Committee on
Climate Change

Independent advice to government
on building a low-carbon economy
and preparing for climate change

Bioenergy Review (2018) - Call for Evidence

Please answer only those questions where you have particular expertise and are able to provide links to supporting evidence.

In 2011 the Committee on Climate Change (CCC) published a Bioenergy Review to provide an assessment of the potential role of bioenergy in meeting the UK's carbon budgets. The Bioenergy Review drew on the best available evidence to address questions relating to the sustainability of bioenergy, lifecycle emissions, resource availability and best-use across the economy. It highlighted the importance of bioenergy for meeting the UK's climate change targets and made recommendations for tightening the sustainability standards for bioenergy resources - recommendations that were subsequently adopted by the UK Government.

The CCC is now planning to update its work on bioenergy, culminating in a new Bioenergy Review to be published in Autumn 2018. This will consider the latest evidence to provide an updated view on the role of bioenergy in decarbonising the UK economy through to 2050. Key themes to be explored include sustainability and certification, GHG emissions accounting, developing sustainable supply, non-energy uses of bioenergy resources, and transitions to future best-uses of bioenergy resources. We will identify recommendations for further action and aim to develop indicators to allow the CCC to monitor progress over time.

Stakeholder engagement will underpin the 2018 Bioenergy Review. This Call for Evidence is the first formal step in the engagement process. It is intended to provide all stakeholders with the opportunity to input to the CCC's work and to enable the CCC to draw on the full range of up-to-date evidence relating to bioenergy production, sustainability and use.

The Call for Evidence will be followed by stakeholder workshops on specific key topics in 2018. In addition, we will be establishing an Expert Advisory Group to provide advice and support to the CCC throughout the review.

Responding to the Call for Evidence

We encourage responses that are brief and to the point (i.e. a maximum of 400 words per question, plus links to supporting evidence), answering only those questions where you have particular expertise. We may follow up for more detail where appropriate.

Please use the website form when responding, or if you prefer you can use this word form and e-mail your responses to: communications@theccc.gsi.gov.uk. Alternatively, if you would prefer to post your response to us, please send it to:

The Committee on Climate Change – 2018 Bioenergy Review Call for Evidence
7 Holbein Place
London SW1W 8NR

The deadline for responses is 9am on 5th February 2018.

Confidentiality and data protection

Responses will be published on the CCC website after the response deadline, along with a list of names or organisations that responded to the Call for Evidence.

If you want information that you provide to be treated as confidential (and not automatically published) please say so clearly in writing when you send your response to the consultation. It would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded by us as a confidentiality request.

All information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information legislation (primarily the Freedom of Information Act 2000, the Data Protection Act 1998 and the Environmental Information Regulations 2004).

Information on organisation / individual submitting response

If you are responding on behalf of an organisation please provide a brief description of your organisation and your role within this organisation.

The Royal Society for the Protection of Birds (the RSPB) is the charity that takes action for wild birds and the environment. We are the largest wildlife conservation organisation in the country with over one million members. We own or manage 151,954 hectares of land for nature conservation on 213 reserves throughout the UK.

The RSPB recently produced a report 'The RSPB's 2050 Energy Vision: Meeting the UK's climate targets in harmony with nature' which analyses and demonstrates how the UK can deliver its 2050 climate targets and transition to low carbon energy with lowest risk to sensitive species and habitats. The report concludes that ambitious levels of renewable energy are possible at low ecological risk, and renewable energy should be prioritised in our long-term energy strategy and energy mix. But it identifies a limited role for bioenergy based on the risks it poses to the environment and the climate. However, in order to achieve this, all kinds of energy installations must be sited, designed and managed in a way that does not harm the natural environment.

The RSPB has worked on bioenergy issues for a number of years and has previously published a number of key studies and reports on the topic, including 'Bioenergy: A Burning Issue' (http://ww2.rspb.org.uk/Images/Bioenergy_a_burning_issue_1_tcm9-288702.pdf) and 'Dirtier than Coal' (http://ww2.rspb.org.uk/Images/biomass_report_tcm9-326672.pdf).

If you are responding as an individual we would be grateful if you could provide a brief description of your background and interest in bioenergy.

GHG emissions and sustainability of bioenergy imports

Our 2011 Bioenergy Review concluded that UK and EU regulatory approaches should be strengthened to better reflect estimates of the full lifecycle emissions of bioenergy feedstocks, taking into account both direct and indirect land-use change impacts. Whilst changes have been made to these regulatory frameworks, both life-cycle emissions and the wider sustainability impacts of bioenergy remain highly contested issues, particularly in relation to bioenergy imports. Given the potential role for bioenergy in the UK's low-carbon transition, and the potential increase in bioenergy feedstock production in the future, it will be essential that policy is based on the latest available evidence and that bioenergy is genuinely sustainable.

The term 'sustainable' here is used to cover a wide-range of issues relating to GHG emissions, biodiversity, water use, land-use, land-rights, air-quality and other social and environmental issues.

1. What is the latest evidence on lifecycle GHG emissions of biomass and other biofuels imported into the UK? How could this change over time as a function of scaling up supply? We are particularly interested in evidence that considers the full range of relevant issues including changes to forest and land carbon stocks, direct and indirect land-use change and wider market effects.

