schemes in principle, but expresses concern that:

> Unilateral standards that increase relative costs in the UK market risk increasing costs to UK producers and consumers and may simply displace into other national markets any product that fails to comply with UK standards, with no net environmental benefit.[188]

154. Legal advice taken by the Government and other parties during two feasibility studies on RTFO certification indicated that linking carbon certification to the RTFO could be compatible with EU law and WTO trade rules, depending upon the design and implementation of the certification scheme. However, attempts to include wider environmental or sustainability criteria within a certification scheme could be vulnerable to legal challenge.[189]

183 Ev 214

184 Ev 248

185 Ev 40–41

186 Q 268 [English Nature]; Ev 238 [Environmental Industries Commission]

187 Ev 3; Q 36

188 Ev 20

189 E4tech, ECCM and Imperial College London, *Feasibility study on certification for a Renewable Transport Fuel Obligation*, June 2005; Department for Transport, *RTFO Feasibility Report*, November 2005

155. Shell's argument for a carbon assurance scheme hinged on the need to promote the use of those biofuels which deliver the greatest carbon savings, and expressed concern that the current policy could 'lock out' second generation biofuels—purely because first generation fuels are cheaper and simpler to produce—resulting in suboptimal carbon savings. Darran Messem from Shell told us:

> …policy does not discriminate in terms of the sustainability for the CO_2 footprint of the biofuel that is implemented and typically it is the simpler, lower-cost production technologies that will be encouraged to the market fastest, and typically it is those that will have the worst performance in terms of CO_2 … we think the policy objective for reducing greenhouse gas emissions would be better served by having a certification scheme for biofuels that enables us to really understand what is the CO_2 impact and to enable technologies like cellulose ethanol and biomass to compete on their CO_2 performance … My biggest fear in that regard is that the policies that do not discriminate between CO_2 performance of biofuel will encourage first generation technologies to such an extent that they lock the market out for second generation technologies because the first generation technologies are in there first, and that would result in a less than optimal CO_2 benefit for the supply of biofuel.[190]

156. Government officials told us that there will not be a "carbon balance requirement" in the initial phase of the RTFO, although companies will be required to report the carbon emissions of the fuel over its life cycle. Officials recognised the risk associated with the potential environmental impacts overseas and conceded that, if the RTFO was to recognise better performing fuels in terms of carbon emissions, "a robust methodology" would be essential.[191]

157. Defra says in supplementary evidence to our inquiry that the Government is giving some consideration to carbon assurance; the Low Carbon Vehicle Partnership is working on "the development of reporting systems for carbon savings and environmental standards and it is intended that a social standard should also be developed" which will quantify carbon emissions throughout the life cycle of the fuel. In order to have the standards in place in time for the first RTFO reporting period, the Government intends to pilot them in the first half of the 2007–08 financial year with standards to be rolled out during the second half.[192]

158. **We welcome the news that the Government is developing a carbon and sustainability assurance scheme, but we were extremely disappointed to hear that there will not be a "carbon balance requirement" in the initial phase of the Renewable Transport Fuel Obligation. First generation biofuels are easier to produce and cheaper to buy than second generation biofuels, which require more investment but offer greater carbon savings. We have serious concerns that the RTFO—as it currently stands—could 'lock in' first generation biofuel technologies and so damage the prospects for development and use of more advanced fuels. 'Well-to-wheel' life–cycle**

190 Qq 305, 312, 314

191 Qq 449, 455

192 Ev 180

analyses of potential carbon savings from all biofuels must be in place to inform policy before the Government pushes ahead with the RTFO. We support calls to link carbon savings with RTFO certification. No biofuel which causes more CO_2 emissions on a 'well-to-wheel' basis than its fossil fuel counterpart should be eligible either for the RTFO or the 20p duty derogation.

159. **We are also aware of the implications of first generation biofuels for sustainable development and the environment. We support the work of the Low Carbon Vehicle Partnership in its work to develop reporting systems for carbon savings and environmental standards and we recommend that the Partnership's study be extended to assess the feasibility of linking these standards to RTFO certification. As far as imports for the purposes of bioenergy generation—either of the raw feedstock or of finished biofuels—are concerned, we further recommend that the Government take immediate steps to examine the legal and trade implications of accommodating international sustainability criteria within the RTFO.**

Enhanced Capital Allowance Scheme

160. In the 2006 Budget the Chancellor announced an Enhanced Capital Allowance (ECA) scheme for the cleanest biofuels production plants. Plants eligible under the scheme would either:

- incorporate "environmentally beneficial processes", on-site renewable power or combined heat and power systems for example; or
- use "designated 'advanced processes', such as the processing of ligno-cellulosic feedstocks"—second generation biofuels.

The scheme would write off 100% of first year qualifying spending against taxable profits. Subject to State Aids clearance from the EU, the scheme could be in place by April 2007.[193]

161. British Sugar welcomed the announcement of the ECA, but added a note of caution that "its ability to instigate significant change should not be over-estimated."[194] Likewise, the NFU also welcomed the scheme but wanted to see "more of a lead from local government and regional government in things like public procurement".[195]

162. Despite assertions by the Treasury that "the primary objective of the scheme" is to stimulate investment in "the cleanest biofuel production plant, which includes second generation plant",[196] Defra states that "the scheme is not expected to result in an increase in the production of biofuels".[197]

193 Ev 155 [Defra]

194 Ev 221

195 Q 15

196 Q 425

197 Ev 155

163. **It is not yet clear what effect the Government anticipates the Enhanced Capital Allowance scheme will have on encouraging biofuel development. But we are keen to see evidence of its impact and to receive details of the analysis that led to this scheme being introduced. We recommend that the Government take all necessary steps to ensure that State Aids approval is received from the European Commission and that Defra monitor the effectiveness of the scheme and report on a regular basis.**

164. **We were dismayed to be told by Treasury officials that Defra will run the Enhanced Capital Allowance Scheme, and by Defra that it is "principally a matter for the Treasury". This kind of confusion at the heart of Government hardly sends encouraging signals to this potentially important industry. We recommend in the first instance that the Government make clear which Department will have the final word on qualification criteria for the Scheme. Both Defra and the Treasury told us that a series of discussions took place with industry when developing the proposed Enhanced Capital Allowance Scheme. We recommend that the Government, in its response, set out its estimate of the proportion of businesses within the industry that are expected to benefit from the scheme.**

165. **We further recommend that Defra publish a comprehensive list of bioenergy-related derogations, allowances and other incentives, stating in each case which Government department has the lead in overseeing its operation and what its latest estimate is of the take-up of each scheme.**

