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.

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.

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?

3. Currently the UK imports a significant proportion of wood pellets for biomass electricity production from North America, particularly the south-east USA.

    a) What are the wider market impacts of demand for wood pellets on forestry management practices and carbon stocks at the landscape level in North America?
    b) What evidence is there that wood pellet production displaces other uses of forestry products in North America? (e.g. panel board or lumber production)
    c) What are the most likely alternative/counterfactual uses of forestry products used for wood pellet production?
    d) How are these wider market impacts (sub-questions a-c) likely to change over time if demand for wood pellets significantly increases?

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)?

5. Are there any benefits resulting from importing biomass or other biofuels into the UK (e.g. development benefits)? How might these vary internationally? What are the conditions required for any benefits to be realised?

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?

7. Ofgem has identified a number of certification schemes that it considers appropriate for demonstrating compliance with the 'Land Criteria' under the Renewable Obligation sustainability standards. Are these certification schemes adequate? Why/why not? How could they be improved?

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

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?

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?

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?

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.

12. What are the most credible and up-to-date estimates for global bioenergy resource potential through to 2050, broken down by feedstock type? What key assumptions underpin these estimates?

In most of the long-term biomass resource evaluations, such as the one from the IEA, yield increases are considered to continue based on past trends. This should be seriously questioned, as we will be seeing more extreme weather patterns and perhaps some agricultural regions will become less productive due to climate change. Also, the assumption that the yield gap is significantly narrowed between the developed and developing world is a big assumption which affects the end results significantly. Dietary shifts are often not properly accounted for (and difficult to estimate). This is especially relevant regarding shifts to diets with more meat in the developing world which would lead to a higher land use need for the cultivation of feed. Due to these concerns the amount of land available for bioenergy or biomass production remains highly uncertain.

Please provide details of any assessments of global bioenergy resource explicitly tied to sustainability standards (covering GHG emissions, biodiversity, water use, land-use, land-rights, air-quality and other social and environmental issues)

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?

The IEEP (Institute for European Environmental Policy) has looked into the availability of marginal and abandoned land coming to the conclusion that there is insufficient data on these at EU level. Also agricultural land is abandoned for many reasons and it can also have significant biodiversity value. Thus, the assumption that all there is plenty of "abandoned" land available for bioenergy purposes is incorrect. The economics of using marginal or abandoned land also needs to be included into the potential estimates.
https://ieep.eu/publications/farmland-abandonment-in-the-eu-an-assessment-of-trends-and-prospects
https://ieep.eu/uploads/articles/attachments/529ee411-8fdf-4698-a95c-1c59c8cfe7b3/land_abandonment_Final_report.pdf?v=63664509698
https://ieep.eu/uploads/articles/attachments/4ac6cfa9-fdfc-4cbc-b906-06c0d179c1cd/IEEP_2015_Land_scoping_Study.pdf?v=63664509934

14. What are the most credible and up-to-date estimates for the amount of bioenergy resource that could be produced from UK waste sources through to 2050? Where possible please state any assumptions relating the reduction, reuse and recycling of different future waste streams.

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

16. What should be the assumptions on the share of international resource which can be accessed by the UK (e.g. per capita, current or future energy demand)?

17. What are the prospects for the development and commercial production of 3rd generation bioenergy feedstocks (e.g. algae)? What are the timescales, costs, risks, opportunities and abatement potential of using algae to make biofuels?

When considering algae production for biofuels one needs to consider the water usage and risk of invasive algae species entering the natural water ways.

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.

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

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

21. What international examples of best-practice should the UK should look to when considering approaches to scaling-up domestic supply?

22. What policy measures should be considered by Government to help scale-up domestic supply?

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.

23. Gasification has been identified as a potentially important technology for unlocking the full potential of bioenergy to support economy-wide decarbonisation.
    a) What are the likely timescales for commercial deployment of gasification technologies?
    b) What efficiencies and costs are likely to be achieved? What scope is there for improvement and/or cost reductions over time? Please differentiate between feedstocks where possible/necessary.
    c) What are the main barriers and uncertainties associated with the development, deployment and use of gasification technologies?
    d) What risks are associated with gasification technologies and how can these be managed?
    e) What policies and incentives are required to facilitate commercial deployment?

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 potential timescales for commercial deployment of BECCS technologies?
    b) What are likely to be the optimal uses of BECCS (e.g. electricity generation, hydrogen production)?
    c) What efficiencies and costs are possible?
    d) How will performance and cost differ according to feedstock type? What are likely to be the optimal feedstock types for BECCS? What are the implications for domestic supply vs imports (e.g. feasibility, considerations in scaling up over time)?
    a. What are the main barriers and uncertainties associated with the development, deployment and use of BECCS?
    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?

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?

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.

a) What are the most promising technologies/processes for advanced biofuel production up to 2050? Please provide details on each technology/process including advantages/disadvantages, timescales for commercial deployment, feedstock type, fuel type and end-user.

HVO is often described as the "market ready" advanced technology. But if the technology is sometimes considered "advanced", it doesn't mean that the feedstocks used for producing HVO biofuels enter the category of "advanced" fuels. Availability of sustainable feedstock sources is limited and many already have existing uses (often higher in the waste hierarchy) which should not be displaced. The use of crude palm oil and PFAD for the production of HVO is very damaging for the climate. Advanced ethanol (cellulosic and ligno cellulosic) development has not taken up partly because conventional ethanol is dominating the small market segment allowed by the blending limits. The development of biomass-to-liquid technologies remains uncertain due to the limited availability of sustainable biomass. The focus of policy support should only be on biomass residues, not leading to increasing harvesting levels in forests directly or indirectly.