Since the Committee's 2011 Bioenergy Review, a large amount of new evidence has emerged on the lifecycle greenhouse gas emissions of bioenergy, particularly the impacts of burning the carbon stocks themselves and the impact of sequestration foregone. In particular, it is now very clear that many types of biomass and biofuels fail to deliver emissions savings within timeframes relevant to climate change. In some cases, biomass and biofuels are known to be **causing emissions increases** relative to fossil fuels. Biofuels that result in direct or indirect land use change, and woody biomass feedstocks – particularly the use of **stumps and whole trees** – are associated with the highest carbon emissions.

Crucially, this is not currently reflected in lifecycle greenhouse gas emissions accounting methodologies that often ignore/exclude emissions caused by land use change (direct and indirect) or changes to soil/forest carbon stocks. Therefore, biomass and biofuels are perversely incentivised or wrongly categorised as zero carbon (often only transport and production emissions are accounted for in the lifecycle analyses).

Several new pieces of key evidence have emerged in recent years:

- The UK Government's own Biomass Emissions and Counterfactual calculator and report showed that some types of biomass (particularly new harvesting of whole trees) can result in emissions even higher than those of fossil fuels: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/349024/BEAC_Report_290814.pdf
- The European Academies Scientific Advisory Council has concluded that the use of forest biomass can result in emissions so significant over the medium term that some types should be ruled out. They state that only those types of biomass that deliver emissions savings within climate-relevant time frames should be supported for energy uses: http://www.easac.eu/fileadmin/PDF_s/reports_statements/Forests/EASAC_Forests_web_complete.pdf
- A report published by the European Commission and produced by the UK Government's Forest Research agency, concludes that by 2050 the greatest emissions savings would be achieved by energy mixes with the lowest contributions from forest biomass: https://ec.europa.eu/energy/sites/ener/files/documents/EU%20Carbon%20Impacts%20of%20Biomass%20Consumed%20in%20the%20EU%20final.pdf
- A newly-published scientific study shows that replacing coal with woody biomass can create a carbon debt that lasts between 44-104 years, and that replacing natural forests with pine plantations increases the carbon impact because plantations have a lower carbon density than natural forests: http://iopscience.iop.org/article/10.1088/1748-9326/aaa512/meta
- Analysis conducted by the Natural Resources Defense Council shows that when whole trees make up just 12% of wood pellets, they can produce emissions equivalent to natural gas for up to 50 years: https://www.nrdc.org/sites/default/files/bioenergy-modelling-IB.pdf
- A study by the Southern Environmental Law Center shows that if emissions from combustion of biomass were to be accounted for in the energy sector, then at most 8% of a wood pellet could come from hardwoods, before the 285gCO2/kWh limit imposed by the UK Government would be exceeded: https://www.southernenvironment.org/uploads/audio/2015-05-27_BEAC_calculations_SE_hardwoods.pdf
- Two Chatham House-published reports show that the Land Use, Land Use Change and Forestry (LULUCF) emissions accounting rules are designed in such a way that large quantities of emissions caused by the use of forest biomass may never be accounted for. This occurs either in the scenario that biomass emissions are included as part of a projected reference level baseline, where only emissions exceeding that baseline are ever counted, or where biomass is imported from a country which does not account for its land use emissions under the Kyoto Protocol (such as the US) to a country which counts biomass used for energy as zero carbon in its energy sector (such as the UK): https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2017-02-23-woody-biomass-global-climate-brack-final2.pdf; https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2017-02-23-impacts-demand-woody-biomass-climate-forests-brack-final.pdf

- A report published by the European Commission showed that emissions from biofuel feedstocks, particularly biodiesel, can be very significant due to the direct and indirect land use change incurred by their cultivation: https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf
- In recent months, several letters have been written by hundreds of prominent scientists from across the world calling on decision-makers for limits on the use of forest biomass for energy due to its impacts on the climate: https://www.euractiv.com/section/energy/opinion/eu-must-not-burn-the-worlds-forests-for-renewable-energy/; https://drive.google.com/file/d/0B9HP_Rf4_eHtQUpyLVIzZE8zQWc/view; https://www.euractiv.com/section/climate-environment/opinion/why-sustainable-forest-management-does-not-make-wood-a-good-climate-alternative-to-fossil-fuels/

2. Under what circumstances can imported biomass and other biofuels deliver real GHG emissions savings (considering full life-cycle emissions and indirect/wider market effects)? Conversely, what evidence is there for ruling out certain sources on the grounds of lifecycle GHG emissions or sustainability risks?

One of the best ways to reduce emissions is to protect and restore natural stores and sinks of greenhouse gas emissions. Harvesting biomass from these ecosystems for energy can result in 'foregone sequestration' – i.e. the role that the vegetation would have played absorbing carbon is lost. Far more beneficial from a carbon point of view is to leave these ecosystems intact or even to restore them. A recent study by The Nature Conservancy highlights the opportunities available for doing this: http://www.pnas.org/content/114/44/11645.abstract

There are limited circumstances under which biomass and biofuels can deliver real emissions savings. In many cases this is not to do with whether the biomass or biofuels are imported or domestic, but to do with the type of feedstock used. The emissions released from transport are often a relatively small proportion of the overall emissions impact and focussing on them can be a red herring.