Cross-Government strategy

166. Our predecessor Committee's report on climate change noted a lack of co-ordination across Government on climate change and called for the appointment of a Minister for climate change or Cabinet Committee to address this issue across all Government departments.[198] Much of the evidence we received in this inquiry once again complained of the lack of co-operation between Government departments, with responsibilities for bioenergy being "spread too thinly across too many departments".[199] Several witnesses agreed that current policy in the bioenergy sector is "disparate [and] disjointed",[200] concluding that departments must work more closely together for a "more coherent policy".[201] Graham Hilton from the Energy Crops Company noted that:

> As far as biofuels are concerned, we were told some time ago that there were five Government departments involved in looking at this, and that it was so important that there would not be a lead department, all five would lead. I am not sure if it occurred to anybody at that time how unhelpful it was if those five led in different directions, and that certainly seems regularly to have been the case. … It is very difficult at times to understand what some of the individual departments are trying

198 House of Commons Environment, Food and Rural Affairs Committee, Ninth Report of Session 2004–05 *Climate change: looking forward*, HC 130, April 2005

199 Q 50 [Renewable Energy Association, Mr Meeks]

200 Q 51 [Renewable Energy Association, Mr Boyle]

201 Qq 203–204 [Biosciences Federation and the Royal Society of Chemistry]

> to achieve. At the early stages of legislation, one has often encountered that Defra will have an attitude on transport, DfT will have an attitude on agriculture, and Treasury may have an attitude on carbon assurance. It seems to be the rule rather than the exception for Government departments to seem to have views on things which are not within the apparent orbit of their departmental responsibilities.[202]

167. The Minister of State told us that:

> There are a number of areas where Defra has policy lead responsibility where it does not have direct control over policy and that is as you would expect in dealing with a big issue such as climate change that covers a wide variety of government departments.[203]

168. **We are disappointed that much of the evidence we received suggests a distinct lack of 'joined-up' Government concerning bioenergy. On a cross-cutting issue such as this it is essential that all relevant Government departments are—and are seen to be—pulling in the same direction. The evidence we received during our inquiry leads us to conclude that Defra appears to have 'all of the targets and none of the levers'. This is unacceptable. If the Government is to honour its commitment to reduce CO_2 by 20% below 1990 levels by 2010, much more effective co-operation between departments is critical. No one department appears to take ultimate responsibility for the issue of climate change, and we are disappointed to have to reiterate the recommendation made by our predecessor Committee and *again* call for a central co-ordinating post to be created at Cabinet level to deal with this important cross-cutting issue.**

169. The Biosciences Federation and Royal Society of Chemistry assert that efforts made in "developing renewable energy policy should be mirrored by concerted efforts to improve user efficiency".[204] English Nature holds the view that "There is a danger that by over-reliance on 'renewables' such as biofuels to deliver climate change targets, attention may be distracted from the wider issues of energy efficiency and demand management".[205]

170. **We acknowledge that bioenergy is not a 'silver bullet' that will in itself overcome the UK's climate change challenge, but we believe that it must play an important role in a range of measures—which must also include demand reduction and increased energy efficiency—to reduce the UK's climate impact. We will examine some of these other measures in our next inquiry into Climate change: the "citizen's agenda".**

Research and development

171. Defra says that research and development (R&D) funding of around £600,000 per annum is being provided to "underpin an expansion in the commercial breeding programmes for biomass energy crops".[206] The Climate Change Programme 2006 states

202 Qq 74–75

203 Q 474

204 Ev 91

205 Ev 112

206 Ev 157

that the Government will continue to fund its research on non-food crops at a level of around £2million a year.[207] In addition, £15 million has been allocated to the DTI technology programme which will include R&D on second generation biofuels.[208] During our inquiry, however, we heard of concerns that the recent restructuring of two research centres could jeopardise work on climate change and land use, diluting the effect of investment in bioenergy.

172. In March 2006, approval was given to a proposal by the Natural Environment Research Council (NERC) to restructure the Centre for Ecology and Hydrology (CEH). This will mean the closure of CEH sites at Dorset, Oxford, Monk's Wood in Cambridgeshire and Banchory, in Aberdeenshire. Remaining staff will be based at four sites at Bangor, Edinburgh, Lancaster and Wallingford, Oxfordshire.

173. According to NERC:

> By focusing CEH activities at four sites, significant savings will be made overall in running and maintenance costs so that more funding will be available for science. … It is anticipated that the restructuring will cost about £43m, will take four years and reduce CEH's operating costs by over £7m per year. … This leaves about £5m per year to invest in high-quality science across NERC's priority areas.[209]

174. The RSPB has strongly criticised the decision,[210] with Prospect, the scientists' union, arguing that the cuts and closures would "amount to a loss of crucial information on biodiversity and tangible evidence of climate change". NERC has conceded that there will be a reduction in work on the prediction of climate change impacts as a result of the restructuring, an admission that led the Royal Society to express concern about the closures.[211]

175. On the other hand, the Institute of Grassland and Environmental Research (IGER), near Aberystwyth, has also recently announced the imminent loss of 40 posts and a downsizing of some of the research facilities owing to "a funding shortfall brought about by a sharp reduction in Defra income."[212] Defra is reducing IGER funding by around £0.3 million, and acknowledges that "refocusing of research programmes" to concentrate on "climate change, sustainable development, protecting natural resources and rural communities" will lead to a reduction in investment in land-based and grassland research.[213]

176. In giving evidence to the Committee, the Environment Agency offered to conduct a "wider life-cycle study of the potential for use of land for the growth of different biomass crops … including the consideration of more complex alternative strategies, such as

207 Defra, *Climate Change: The UK Programme 2006*, Cm 6764. March 2006

208 Q 506 [Defra]

209 *BBC News*, "Research lab closures to go ahead", 13 March 2006

210 RSPB Public Affairs Department, "CEH closures send UK to bottom of the class", 14 March 2006

211 NERC Business Co-ordination, March 2006; *BBC News*, "Research lab closures to go ahead", Monday 13 March 2006

212 Institute of Grassland and Environmental Research; www.iger.bbsrc.ac.uk

213 Ev 181

leaving fields to lie fallow, or using digested sewage sludge to increase the yield of wood crops."[214] **We welcome the Environment Agency's offer to undertake a life-cycle study of alternative land-use study and recommend that Defra support and oversee this work.**

177. **By cutting its investment in established research centres such as the Institute for Grassland and Environmental Research (IGER), the Government risks missing a valuable opportunity to be at the forefront of new renewable bioenergy technologies. The Government has said it wishes to focus its research and development effort on climate change and sustainable development but, as we have noted, land use is a critical element of climate change policy. Therefore, we are concerned that this restructuring of investment might be to the detriment of land-based research at a time when land-use issues, particularly in terms of non-food crops, are coming to the fore. We further note that Defra's own Chief Scientific Adviser shares these concerns and has said that an additional £20–30 million needs to be spent on research and development if the Government is to achieve its objectives.[215] We recommend in the first instance that the Government publish a breakdown of its spending on bioenergy research and development, pending a full review of its resources for land-based research.**

6 International comparisons

Overview

178. The net result of current policy is that the UK lags behind other countries in its efforts to promote bioenergy. While the UK does not have the land capacity to rival countries such as Brazil in terms of biofuel production, it could realistically seek to match the achievements of countries such as Sweden and Denmark, whose policies represent best practice in supporting the production and use of biofuels and biomass.