The following study by ICCT looked at different advanced biofuels and their potential contributions to different policy options until 2030. It shows that the type of target also impacts the fuels supported, with GHG targets delivering a different biofuels mix than a volume target. https://www.theicct.org/sites/default/files/publications/RED-II-Analysis_ICCT_Working-Paper_05052017_vF.pdf

b) What efficiencies and costs are likely to be achieved? What scope is there for improvement and/or cost reductions over time? Please differentiate between technologies/processes.

As the cost of the fuels is very much dependant on the raw material cost, there is no major price decrease foreseeable. The feedstock price for advanced biofuels at the point of origin is unlikely to go down, an upward shift is more likely as demand increases. The logistics costs for the geographically spread out waste and residual biomass are significant. There is some reduction potential due to better logistics but a major decrease is unlikely. The capital costs should go down as more plants are built, as the first of a kind plants are more expensive, and building prices become cheaper as we move along the learning curve.

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

Advanced biofuels should be developed only from waste and residual biomass, respecting the waste hierarchy and cascading use principles. This limits the amount of contributing feedstocks, but ensures higher overall GHG savings, as displacement emissions would be low. Respecting the waste hierarchy and cascading use principles allows also more space for development in the non-energy parts of the bioeconomy.

The following study looked at the displacement emissions of different biofuels feedstocks. Displacement emissions need to be considered when setting a longer term policy for advanced biofuels. This issue is as important as the indirect land use change (ILUC) for crop biofuels. To avoid repeating the same mistakes with the new generations of biofuels, all GHG emissions – including the ones from displacement - need to be taken into account. https://www.theicct.org/sites/default/files/publications/Waste-not-want-not_Cerulogy-Consultant-Report_August2017_vF.pdf

d) What are likely to be the optimal end-uses of advanced biofuel technologies?

Use of advanced biofuels should also be channelled to sectors which are hard to electrify. Where direct use of electricity is possible, it provides a much more efficient way of transport.

e) What are the main barriers and uncertainties associated with the development, deployment and use of advanced biofuel technologies?

Sustainability certainty is a major risk. Hence, from the beginning, it is essential that several safeguards, including the waste hierarchy, are followed. This also means that feedstocks considered now for advanced biofuels might not be used so much in the future, as better uses for them may be developed in the material or feed sector.

If the waste hierarchy is not followed you will create displacement emissions, as the raw material previously used in another sector needs to be replaced by something else. These emissions can be quite significant for some advanced biofuel feedstocks.
https://www.theicct.org/sites/default/files/publications/Waste-not-want-not_Cerulogy-Consultant-Report_August2017_vF.pdf

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

The main risk lies in using unsustainable raw materials. This would also damage the reputation of the industry, and create a lower public acceptance. This risk can be managed by ensuring that only real wastes and residues are used from the beginning while following the waste hierarchy and cascading use principles.

g) What policies and incentives are required to facilitate commercial deployment of advanced biofuels?

A prerequisite for any incentives is that advanced biofuels are produced from wastes and residues and subject to robust sustainability criteria and that their climate impact is significantly better than a fossil fuel. The proposed Commission target (3.6%) at EU level is already very high and we recommend to set incentives at lower levels, which are in line with sustainable availability. A mandate may be required to encourage their supply into the aviation sector, as a multiplier as part of the REDII results in additional costs being met by the road sector. However, such a mandate should NOT increase the total volumes of renewable fuels supplied through the REDII.
https://www.transportenvironment.org/publications/target-advanced-biofuels
https://www.transportenvironment.org/sites/te/files/publications/2017_09_Aviation_REDII_final.pdf
https://www.theicct.org/publications/alternative-jet-fuel-development-and-deployment-north-america

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.

28. In our 2011 review we identified wood in construction as a potentially effective method of CCS and a high priority 'non-energy' use in our best-use hierarchy.
    a. What lifecycle GHG emissions savings can be achieved by using WIC? Under what circumstances does WIC fail to deliver GHG emissions savings? Please consider the full range of impacts associated with using WIC including substituted product emissions (e.g. cement), product equivalence (impacts on co-products), end-of-life options and biogenic carbon storage.
    b. What is the potential for increasing the amount of wood used in construction in the UK? What are the barriers and how can they be overcome?
    c. What is the potential for using UK-produced timber in construction rather than imports? What are the barriers and how can they be overcome?
    d. What is the expected lifetime of different wood products in construction (e.g. cross-laminated timber)?
    e. What currently happens to wood in construction at the end of its useful life? What other viable options should be developed?

29. There are also a number of other potential non-energy uses of bio-feedstocks including bio-based plastics and bio-based chemicals.
    a. What other non-energy uses of bio-feedstocks have the most potential through to 2050 in terms of GHG abatement, cost, timescales and market size?
    b. What are the barriers to increasing these non-energy uses and how can these barriers be overcome?
    c. What risks are associated with the pursuit of other non-energy uses of bio-feedstocks and how can these be managed?

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?

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?

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

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?

34. Please provide details of any examples of international best-practice in the area of bioenergy indicators.

Other

35. Please submit any further evidence that you would like us to consider.