Genuine wastes and residues, such as sawmill wastes, are likely to make the biggest contribution to reducing emissions. A report by the European Climate Foundation gives a sense of some of the many types of waste and residue feedstock that might be available (bearing in mind competition with other sectors of the economy: https://europeanclimate.org/wp-content/uploads/2014/02/WASTED-final.pdf

Conversely, it is clear that some types of biomass (such as the use of roundwood) can result in significant emissions, even emissions increases relative to fossil fuels over the medium term. As advised by the European Academies Scientific Advisory Council it is important to consider whether forest biomass can actually deliver emissions savings within timescales compatible with a 1.5 degrees goal.

4. Aside from GHG emissions, what evidence is there of other sustainability impacts associated with imported biomass or other biofuels? What evidence is there for how these might change as a function of scaling up supply (from the US, and internationally)?

Biomass and biofuels can often have significant impacts upon the natural environment and biodiversity. Direct and indirect land use change can put increased pressure on habitats that are already at risk from other drivers of change. The conversion of land to intensive crops, or increased deforestation from natural forests, can cause harm to wildlife and the integrity of habitats and ecosystems.

This is particularly problematic if it occurs in areas that are very important for biodiversity. For example, in 2016 the US southeast coastal plain was declared the world's 36th biodiversity hotspot by Conservation International. This is where a large proportion of harvesting for biomass destined for UK and EU power stations is occurring. Where reforestation occurs, it often results in the replacement of naturally regrown hardwood forests with pine plantations, having a negative impact on biodiversity.

A number of reports and studies by the Natural Resources Defense Council highlight the impact the wood pellet industry is having on forests and their biodiversity in the southeast US: https://www.nrdc.org/sites/default/files/southeast-biomass-exports-FS.pdf; https://www.nrdc.org/sites/default/files/ene_09091601b.pdf; https://www.nrdc.org/sites/default/files/wood-pellet-biomass-pollution-FS.pdf.

Meanwhile investigations by NGO Dogwood Alliance continue to highlight the ongoing incursion of the wood pellet industry into ecologically rich and precious wetland and hardwood forests in the same area: https://www.dogwoodalliance.org/wp-content/uploads/2015/06/Wetlands-Logging-Investigation-Flyer.pdf

Meanwhile, the UK's drive for bioenergy has come from the EU's Renewable Energy Directive. But this push for bioenergy sourced within Europe is having environmental impacts too. In order to avoid impacts on biodiversity, the available biomass resource may need to be significantly constrained. Estimates by the Institute for European Environmental Policy show that space for energy crops across Europe may be significantly constrained by taking a precautionary approach that avoids harm to biodiversity. Even then, substantial uncertainty remains regarding the quantity of spare land that may genuinely be available, and some of this may still have environmental impacts if used: http://www.birdlife.org/sites/default/files/attachments/IEEP_2014_Space_for_Energy_Crops_0.pdf

BirdLife Europe has published a series of case studies of the impacts of biomass and biofuels on the environment across Europe: https://www.birdlife.org/sites/default/files/bbb_3.2_web_lowres.pdf This study shows that increased harvesting from Europe's forests and conversion of land to crops can cause significant environmental harm.

The increased use of palm oil in European biofuels is having a significant impact on the biodiversity-rich forests of southeast Asian countries such as Malaysia and Indonesia. NGO Transport and Environment have found that palm oil is constituting a growing proportion of biofuels used in the EU: https://www.transportenvironment.org/sites/te/files/publications/2016_11_Briefing_Palm_oil_use_continues_to_grow.pdf
The use of palm oil has been linked to significant environmental destruction in southeast Asia putting not only rich carbon stores in peatland forests but also rare wildlife and habitats at risk: https://www.greenpeace.org/seasia/Global/international/publications/forests/2017/Still-Cooking-the-Climate.pdf

Climate change is the greatest long-term threat to wildlife. Significant efforts are needed to urgently reduce emissions. The use of biofuels and biomass that fail to deliver emissions savings or even result in emissions increases undermine these efforts. Therefore, an indirect impact of the use of high-carbon biomass and biofuels is to worsen climate change.

Sustainability policy and certification

The sustainability framework for bioenergy in the UK has evolved significantly since 2011. Changes have included the tightening over time of lifecycle GHG emissions limits for bioenergy supported under Government incentive schemes, changes to EU rules on liquid biofuels and the development of certification schemes. Nonetheless questions remain regarding the current framework's capacity to guarantee high sustainability standards.

The term 'sustainability framework' refers here to the policies, regulations and incentives in place to promote bioenergy sustainability in the UK.

6. What are the strengths, weaknesses and gaps of the current sustainability framework for bioenergy in the UK? How could the current sustainability framework for bioenergy in the UK be improved to address these issues?

- The main gap in the existing sustainability framework is that it does not fully account for greenhouse gas emissions: namely Indirect Land Use Change (ILUC) emissions are not accounted for (in the case of biofuels for transport) and the emissions from combustion of biomass for heat and power are ignored (because it is assumed they will be fully accounted for in the land use emissions accounting sector).
- At present particularly problematic is that under the Renewables Obligation only 70% of feedstock has to be both legal and sustainable; the remaining 30% can be legal alone (but does not have to meet the sustainability standards).
- A regional risk approach is used for assessing the potential sustainability risks of biomass. This approach is applied at far too coarse a scale in order to be able to identify potential on-the-ground impacts to the environment.
- The use of bespoke evidence (an alternative to PEFC or FSC certification) to prove sustainability allows operators to use far too broad and weak a range of

measures. The RSPB considers that only FSC certified wood provides sufficient protection for the natural environment and wildlife.