179. Our conclusions in this report emphasise the role that action at local level has to play in establishing the generation and use of bioenergy on a commercial scale. We will further investigate the potential of efforts at local level in connection with our "citizen's agenda" inquiry. We conclude this inquiry by urging the national Government to work harder to equip itself with the scientific and economic research it needs to make complex policy decisions, and in the meantime, to increase its support for the generation of bioenergy from a range of sources. Without this support the Government cannot realistically hope to act as a credible domestic or international leader on climate change.

Biomass

180. According to the DTI Microgeneration Strategy there are only 150 biomass boilers (using wood pellets) in the UK. [216] This is despite evidence that biomass heating (with electricity) can—in its present state of development—be cost-effective when compared to

214 Ev 232

215 Defra, Science Advisory Council, Minutes of the 9th meeting of the Council, 26 April 2006, SAC(06)12

216 Department for Trade and Industry, Microgeneration Strategy *Our Energy Challenge: Power from the people*, March 2006

conventional domestic electricity and could reduce household carbon emissions by 3%, or around 720,000 tonnes.[217]

181. In contrast to the UK, Austria and Denmark both have well-established biomass heating infrastructures. Austria is heavily forested, but Denmark, where forest cover amounts to 10% of its total area, is broadly comparable with the UK. Denmark currently imports wood pellets by ship from the Baltic and Canada.[218] According to Powys County Council, which has established a partnership with Upper Austria, there has been a large increase in woodfuel heating in the region in the last decade, with over 300 woodfuel district heating networks, and wood pellet heating systems in nearly 50% of new homes.[219] In Austria, sales of domestic biomass boilers only really took off with the introduction of wood pellets—a clean, "pleasant to handle", convenient fuel requiring less storage space than conventional woodchips.[220]

182. Scandinavia—and Sweden in particular—was often held up in evidence as an exemplar of good practice in terms of bioenergy. According to the Natural Gas Vehicle Partnership, more than 50% of the natural gas used in Sweden is biomethane.[221] The NFU told us that the UK would do well to look to the Scandinavian example:

> I look around at the 470,000, 480,000 new homes looking to be built in the south-east, if that was in Denmark or Sweden they would have a compulsory district heating scheme, a combined heat and power scheme, which seems to me a brilliant use of renewable by-product from farming if we could do that.[222]

183. **The Biomass Task Force argues that "the potential for biomass district heating systems needs to be better understood", highlighting their use in Finland and Sweden in particular, and supporting the use of planning obligations to establish district heating systems, particularly in new housing developments.[223] We agree and note that measures such as these are also relevant to policy on tackling fuel poverty.**

184. In June 2006 the Government announced that its office estate would go carbon neutral by 2012.[224] The Government Estate is estimated to comprise some 50,000 buildings. The Biomass Task Force proposes that the Government adopts a programme of positive preference which requires "all new build and refurbishment in the public estate to consider fully the use of biomass". This would apply to the use of biomass heating in schools, for example, which would bring the additional benefit of raising awareness of the problem of

217 Ev 207 [Energy Saving Trust]

218 Department for Trade and Industry Global Watch Mission Report, *Energy from biomass—a mission to Austria and Denmark*, March 2006

219 Ev 189

220 Department for Trade and Industry Global Watch Mission Report, *Energy from biomass—a mission to Austria and Denmark*, March 2006

221 Ev 230

222 Q 10 [Mr Kendall]

223 Biomass Task Force, *Report to Government*, October 2005

224 Defra, news release '*Government signals a step-change on environmentally sustainable behaviour*', 258/06, 12 June 2006

climate change and the urgent need to implement mitigating measures at every level. In its response to the Task Force report, the Government has pledged "to map the potential use of biomass across the main procuring departments of the Government estate".[225]

185. **We commend the Government's decision to adopt the Biomass Task Force's recommendation that it consider the use of biomass across the Government estate, and call upon the Government to publish a detailed plan, before the end of 2006, showing how biomass will be fully utilised across the Government estate, and what contribution this will make towards the achievement of the target to make Government carbon neutral by 2012. We also call upon the Chancellor to use the 2007 Comprehensive Spending Review to ensure that the Departmental Budgets contain sufficient resources to fulfil this commitment.**

Biofuels

186. Biofuels were pioneered in Brazil in the 1970s when, in response to the oil crisis, ethanol from sugar cane was added to petrol. By the mid-1980s, around 90% of new car sales in Brazil were of ethanol-only vehicles. However, after a poor harvest in 1990 resulted in a national ethanol shortage, confidence in the fuel dropped. Only in recent years has bioethanol consumption risen again, owing to the introduction of 'flexfuel' cars, capable of running on a range of ethanol-petrol blends (the ratios are commonly anywhere between 75% and 25%). Brazil is still the world's largest producer of sugar-based bioethanol—followed by the US—and produces around 16 billion litres a year, which is approximately half the world's total output. Around 14.5 billion litres of this is used in Brazil.

Alternative vehicle technologies

187. Recent developments in vehicle technology have included 'Flexi-Fuel' vehicles, which are capable of running on blends of ethanol and petrol commonly ranging between 100% fossil petrol to 85% bioethanol (hence the term 'E85'). The Ford Motor Company told us that with adequate Government support, FFVs could be a popular option for consumers:

> In 2005, 90% of all the Focus vehicles sold in Sweden were FFVs [Flexi-Fuel Vehicles], a total [of] over 15,000 FFVs have been sold and more than 60% of FFVs are bought by retail customers. By 2008 we project 25% of new vehicles sold in Sweden will be capable of running on E85. In 2006 new car sales in Brazil are likely to rise to 80% FFVs.[226]

188. Both Ford and British Sugar claim the situation in Sweden is a direct result of the Swedish Government's policy of heavily incentivising the use of environmentally friendly products. To encourage uptake of vehicles with lower carbon emissions, Sweden has introduced free parking, exemption from congestion charging and tax incentives for eligible vehicles.[227]

225 Defra, News Release 183/06, "Getting the best out of biomass", 27 April 2006

226 Ev 135

227 Q 348 [Ford]; Ev 221 [British Sugar]

189. Somerset County Council—together with the Avon and Somerset Constabulary, Ford Motor Company, the Energy Saving Trust, Wessex Water and Wessex Grain—has developed a scheme to establish the use of bioethanol as a transport fuel in the UK. Around 22 Flexi-Fuel vehicles (FFV) which use E85 are now in operation.[228] Currently supplies of E85 are being imported from Spain but there are plans to replace this supply with bioethanol produced from wheat in the UK.[229] The NFU argues that procurement at local government level—with large fleets of vehicles and earmarked fuel depots—would provide an ideal opportunity to promote the use of E85 vehicles. [230]

190. Bioethanol is less energy dense than conventional gasoline. This means that vehicles travel fewer miles per gallon, and so the cost per mile is greater, despite the discount for E85 afforded by the duty derogation. When petrol was retailing at 95.9p per litre (ppl), E85 at the same location sold for 92.9ppl. This difference in energy density has been recognised by the Swedish Government, which has taken steps to reduce the cost of E85, such that the cost per mile is now equivalent to conventional petrol.[231]

191. HM Treasury outlined the Government's policy of supporting biofuel production in general through the RTFO mechanism, in the expectation that the market will decide how the 5% by volume target is distributed across the range of different blends up to E85 fuels.[232]

192. **Vehicle manufacturers have the technology available for E85 and flex-fuel vehicles, and uptake in Sweden is already high. We recommend that the Government assess the model provided by Somerset County Council which has established a pilot scheme to encourage E85 uptake at local level. We further recommend that Defra work with HM Treasury to produce a cost-benefit analysis of proposals to introduce a range of incentives similar to those used successfully in Sweden.**

193. **As the availability of low carbon vehicles increases, the Government should develop a uniform system to help consumers make informed choices about the CO_2 savings which can be achieved from different types of vehicle. Such a scheme should employ the same approach as is currently used to make fuel consumption comparisons under differing kinds of driving conditions.**

Fuel standards

194. The maximum proportion of first generation biofuels which can be included in conventional fossil fuels and still comply with the European Fuel Standards Directive for retail fuel sales is 5% by volume.[233] As a direct consequence, manufacturers will only honour vehicle warranties—some of up to seven years—if the fuel used contains 5% or less by volume biofuel. This does not apply to specially designed Flexi-Fuel vehicles and the use

228 NFU Media Release, "British farmers determined to supply green fuels", 12 April 2006

229 Ev 136

230 Qq 22–23

231 Qq 347–348 [Ford]

232 Q 407

233 EN 228 for petrol and EN 590 for diesel

of E85. According to the Biofuels Corporation, "An early indication of a move to 10% by 2015 is a critical catalyst to revising the fuel standards and ensuring vehicle warranties follow."[234]

195. The Department for Trade and Industry's Global Watch unit reports that in the US, when vehicles run on fuel mixes of up to levels of 10% bioethanol, vehicle warranties are honoured.[235] UK vehicle manufacturers set out the argument for changing the EU standard:

> We know that vehicles are being manufactured in the UK and exported to the US to run on a ten per cent standard. There is no barrier to the technology. We can produce cars that run on that. We produce them in the UK now. It is just a clarification of what the standard is going to be.[236]

196. Several witnesses—including members of the petroleum industry and vehicle manufacturers—noted that the European Committee on Standardisation (CEN) is currently in discussions with key stakeholders to develop new European fuel standards which allow for higher inclusion levels of biofuels. The Society of Motor Manufacturers and Traders and the Biofuels Corporation both highlight the necessity for the UK Government to lobby for the early adoption of new fuel standards for biofuel blends of up to 10%.[237]

197. **The Government must make clear its long-term targets for the Renewable Transport Fuel Obligation as soon as possible, in order to give car manufacturers and the petroleum industry sufficient lead time to develop vehicle engines and make the infrastructure adjustments necessary to support the use of fuels containing higher proportions of biofuels. We note that increasing the current limit of 5% will require the European Committee on Standardisation (CEN) to develop new fuel standards for higher inclusion levels of biofuels by volume. We recommend that the Government work with the CEN to ensure that new standards are set as a matter of urgency.**

Overall conclusion

198. Climate change is a long-term concern but action is needed today. Bioenergy is only one part of a many-faceted solution to the pressing problem of climate change, but we must make use of all the measures available to us. If the UK is to be a credible leader, setting the global agenda for tackling climate change, the Government must take every opportunity to reduce domestic carbon emissions. Bioenergy represents one of the most significant such opportunities available today.

234 Ev 41

235 DTI Global Watch Mission Report, *Second generation transport biofuels – a mission to the Netherlands, Germany and Finland*, March 2006

236 Q 146

237 Ev 63 [SMMT]; Q 85 [Biofuels Corporation]

Conclusions and recommendations

Units, measurements and terminology

1. In conducting this inquiry we encountered a wide range of different units, measurements and terms which are all used in calculations of energy and emissions. We recognise that different kinds of data are needed for different purposes, but the Government should ensure that its use of units and terminology is consistent across departments so that those outside the science community can form a clearer view of the relative merits of different forms of energy in the context of climate change. (Paragraph 12)

2. The Government has estimated the contribution that bioenergy could make to the UK's energy mix by sector as percentages of the total, and using different dates for each sector. This does not facilitate useful comparison and suggests a lack of consistency in approach across Government departments. We recommend that the Government recast its estimates, settling on one target date and indicating what the relative percentages, in million tonnes of oil equivalent (Mtoe), actually represent. (Paragraph 14)

Potential carbon savings from bioenergy

Biomass for heat and electricity

3. Current Government policy focuses on renewable electricity generation at the expense of the prospects for the development of renewable heat. We note that in its response to the Biomass Task Force Report the Government has undertaken to increase the use of biomass heat and electricity. We recommend that the Government build on this commitment by setting out clear and quantifiable targets for biomass heat in its forthcoming Biomass Strategy. We further recommend that the Strategy redress the balance between biofuels, renewable electricity and renewable heat, to reflect the greater potential carbon savings offered by biomass heat. (Paragraph 35)