8. What certification schemes currently represent 'best practice'? Why?

The RSPB considers that FSC is the only global forest certification system that has widespread support from environmental organisations due to the nature of its requirements for the production of national forest management standards and their audit at site level, combined with transparent and rigorous 'chain of custody' for product traceability. FSC also includes social, environmental as well as economic representation at all levels of policy making, standard development and auditing, as well as having robust complaints procedures. We welcome FSC improving its traceability 'chain of custody' requirements to include tree species on documentation as well as origin.

9. Ofgem has set out approaches to calculating bioenergy GHG emissions for demonstrating compliance with the 'GHG Criteria' under the Renewable Obligation sustainability standards. Are these approaches adequate? Why/why not? How could they be improved?

At present the emissions caused by burning biomass are not accounted for under this methodology because they are supposed to be captured by the land use emissions accounting rules. However, those rules are flawed, meaning that some emissions from biomass are never accounted for. When it comes to forest biomass, this problem is compounded by rules for accounting for emissions that contain loopholes: as a result, significant quantities of emissions are never accounted for. The current EU and international LULUCF rules for accounting for emissions contain several specific weaknesses. These weaknesses result in large quantities of emissions generated from the use of forest biomass for energy never being accounted for.

One way we advocate that a practical approach to prevent the use of high-carbon biomass feedstocks (such as roundwood) would be to make them ineligible for financial support. The scientific evidence is now very clear that using these types of feedstocks may deliver emissions savings in the long term but rarely or never deliver emissions savings within the very short time frames required to mitigate climate change. In fact, there is very clear evidence that many types of biomass that are currently used at scale (such as whole trees) can increase emissions relative to fossil fuels or deliver at best meagre emissions savings.

10. Please highlight any further measures you feel are required to ensure bioenergy feedstocks used in the UK are sustainable and deliver significant life-cycle GHG emissions savings. Why are these measures needed?

There are a number of key measures that would enhance the sustainability of bioenergy feedstocks and ensure that they deliver significant greenhouse gas emissions savings:

- Rule out high carbon feedstocks, particularly the use of stumps and roundwood.
- Account for Indirect Land Use Change emissions when calculating the lifecycle emissions of biofuels used for transport.
- Apply robust sustainability standards to 100% of feedstock (as opposed to the current 70%).

11. Some large UK users of imported biomass use a risk-based approach to assess the sustainability risks associated with importing biomass from specific jurisdictions. What is the role for these approaches?

The RSPB is extremely concerned that risk-based approaches ignore the reality on the ground and operate at far too coarse a spatial scale. Therefore, they can miss significant on-the-ground impacts on the natural environment. Risk-based approaches should be replaced by evidence gathered at the supply-base or stand level.

Supply of bioenergy feedstocks

In our 2011 Bioenergy Review we considered scenarios for the amount of sustainable bioenergy resource available to the UK over the coming decades. Our central 'Extended Land Use' scenario suggested that around 10% of the UK's primary energy demand could be met from bioenergy in 2050, with over half coming from domestic feedstocks. We are now looking to develop new supply scenarios through to 2050 to reflect the latest evidence on sustainability and different assumptions about the potential future availability of imported and domestically produced bioenergy resources.

To support the development of these scenarios and our wider work, the CCC is currently undertaking new analysis on how the use and management of land in the UK can deliver deeper emissions reduction and increased sequestration. This analysis will provide updated data on the potential supply of non-waste and non-food bioenergy resources from UK sources. For projections of international bioenergy resources and waste-based UK bioenergy resources we will review the latest evidence and publicly available literature. We are particularly interested in quantitative estimates of resource potential, broken down by feedstock type, that are underpinned by explicit assumptions relating to sustainability.

13. What is the latest evidence relating to the availability of 'marginal' and abandoned agricultural land for growing bioenergy crops (where possible, reflecting broader sustainability requirements e.g. water stress, biodiversity, social issues)? Is this evidence adequately reflected in global resource estimates?

In 2014 the Institute for European Environmental Policy published a study examining the space for energy crops across the EU, taking into account the potential availability of 'spare' or 'marginal' land and potential impacts on biodiversity (http://www.birdlife.org/sites/default/files/attachments/IEEP_2014_Space_for_Energy

_Crops_0.pdf). The study concluded that, while it was able to constrain the amount of land due to potential environmental impacts, the data on spare land was not of a high enough quality and even the small area of spare land available may still result in an adverse environmental impact. It is important to note that economically marginal and abandoned agricultural land can have high biodiversity value.

15. What factors (opportunities, constraints, assumptions) should the CCC reflect in its bioenergy resource scenarios through to 2050?

The Committee on Climate Change should in part take a spatial approach to the development of bioenergy resource scenarios. In 2016 the RSPB published its Energy Vision reports, using an innovative, peer-reviewed spatial mapping technique to examine where renewable energy might be deployed across the UK with a low environmental risk .(http://ww2.rspb.org.uk/Images/energy_vision_summary_report_tcm9-419580.pdf). It showed that there could only be a limited role for sustainable bioenergy in the UK's energy system.