4. Reflecting on the conclusions of the Biomass Task Force, and acknowledging that the Government has already published its response to the Task Force report, we are disappointed that the Government has failed to take the opportunity offered by the Energy Review properly to address the issue of biomass heat, and has only committed to producing the Biomass Strategy "over the coming year". Given the urgent need for concrete measures to support biomass heat, we should not have to wait until 2007 for the Biomass Strategy, and recommend that the Government make clear in its response exactly when it anticipates publishing this strategy, and further suggest that it does so at the earliest possible opportunity. (Paragraph 36)

Marine biomass

5. We agree with the Biosciences Federation and Royal Society of Chemistry that the potential of marine biomass as a source of energy should not be overlooked. We

recommend that the Government conduct a scoping study to investigate the potential for and anticipated carbon savings from the use of marine bioenergy, and to establish the likely up to date costs associated with developing this technology. We emphasise, however, that any research in this field must be carried out in addition to—and not instead of—research and development into land-based bioenergy production. (Paragraph 42)

Potential carbon savings from biofuels

6. No analysis of the relative benefits of different forms of energy is complete without consideration of the cost, in both financial and sustainability terms, of reducing emissions. The difficulties of making reliable calculations—owing to the volatility in oil prices, and consequently biofuel prices, as well as cost differences in feedstocks and processing methods—are well understood. We seek confirmation from the Government that the Stern Review on the Economics of Climate Change will provide clarity in this area. (Paragraph 50)

Second generation biofuels

Barriers to production

7. Defra does not say when in the future it expects second generation biofuels to become cost-effective, or what contribution the Government intends to make in terms of research and development in this field. While we accept that the Government may be reluctant to pick technology 'winners' and 'losers' at this stage, it is vital that the Government examine the barriers to further progress on second generation biofuels, and—as a matter of urgency—establish the level of investment and policy support required to accelerate development of this technology. (Paragraph 63)

Second generation biofuels for aviation

Synthetic kerosene

8. Although we recognise the valid safety concerns raised by witnesses regarding second generation aviation fuels, we note that synthetic kerosene is already being used in aircraft departing from Johannesburg. We are puzzled as to why the Government does not appear to be pursuing the option of second generation Fischer-Tropsch kerosene—as used in South Africa—to deal with the rapidly growing climate impact of aviation. If a biomass-derived process for producing synthetic kerosene can be made economically viable, the UK Government must support its development. We recommend that the Government take immediate steps to investigate the economic viability of using biomass as the feedstock for synthetic kerosene. (Paragraph 72)

Biogas

Biogas for transport

9. We recognise the carbon saving potential of biogas as a transport fuel, but acknowledge that the necessary adjustments to transport infrastructure represent an obstacle to biogas uptake. We note the Government's acknowledgement of the need to assess the feasibility of using biogas as an alternative to diesel and welcome the Government's Surrey-based pilot project to examine the use of landfill gas as a transport fuel. We recommend that a feasibility study be undertaken in time for the results to contribute to the Government's Biomass Strategy, expected in the coming year. (Paragraph 77)

Anaerobic digestion

10. We recognise the potential of anaerobic digestion significantly to increase the use of waste as a source of renewable energy. We reiterate the point made by the Biomass Task Force that care must be taken in selecting the most efficient anaerobic digestion technologies. We note that the Government has committed to reviewing its current approach to anaerobic digestion by April 2007. This is too late. Defra's current review of the Waste Strategy—which is due to be published later this year—provides a more suitable opportunity to fulfil this commitment and we recommend that the Government use the review to bring forward all of its work in this area. (Paragraph 84)

Land use

Food security

11. We conclude that second generation biofuel production is less likely to have the same impact on world commodity markets as first generation biofuel production, which competes with the food industry for corn and oil feedstocks, further pointing to the desirability of investing in the necessary technologies. (Paragraph 102)

Energy from waste

12. It was made clear to us that organic waste material—much of which currently goes to landfill—represents an untapped source of energy. We support the work of the Biomass Task Force and its leader Sir Ben Gill in highlighting the energy potential of waste, and trust that this line of thinking will be fully integrated into the Government's forthcoming new strategy for waste. We see the generation of heat and electricity as an important part of any effective waste strategy. The contribution of waste to energy production could be substantial. However, this should be made alongside, and not instead of, efforts in other areas. (Paragraph 108)

General conclusions on land use

13. Questions over land use are at the heart of bioenergy policy. We are concerned by the implications of the Government's claim that "by 2050 the UK could produce as

much as one third of its transport energy needs" from renewable sources. We recommend that the Government make clear in its response to our report the evidence—and assumptions made in relation to land use—to support this claim. Biofuels for transport currently offer an important way to reduce carbon emissions from the growing transport sector, but increased production may have an adverse effect on food production and biodiversity. If the Government goes ahead with the increase in the Renewable Transport Fuel Obligation beyond 5%, as proposed in the Energy Review, there may be serious UK land use implications. Exploiting the 'dual-functionality' of crops to provide both food and bioenergy may go some way to mitigating this. (Paragraph 113)

14. Biomass crops used for heat and electricity can have a positive impact on biodiversity, and offer greater carbon savings per hectare, but in the case of short rotation coppice, are costly to establish and yield no output for four years. They therefore require considerable investor confidence. Whilst we recognise that the complex matrix of advantages and disadvantages relating to the various uses of arable land precludes any simple choice between sources, the Government must act now to help reconcile and rationalise these apparent inconsistencies in order to maximise carbon savings. (Paragraph 114)

Government policy on bioenergy

15. Government policy does not leave room for newer, more efficient technologies to develop and become commercially viable because it does not link incentives to carbon savings. We recommend that the Government begin to remedy this initially in implementing the Renewable Transport Fuel Obligation. (Paragraph 115)

Biomass support schemes

16. We are pleased that Defra is keeping the prospect of a Renewable Heat Obligation under review: this option should not be ruled out altogether without further consideration. We recommend that Defra undertake a full analysis of such an Obligation, but emphasise that such an analysis should not be the cause of any delay to other Government measures in support of biomass heat. (Paragraph 125)

Barriers to biomass heat

17. Biomass heat has great potential to generate significant carbon savings. But we do not believe that the Government has properly positioned itself to exploit this potential. The Government must also quantify what it means by the "optimum use" of biomass. Despite the Government's acknowledgement that the contribution from biomass "can be very significant", we note that the Renewable Transport Fuel Obligation is predicted to save 16 times more carbon than the new subsidy for biomass heat. The Government should publish the evidence base—including the basis for its calculation of the carbon savings anticipated to be made from the RTFO—for its current policies. We recommend that financial and policy support for biomass-derived heat be increased to a level that ensures associated carbon savings are at least on a par with those anticipated from the Renewable Transport Fuel

Obligation. We further recommend that the Government take the opportunity provided by its long-term Biomass Strategy to make these changes. (Paragraph 134)

Renewable Transport Fuel Obligation (RTFO)

18. We note that the 2010 Renewable Transport Fuel Obligation target of 5% biofuel inclusion by volume falls far short of the indicative target of 5.75% by energy as set down by the EU Biofuels Directive. We support the recent announcement made in the Energy Review that the Government is considering increasing the level of the Obligation. However, the Government must take action to ensure its three "critical factors" are met. The Government must also outline specific—rather than hypothetical—targets beyond 2010 as soon as possible, in order to encourage the level of investment necessary for the Obligation to be a success. In addition, the Government should set out the assumptions and evidence base that underpin the Energy Review's conclusion that doubling the level of the Obligation will prevent the emission of a further million tonnes of carbon a year. (Paragraph 141)

Carbon assurance schemes

19. We welcome the news that the Government is developing a carbon and sustainability assurance scheme, but we were extremely disappointed to hear that there will not be a "carbon balance requirement" in the initial phase of the Renewable Transport Fuel Obligation. First generation biofuels are easier to produce and cheaper to buy than second generation biofuels, which require more investment but offer greater carbon savings. We have serious concerns that the RTFO—as it currently stands—could 'lock in' first generation biofuel technologies and so damage the prospects for development and use of more advanced fuels. 'Well-to-wheel' life–cycle analyses of potential carbon savings from all biofuels must be in place to inform policy before the Government pushes ahead with the RTFO. We support calls to link carbon savings with RTFO certification. No biofuel which causes more CO_2 emissions on a 'well-to-wheel' basis than its fossil fuel counterpart should be eligible either for the RTFO or the 20p duty derogation. (Paragraph 158)

20. We are also aware of the implications of first generation biofuels for sustainable development and the environment. We support the work of the Low Carbon Vehicle Partnership in its work to develop reporting systems for carbon savings and environmental standards and we recommend that the Partnership's study be extended to assess the feasibility of linking these standards to RTFO certification. As far as imports for the purposes of bioenergy generation—either of the raw feedstock or of finished biofuels—are concerned, we further recommend that the Government take immediate steps to examine the legal and trade implications of accommodating international sustainability criteria within the RTFO. (Paragraph 159)

Enhanced Capital Allowance Scheme

21. It is not yet clear what effect the Government anticipates the Enhanced Capital Allowance scheme will have on encouraging biofuel development. But we are keen to see evidence of its impact and to receive details of the analysis that led to this scheme being introduced. We recommend that the Government take all necessary steps to

ensure that State Aids approval is received from the European Commission and that Defra monitor the effectiveness of the scheme and report on a regular basis. (Paragraph 163)

22. We were dismayed to be told by Treasury officials that Defra will run the Enhanced Capital Allowance Scheme, and by Defra that it is "principally a matter for the Treasury". This kind of confusion at the heart of Government hardly sends encouraging signals to this potentially important industry. We recommend in the first instance that the Government make clear which Department will have the final word on qualification criteria for the Scheme. Both Defra and the Treasury told us that a series of discussions took place with industry when developing the proposed Enhanced Capital Allowance Scheme. We recommend that the Government, in its response, set out its estimate of the proportion of businesses within the industry that are expected to benefit from the scheme. (Paragraph 164)

23. We further recommend that Defra publish a comprehensive list of bioenergy-related derogations, allowances and other incentives, stating in each case which Government department has the lead in overseeing its operation and what its latest estimate is of the take-up of each scheme. (Paragraph 165)

Cross-Government strategy

24. We are disappointed that much of the evidence we received suggests a distinct lack of 'joined-up' Government concerning bioenergy. On a cross-cutting issue such as this it is essential that all relevant Government departments are—and are seen to be—pulling in the same direction. The evidence we received during our inquiry leads us to conclude that Defra appears to have 'all of the targets and none of the levers'. This is unacceptable. If the Government is to honour its commitment to reduce CO_2 by 20% below 1990 levels by 2010, much more effective co-operation between departments is critical. No one department appears to take ultimate responsibility for the issue of climate change, and we are disappointed to have to reiterate the recommendation made by our predecessor Committee and again call for a central co-ordinating post to be created at Cabinet level to deal with this important cross-cutting issue. (Paragraph 168)

25. We acknowledge that bioenergy is not a 'silver bullet' that will in itself overcome the UK's climate change challenge, but we believe that it must play an important role in a range of measures—which must also include demand reduction and increased energy efficiency—to reduce the UK's climate impact. We will examine some of these other measures in our next inquiry into Climate change: the "citizen's agenda". (Paragraph 170)

Research and development

26. We welcome the Environment Agency's offer to undertake a life-cycle study of alternative land-use study and recommend that Defra support and oversee this work. (Paragraph 176)

27. By cutting its investment in established research centres such as the Institute for Grassland and Environmental Research (IGER), the Government risks missing a valuable opportunity to be at the forefront of new renewable bioenergy technologies. The Government has said it wishes to focus its research and development effort on climate change and sustainable development but, as we have noted, land use is a critical element of climate change policy. Therefore, we are concerned that this restructuring of investment might be to the detriment of land-based research at a time when land-use issues, particularly in terms of non-food crops, are coming to the fore. We further note that Defra's own Chief Scientific Adviser shares these concerns and has said that an additional £20–30 million needs to be spent on research and development if the Government is to achieve its objectives. We recommend in the first instance that the Government publish a breakdown of its spending on bioenergy research and development, pending a full review of its resources for land-based research. (Paragraph 177)

International comparisons

Biomass

28. The Biomass Task Force argues that "the potential for biomass district heating systems needs to be better understood", highlighting their use in Finland and Sweden in particular, and supporting the use of planning obligations to establish district heating systems, particularly in new housing developments. We agree and note that measures such as these are also relevant to policy on tackling fuel poverty. (Paragraph 183)

29. We commend the Government's decision to adopt the Biomass Task Force's recommendation that it consider the use of biomass across the Government estate, and call upon the Government to publish a detailed plan, before the end of 2006, showing how biomass will be fully utilised across the Government estate, and what contribution this will make towards the achievement of the target to make Government carbon neutral by 2012. We also call upon the Chancellor to use the 2007 Comprehensive Spending Review to ensure that the Departmental Budgets contain sufficient resources to fulfil this commitment. (Paragraph 185)