The Committee should also note many scenarios for meeting the 1.5 degrees Paris target rely upon significant deployment of BECCS. However, the use of BECCS at the scale suggested by these scenarios would have significant consequences for the natural environment through land use change and water use alone. In addition, the Committee should consider the extremely important carbon storage and sequestration role that natural forests (and other ecosystems) can play when protected and restored instead of harvested for energy.

The Committee on Climate Change should also consider that just because a certain amount of biomass resource is available, the UK does not necessarily need to use all of it**. Evidence strongly suggests that the greatest greenhouse gas emissions savings can be achieved by those energy mixes with the smallest proportions of bioenergy** (https://ec.europa.eu/energy/sites/ener/files/documents/EU%20Carbon%20Impacts%20of%20Biomass%20Consumed%20in%20the%20EU%20final.pdf). Furthermore, evidence clearly shows that, even when intermittency costs are factored in, biomass will very soon be more expensive than wind or solar power in the UK. Therefore, investing in bioenergy deployment may be a more costly decarbonisation pathway than a different renewables mix (https://www.nrdc.org/sites/default/files/money-to-burn-ii-uk-biomass-fs.pdf).

Scaling up UK sustainable supply

An objective of our current work on bioenergy is to better understand and reflect the potential for scaling-up of the supply of sustainably produced domestic (UK) bioenergy resources through to 2050. We aim to identify and develop policy recommendations for 'low-regrets' measures/strategies that can be implemented in the near term.

18. What are the main opportunities to scale-up the supply of sustainably-produced domestic bioenergy supply in the UK? Where possible please provide details on the scale of opportunity.

A recent project between the RSPB and the (then) Department of Energy and Climate Change highlights the potential for the utilisation of the biomass produced as a by-product from the management of nature conservation areas (https://ecosystemsknowledge.net/sites/default/files/wp-content/uploads/DECC%20Biomass%20to%20Bioenergy%20End%20User%20Report_0.pdf).

Habitats managed for the benefit of nature conservation are dynamic systems and in a high percentage of habitat types regular management is required to maintain them as such. This work can generate large volumes of a range of different biomass types which is generally underutilised and often a challenge and costly to dispose of.

The scale of the opportunity is estimated to be in the region of the following:

Habitat type	**Area in the UK Ha**	**Percentage of area cut annually**	**Ha cut**	**Dry Tonne per ha**	**Dry Tonnage per year**	**Calorific Value for combustion MWh/t**	**Total MWh if combusted**
Reedbed	1,287	5%	64.35	7	450.45	4	1,802
Wet grassland	7,457	75%	5592.75	4	22,371.00	4	89,484
Lowland Fen	1,665	10%	166.5	9	1,498.50	4	5,994
Upland acid grassland	21,679	10%	2167.9	2	4,335.80	4	17,343
Mixed heath (gorse, heather & bracken)	3,156	10%	315.6	3.6	1,136.16	4	4,545
		Totals			**29,791.91**		**119,168**

19. What risks are associated with scaling-up domestic supply and how can these risks be managed?

Utilisation of biomass for bioenergy from land managed for nature conservation would need to be regulated to ensure that the areas harvested were done so for biodiversity benefit and not for the generation of biomass. This risk can be managed through all management work being undertaken according to a nature conservation five-year management plan. This plan needs to be approved by the relevant governing body and will detail reasons for habitat management together with amounts and type to be carried out.

A drive to increase the UK's domestic supply of bioenergy through deployment of energy crops or reforestation or afforestation could result in significant land use change. This can have knock-on emissions impacts through indirect land use change and could also have significant direct impacts on natural habitats. In areas where industrial afforestation takes the place of land formerly used for agriculture, there may be an opportunity cost as this land could potentially be converted to woodland habitats, which may result in greater biodiversity benefit. If afforestation takes place on peatlands the net carbon impact could be damaging for the climate.

20. What 'low-regrets' measures should be taken now (e.g. planting strategies) to increase sustainably-produced domestic bioenergy supply?

The RSPB considers that one low-regrets measure would be to take advantage of nature conservation arisings (as detailed above).

Best-use of bioenergy resources

Our 2011 review developed a hierarchy of appropriate uses for bioenergy feedstocks based on minimising costs and maximising abatement. We concluded that if CCS technology is available it is appropriate to use bioenergy in applications with CCS, making it possible to achieve negative emissions under the right circumstances. This could include power and/or heat generation, hydrogen production, and biofuels production for use in aviation and shipping. If CCS is not available, bioenergy use could be skewed towards heat generation in energy-intensive industry, and to biofuels in aviation and shipping, with no appropriate role in power generation or surface transport. In either case, we concluded the use of woody biomass in construction should be a high priority given that this can potentially secure negative emissions through a very efficient form of carbon capture.

We are now looking to update this analysis to reflect the latest technological and market developments. We are particularly interested in technologies such as biomass gasification, CCS and advanced second and third generation biofuels as well as the potential role of hydrogen to support decarbonisation across the economy. To support our consideration of these areas, the CCC is currently undertaking analysis into the potential of the hydrogen economy and we are planning to undertake further investigation into non-energy uses of bioenergy resources.

24. Bioenergy with Carbon Capture and Storage (BECCS) has been identified as a key potential mechanism for achieving the UK's 2050 carbon target due to the 'negative emissions' it could offer.

    a. What are the main barriers and uncertainties associated with the development, deployment and use of BECCS?