Biofuels

Alternative vehicle technologies

30. Vehicle manufacturers have the technology available for E85 and flex-fuel vehicles, and uptake in Sweden is already high. We recommend that the Government assess the model provided by Somerset County Council which has established a pilot scheme to encourage E85 uptake at local level. We further recommend that Defra work with HM Treasury to produce a cost-benefit analysis of proposals to introduce a range of incentives similar to those used successfully in Sweden. (Paragraph 192)

31. As the availability of low carbon vehicles increases, the Government should develop a uniform system to help consumers make informed choices about the CO_2 savings which can be achieved from different types of vehicle. Such a scheme should employ

the same approach as is currently used to make fuel consumption comparisons under differing kinds of driving conditions. (Paragraph 193)

Fuel standards

32. The Government must make clear its long-term targets for the Renewable Transport Fuel Obligation as soon as possible, in order to give car manufacturers and the petroleum industry sufficient lead time to develop vehicle engines and make the infrastructure adjustments necessary to support the use of fuels containing higher proportions of biofuels. We note that increasing the current limit of 5% will require the European Committee on Standardisation (CEN) to develop new fuel standards for higher inclusion levels of biofuels by volume. We recommend that the Government work with the CEN to ensure that new standards are set as a matter of urgency. (Paragraph 197)

Overall conclusion

33. Climate change is a long-term concern but action is needed today. Bioenergy is only one part of a many-faceted solution to the pressing problem of climate change, but we must make use of all the measures available to us. If the UK is to be a credible leader, setting the global agenda for tackling climate change, the Government must take every opportunity to reduce domestic carbon emissions. Bioenergy represents one of the most significant such opportunities available today. (Paragraph 198)

Annex

Table 3a: A selection of some of the grants and support schemes available for biomass heat and electricity generation

Scheme	Details	Progress to date
	Biomass	
Bio-energy Capital Grants Scheme	UK wide programme to provide grant funding for the development of biomass-fuelled heat or electricity generating technologies. **£66 million—to be committed over four years between 2002 and 2006, and spent by 2010—**was made available in the first round of the scheme. A further round of the scheme, focussing on biomass heat and Combined Heat and Power (CHP), was announced in April 2006. A minimum of £2 million will be available for new projects.	More than 100 biomass boilers have been installed to date, with more anticipated.
Five-year Capital Grant Scheme	To build on the new round of the Bio-energy Capital Grants Scheme (above), a five year scheme has also been announced to support biomass boilers and biomass CHP and will provide **£10–15 million in the first two years.**	Still under development, applications for the new scheme are expected to be invited towards the end of 2006, subject to State Aids clearance.
Energy Crops Scheme	Provides establishment grants for short-rotation coppice (SRC) and miscanthus; and aid to help SRC growers set up producer groups. **£17.9 million provided over 6 years.**	As of October 2005, £1.3million had been taken up for 157 establishment grants; plus 3 producer group projects totalling £545,000. The scheme is still open for establishment grants, but closed to producer groups on 30 June 2006.
Bio-energy Infrastructure Scheme	Provides grants to help develop the supply chain and market infrastructure for purpose-grown energy crops, straw and woodfuel. **A total of £3.5 million is available over three years from 2005–06 to 2007–08**	A further round of the Scheme will be introduced during 2006–07, subject to State Aids approval.
Low Carbon Buildings Programme	Provides incentives for householders to install biomass boilers as part of a larger scheme to support microgeneration technologies (other eligible technologies include ground source heat pumps, solar photovoltaics, micro-	Grants are already available for householders and small organisations; larger projects by public, not for profit and commercial organisations

	wind and small hydro). **The programme will run for three years from 2006 until 2009 with a budget of £80 million**	will be available later in 2006.

Data source: Climate Change: The UK Programme 2006, Cm 6764, March 2006; Biomass Task Force Report, October 2005; Defra, Bio 26, para 5.2; www.lowcarbonbuildings.org.uk ; Government Response to the Biomass Task Force Report, April 2006

Table 3b: A selection of the main biofuel grants and support schemes available

Scheme	Details	Progress to date
	Biofuels	
Renewable Transport Fuel Obligation (RTFO)	According to the RTFO, biofuels should constitute 5% (by volume) of the total road fuel supply by 2010. The RTFO will be introduced in 2008/09 with the level of obligation starting at 2.5%, rising to 3.75% in 2009/10, reaching the target level of 5% in 2010–11. Fuel suppliers will have to meet these targets or buy certificates to make up any shortfall. The Government anticipates carbon savings of 1 MtC by 2010 through implementation of the RTFO.	Due to start in 2008. The RTFO buy-out price for 2008–09 will be 15 pence per litre (ppl).
Duty derogation for bioethanol and biodiesel	Bioethanol and biodiesel are subject to a duty incentive of 20p per litre until 2008. This will then decrease in accordance with the RTFO buy-out payment (see above). The duty derogation does not apply to pure unprocessed cooking oil.	Provisional figures suggest that biofuels comprised 0.25% of total road fuel used in the last three months of 2005. The combined duty derogation and RTFO buy-out price will be 35ppl in 2009–10, but will be reduced to 30ppl in 2010–11.
Enhanced Capital Allowance (ECA) Scheme	Eligible plants—for example, those which incorporate on-site renewable power or produce second generation biofuels—will have 100% of their first year qualifying spending written off against taxable profits. The scheme is predicted to save 0.06 MtC by 2010.	Could be in place by April 2007, subject to State Aids clearance.

Data source: Budget 2006, HC 968, March 2006; Climate Change: The UK Programme 2006, Cm 6764, March 2006; Defra, Bio 26, para 5.2;

Formal minutes

Monday 24 July 2006

Members present:

Mr Michael Jack, in the Chair

Mr David Drew	David Lepper
James Duddridge	Sir Peter Soulsby
Patrick Hall	David Taylor
Lynne Jones	

Draft Report [*Climate change: the role of bioenergy*], proposed by the Chairman, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 198 read and agreed to.

Annex agreed to.

Summary agreed to.

Resolved, That the Report be the Eighth Report of the Committee to the House.

Ordered, That the Chairman do make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No.134.

Several papers were ordered to be appended to the Minutes of Evidence.

Ordered, That the Appendices to the Minutes of Evidence taken before the Committee be reported to the House.

Several papers were ordered to be reported to the House.