The deployment of BECCS poses significant risks to the natural environment due to the scale of land use change that would be required to have any meaningful impact on the concentration of carbon dioxide in the atmosphere.

It is clear that if negative emission technologies (NETs) are used to remove significant amounts of carbon dioxide from the atmosphere then they need to be deployed on a large scale. In the case BECCS and afforestation which are used in

87% of the 2°C scenarios reviewed in the IPCC AR5 this will involve using a lot of land - the most extreme case used nearly half of the earth's land surface area.

Land is not, however, the only thing that could be affected. All NETs typically use either a lot of land or water or energy or nutrients or money or several of these at once. Indeed, some could significantly affect albedo (the reflectance of the Earth's surface) which in turn could affect global heat balance and hence warming or cooling.

A paper published in 'Nature' in recent days draws attention to the conflict between negative emissions technologies like BECCS and the concept of 'planetary boundaries' that may be breached by its environmental impacts (https://www.nature.com/articles/s41558-017-0064-y.epdf?referrer_access_token=FyHZ6WYmSKjlBrKhCtNeHdRgN0jAjWel9jnR3ZoTv0OkhNv1HkUO82XZFYuXtY4ghzZ93ua-L9-FMDelOMcCTnQQIDQ8i5DSWVrqPPYEtdYoAWS1ODx6Qt54NV6SFX5W7N2bHUXgqlRxVW_UYKkdyg1kTAf3DIW8IU3gRdmWlgJFadYhnGLdAWFCzefSt47Bk67WNjI90Z24KPEhRya54qyLrr_vI0CIiOeG0bZOp8YlwoMQgUJVL5WWPXZWxFH12jTn2gSgkhGIUu60_T-p3AyA0KrmOaATzDR-a4SVNiCBecjHhfVMnBza6SzHrTzoNTphuOn-_RMiD3EBfEcCKg%3D%3D&tracking_referrer=www.washingtonpost.com&tid=a_mcntx).

A further paper published in 2016 highlights the significant natural barriers there are to large-scale deployment of negative emissions technologies such as BECCS (https://www.nature.com/articles/nclimate2870).

b. What are the risks associated with the pursuit of BECCS that go beyond the risks that relate to supplying sustainable feedstocks and CCS more generally? How can these be managed?

In addition to the supply of sustainable feedstocks, BECCS poses a significant risk to climate action, since it could encourage delaying action today in favour of unproven emissions reductions in the future. This could unwittingly lock the planet into a higher emissions trajectory and put at risk chances of meeting a 1.5 degrees or 2 degrees target.

25. Once developed BECCS is a technology that could be deployed in many different countries around the world. What principles and mechanisms should be used to determine where BECCS is deployed and how any associated negative emissions are accounted for? Should any UK participation in any international BECCS scheme be counted as additional to efforts to meet domestic carbon budgets?

The Committee on Climate Change has previously made it clear that its view is that the UK should focus on and prioritise domestic action to reduce emissions (https://www.theccc.org.uk/wp-content/uploads/2016/10/UK-climate-action-following-the-Paris-Agreement-Committee-on-Climate-Change-October-2016.pdf). Given this, the RSPB considers that any participation in an international BECCS scheme should not be counted as a contribution towards the carbon budgets targets. Instead, the carbon budgets should be met through domestic action. Relying upon international schemes such as BECCS risks delaying action to reduce emissions now, which is worse for the climate, and action in the future may be more expensive than action today.

26. There is currently substantial interest in the development of 'advanced' biofuels for use in sectors such as aviation, shipping and/or heavy duty transport.

    c) What are likely to be the optimal feedstock types for advanced biofuel technologies?

The best feedstocks are wastes and residues that have no other competing use. A study by the European Climate Foundation identified available and appropriate waste and residue feedstocks at the European level, as well as the appropriate environmental constraints on the use of these resources (https://europeanclimate.org/wp-content/uploads/2014/02/WASTED-final.pdf). Similar types of feedstocks that minimise environmental impacts would be the best resources for advanced biofuels in the UK.

    a) What risks are associated with the pursuit of advanced biofuel technologies and how can these be managed?

Like other biofuels, advanced biofuels can pose risks to the natural environment, particularly if they are a by-product of a harmful environmental process or if their use undermines natural processes. For example, the use of some waste straw is important for restoring soil nutrients, so it is important that it is not all diverted to energy uses.

27. In 2015 the Government published the Industrial Decarbonisation and Energy Efficiency Roadmaps to 2050. These Roadmaps explored decarbonisation options across multiple industrial sectors and the estimated deployment potential, timescales, cost data and abatement for each option (including bioenergy). Are there any substantial changes from these estimates that the CCC should consider when assessing abatement options in industry? If so please provide your reasoning and details of any recent evidence that relates to these changes.

The RSPB is very concerned that the Roadmaps place a very significant reliance upon bioenergy in order to achieve decarbonisation which may overestimate the availability of sustainable biomass. It is quite right for any sustainable biomass resource to be directed towards hard to decarbonise sectors such as heavy industry. However, competition for this scarce resource needs to be accounted for, and other sectors of the economy may already be targeting it.

29. There are also a number of other potential non-energy uses of bio-feedstocks including bio-based plastics and bio-based chemicals.

b. What are the barriers to increasing these non-energy uses and how can these barriers be overcome?