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[Adjourned till Monday 16 October at 4 p.m.

Witnesses

List of written evidence

1	Biofuels Corporation plc (Bio 21)	Ev 36
2	Biomass Task Force, Sir Ben Gill (Bio 31)	Evs 86, 89
3	Biosciences Federation and the Royal Society of Chemistry (Bio 07)	Evs 90, 107, 110
4	British Sugar Plc (Bio 12)	Ev 219
5	D1 Oils Plc (Bio 20)	Ev 240
6	Department for Environment, Food and Rural Affairs (DEFRA) (Bio 26)	Evs 152, 179
7	Energy Crops Company Ltd (Bio 06)	Evs 44, 54
8	Energy for Sustainable Development (ESD) Ltd (Bio 05)	Ev 205
9	Energy Saving Trust (Bio 08)	Ev 207
10	English Nature (Bio 09)	Ev 110
11	Environment Agency (Bio 17)	Ev 230
12	Environmental Industries Commission (EIC) (Bio 19)	Ev 237
13	Food and Drink Federation (FDF) (Bio 15)	Ev 222
14	Ford Motor Company (Bio 24)	Evs 134, 150
15	Friends of the Earth Ltd (Bio 23)	Ev 244
16	HM Treasury (Bio 33)	Ev 183
17	Inetec (Bio 34)	Ev 249
18	Land Network International Ltd (Bio 02)	Ev 192
19	Margarine & Spreads Association (MSA) (Bio 18)	Ev 233
20	National Farmers' Union (NFU) (Bio 14)	Evs 1, 14
21	Natural Gas Vehicle Association (NGVA) (Bio 16)	Ev 223
22	Natural Systems Limited (Bio 04)	Ev 205
23	Powys County Council (Bio 01)	Ev 189
24	Renewable Energy Association (REA) (Bio 27)	Evs 16, 32
25	Renewable Energy Foundation (Bio 03)	Ev 200
26	Rolls-Royce (Bio 29)	Ev 140
27	Royal Society for the Protection of Birds (Bio 10)	Ev 210
28	Scottish Renewables (Bio 11)	Ev 214
29	Shell (Bio 30)	Evs 122, 132
30	Society of Motor Manufacturers and Traders Ltd (SMMT) (Bio 22)	Ev 60
31	UK Petroleum Industry Association Ltd (UKPIA) (Bio 25)	Evs 55, 70
32	Volkswagen (Bio 32)	Ev 70
33	WWF-UK (Bio 28)	Ev 246

List of unprinted written evidence

Additional papers have been received from the following and have been reported to the House but to save printing costs they have not been printed. Copies have been placed in the House of Commons Library where they may be inspected by Members. Other copies are in the Record Office, House of Lords and are available to the public for inspection. Requests for inspection should be addressed to the Record Office, House of Lords, London SW1. (Tel 020 7219 3074). Hours of inspection are from 9:30am to 5:00pm on Mondays to Fridays.

Bio 07b (Annexes A, B and D) - Biosciences Federation & Royal Society of Chemistry (Background papers)

Bio 09a - English Nature - Centre for Ecology & Hydrology: Consultation on NERC Council's statement of intent (Background paper)

Bio 21a - Biofuels Corporation plc - RSPO Principles and Criteria for Sustainable Palm Oil Production (Background paper)

Bio 30 (annex) - Shell - Report to DTI: Context for a strategy on road transport fuels and carbon mitigation (Background paper)

Associated British Foods plc – Collaboration with BP and DuPont on UK biofuel production (Press release)

Reports from the Committee since 2003

(Government Reponses to Committee Reports appear in brackets)

Session 2005–06		
Seventh Report	The Environment Agency	HC 780-I (HC 1519)
Sixth Report	Bovine TB: badger culling	HC 905-I
Fifth Report	Rural Payments Agency: interim report	HC 840
Fourth Report	The Departmental Annual Report 2005	HC 693-I (HC 966)
Third Report	The Animal Welfare Bill	HC 683
Second Report	Reform of the EU Sugar Regime	HC 585-I (HC 927)
First Report	The future for UK fishing: Government Response	HC 532
Session 2004–05		
Ninth Report	Climate Change: looking forward	HC 130-I (HC 533 05–06)
Eighth Report	Progress on the use of pesticides: the Voluntary Initiative	HC 258 (HC 534 05–06)
Seventh Report	Food information	HC 469 (HC 437 05–06)
Sixth Report	The future of UK fishing	HC 122 (HC 532 05–06)
Fifth Report	The Government's Rural Strategy and the draft Natural Environment and Rural Communities Bill	HC 408-I (Cm 6574)
Fourth Report	Waste policy and the Landfill Directive	HC 102 (Cm 6618)
Third Report	The Work of the Committee in 2004	HC 281
Second Report	Dismantling Defunct Ships in the UK: Government Reply	HC 257
First Report	The draft Animal Welfare Bill	HC 52-I (HC 385)
Session 2003–04		
Nineteenth Report	Water Pricing: follow-up	HC 1186 (HC 490 04–05)
Eighteenth Report	Dismantling of Defunct Ships in the UK	HC 834 (HC 257 04–05)
Seventeenth Report	Agriculture and EU Enlargement	HC 421 (HC 221 04–05)
Sixteenth Report	Climate Change, Water Security and Flooding	HC 558 (HC 101 04–05)
Fifteenth Report	The Departmental Annual Report 2004	HC 707 (HC 100 04–05)
Fourteenth Report	Sites of Special Scientific Interest	HC 475 (HC 1255)
Thirteenth Report	Bovine TB	HC 638 (HC 1130)
Twelfth Report	Reform of the Sugar Regime	HC 550-I (HC 1129)
Eleventh Report	GM Planting Regime	HC 607 (HC 1128)
Tenth Report	Marine Environment: Government reply	HC 706
Ninth Report	Milk Pricing in the United Kingdom	HC 335 (HC 1036)
Eighth Report	Gangmasters (follow up)	HC 455 (HC 1035)
Seventh Report	Implementation of CAP Reform in the UK	HC 226-I (HC 916)
Sixth Report	Marine Environment	HC 76 (HC 706)
Fifth Report	The Food Standards Agency and Shellfish	HC 248 (HC 601)
Fourth Report	Environmental Directives	HC 103 (HC 557)
Third Report	Caught in the net: Cetacean by-catch of dolphins and porpoises off the UK coast	HC 88 (HC 540)

Second Report	Annual Report of the Committee 2003	HC 225
First Report	Water Pricing	HC 121 (HC 420)