One of the main barriers to increasing the use of bio-based plastics or chemicals is the competing demand from other industries and the constraints on land availability. Whether for biofuels for transport, for BECCS or for bioplastics, generating biogenic resources can cause an increase in harvesting from existing ecosystems and habitats or drive land use change (direct and indirect) through conversion to crops or trees.

a. What risks are associated with the pursuit of other non-energy uses of bio-feedstocks and how can these be managed?

Deploying bio-based resources for non-energy uses could have significant environmental impacts because it can drive the same types of land use change associated with energy uses.

For example, many bioplastics are based on the use of purpose-grown crops (similarly to biofuels for transport). We can usefully learn lessons from the environmental impacts already caused by crop-based biofuels.

The deployment of crop-based biofuels has resulted in significant impacts on the natural environment. Around 80% of bioplastic feedstock growth is predicted to take place in Asia (http://www.foeeurope.org/position-paper-bioplastics-circular-economy-190116). The growth of biofuel crops such as oil palm has already had devastating effects on habitats and wildlife in countries such as Malaysia and Indonesia, as well as elsewhere in the world. Further pressure from the production of bioplastic crops could increase these impacts on extremely rare and sensitive ecosystems.

There is strong dispute over claims about the quantity of 'abandoned' or 'degraded' land that could be used for crop production and isn't already vital for wildlife, people or carbon sequestration (http://www.wri.org/sites/default/files/avoiding_bioenergy_competition_food_crops_land.pdf). An IEEP assessment (commissioned by Birdlife Europe) of the available land for energy crops in Europe concluded that there is a very limited amount available (http://www.birdlife.org/sites/default/files/attachments/IEEP_2014_Space_for_Energy_Crops_0.pdf).

If the land on which bioplastic crops are grown is converted from a high-carbon type (such as unimproved grassland or forest), or if food or feed crops are displaced and grown elsewhere (causing indirect land conversion) then bioplastics will have a very significant greenhouse gas impact.

This has been the experience with the use of biofuels for transport. Recent research by the European Commission has found that biofuel crops have, in many cases, had a significant negative carbon impact since their introduction

Most biodegradable or bio-based plastics require specific industrial conditions to ensure their proper recycling or degradation. The replacement of some petroleum-based material with plant-based material may make it possible to recycle an item but may not make it biodegradable. No product has yet been approved as biodegradable under marine conditions.

The incineration, anaerobic digestion or landfilling of bioplastics can all result in the release of carbon dioxide or methane (23 times more powerful as a greenhouse gas than carbon dioxide) emissions.

GHG emissions reporting and accounting

GHG emissions reporting rules for bioenergy are different to those for other forms of energy. Emissions relating to the use (combustion) of bioenergy resources are not reported in the country of use but rather in the country where bioenergy resources are produced. Only Annex 1 countries under the Kyoto Protocol currently account for land-use emissions as part of binding emission reduction targets. In addition under Paris Agreement rules emissions (as under the Kyoto Protocol) will be reported against land-use baselines that may already assume a degree of land-use change. For these reasons and others, bioenergy GHG accounting has been criticised for not properly reflecting the impacts of bioenergy.

30. What are the strengths and weaknesses of the current approach to GHG emissions accounting for bioenergy in the UK and internationally? Specifically, what are the main gaps in the current land use emissions accounting rules?

The existing UK rules for accounting for emissions from biomass used for heat and power do not account for the emissions released by the combustion of the feedstock. Instead only transport and processing emissions are accounted for. In the case of solid woody biomass this is because emissions from forest management are supposed to be accounted for in the land use (LULUCF) emissions sector rather than the energy sector. However, as described below, the land use emissions accounting rules are fundamentally flawed and the emissions are not properly accounted for. In addition there is an incorrect perception or assumption among many decision-makers that bioenergy is automatically low or zero carbon because of the carbon dioxide absorbed while the vegetation has been growing.

For transport biofuels, indirect land use change (ILUC) emissions remain unaccounted for, despite the fact that these are a significant source of emissions. In fact, they mean that many types of biofuels deliver meagre emissions savings or even result in emissions increases relative to the petrol and diesel that they replace. The European Commission has published clear evidence showing this (https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf)

This means that biofuels and biomass appear far less carbon intensive than they actually are and are thereby perversely incentivised.

When it comes to forest biomass, this problem is compounded by rules for accounting for emissions that contain loopholes: as a result, significant quantities of emissions are never accounted for. The current EU and international LULUCF rules for accounting for emissions contain several specific weaknesses. These weaknesses result in large quantities of emissions generated from the use of forest biomass for energy never being accounted for. Two reports published by research institute Chatham House highlight these weaknesses: https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2017-02-23-woody-biomass-global-climate-brack-final2.pdf; https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/2017-02-23-impacts-demand-woody-biomass-climate-forests-brack-final.pdf

There are some key ways in which these weaknesses arise:

- The use of projected reference level baselines. Developed country parties to the Kyoto Protocol decided to set projected reference level baselines for accounting for land use emissions. Instead of accounting against a historical baseline, countries are allowed to project the future level of emissions they predict on the basis of a business as usual scenario. Any emissions under this baseline are not accounted for. And any saving against this baseline are seen as an emissions reduction. Meanwhile, only emissions exceeding the projected baseline are ever accounted for. If policies encouraging the use of biomass for energy are included within the projected baseline then these emissions will not be accounted for. Of the 35 countries under the Kyoto Protocol accounting for forest management emissions, 32 of them have opted to use projected reference levels based on business as usual scenarios.
- Some countries which are not party to the Kyoto Protocol (such as the USA) and all developing countries do not account for their land use emissions at all as part of the international framework. If forest biomass is imported from these countries then the carbon impacts of forest harvesting will not be counted in the country of origin. Meanwhile, if the country using the biomass for energy does not count the emissions from the combustion, then these emissions may never be accounted for at all, even though their effect on the climate is very real.
- If a historical reference level is used it may reflect past emissions that are higher than emissions levels today. Therefore, there will actually be headroom within which emissions could increase without breaching the baseline.

31. What are the risks, in terms of GHG emissions, associated with importing biomass or other biofuels from countries that have not committed to limiting or reducing emissions under the Kyoto Protocol or Paris Agreement? How can these risks be managed?

The risks of importing biomass or biofuels from countries not accounting for land use emissions is that the emissions released by the use of these fuels may never be accounted for. The biofuels or biomass may therefore appear to be low-carbon when it may not be. This can perversely incentivise the use of high-carbon biomass for energy purposes. For example, high-carbon forest biomass is currently being imported from the US to the UK in the order of millions of tonnes of wood per year. While the evidence clearly shows that this type of biomass is high-carbon, it is perceived as low-carbon when used in the UK energy system.

For example, in the 12 months July 2015-June 2016, the UK imported 5.5 million tonnes of biomass from the US and Canada. If all of this was used for energy, then up to 7.8MtCO2 may have gone 'missing', never being accounted for in the countries of origin nor in the country of use for energy. Meanwhile, Finland uses significant amounts of domestically harvested wood for energy, but it accounts for its forest management emissions against a projected reference level baseline. Because increased harvesting from bioenergy is built into this baseline, significant quantities of emissions are not being accounted for (i.e. only emissions exceeding the projected reference level will be formally counted as an emission). By 2020, up to 21MtCO2 could go unaccounted for in Finland due to the design of the land use emissions accounting rules. These figures come from the reports published by Chatham House.

One way to address this risk is to rule out high-carbon biomass feedstocks, such as banning the use of whole trees and stumps. Many of the companies currently using biomass are increasingly confident in their claims that they can rely in large part on wastes and residues. Therefore, ruling out the high-carbon feedstocks should prove relatively unproblematic.

Meanwhile, efforts should continue at the EU and United Nations level to fix problems with the rules for accounting for emissions. These rules need to comprehensively cover all countries, and the use of projected reference level baselines should be abandoned in favour of the universal adoption of accounting against a historical base year or base period.

32. What alternative method(s) for bioenergy emissions accounting should be considered? What would the implications of these alternative method(s) be?

If these emissions continue to go unaccounted for in the land use sector (and the rules are not fixed) then one alternative could be to account for the emissions in the energy sector. However, such an approach may be complex and would have implications for land use sector accounting as well.

Even if the UK were not to formally account for the emissions from biofuels and biomass in the energy sector, it could nonetheless introduce proxy accounting, and rule out feedstocks not meeting a certain level of emissions reductions (based on full accounting) within a given climate-relevant timeframe. For example, emissions reductions that will be delivered in 20 or 30 years by woody biomass are too late for meeting 2050 goals to reduce emissions, as we need to be urgently cutting emissions from our energy sector today.

Indicators

As part of the 2018 Bioenergy Review the CCC is planning to develop a set of indicators to track progress towards key bioenergy outcomes. We envisage these will cover key areas such as sustainability, policy development, supply and best-use.

33. What key areas should be reflected in these indicators?

Selecting appropriate indicators would only be possible once the key outcomes are clear. The RSPB would be very concerned if some outcomes potentially cause adverse impacts on the climate or natural environment, or that drive the scale of bioenergy use beyond sustainable levels. For example, if any outcomes are linked to increasing the contribution of bioenergy this could perversely drive increases in quantity (beyond sustainable limits) instead of providing a focus on quality.

- Impact on biodiversity and the natural environment: is there a risk that the biomass being used could have a harmful impact on habitats or biodiversity. This should require an assessment at the most granular scale possible (for example, regional level assessments of risk are too broad-scale in order to identify potential impacts on-the-ground). Where on the ground data are not made available this should be considered to represent a greater risk to the natural environment.
- Harm to ecosystem integrity: does the harvesting or production of the biomass pose a risk to ecosystems and the services they provide to people.
- Genuine emissions reductions (whether or not the source of bioenergy creates a real emissions reduction compared to other energy options, **taking into account land use change, foregone sequestration and loss of carbon stocks**). Wherever possible, the full emissions should be quantified.
- Emissions payback timeframe – if an emissions reduction is achieved, what timeframe is it delivered within. Strong consideration should be given to this, since delaying emissions reductions today will result in greater costs in the future, both financially and to the climate.
- Efficiency of use: is the biomass feedstock being used in the most efficient way possible to generate energy.
- Efficiency of use: could the biomass feedstock have been used in other ways (reused, repaired, recycled) prior to its use for energy.
- Competition with other sectors of the economy: is the use of any biomass feedstock for energy competing with its use by another sector of the economy.