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A Public Dialogue on the Role of Biomass in Achieving Net Zero:

Final Report

Department for Business, Energy & Industrial Strategy

sciencewise

UK Research and Innovation

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Contents

1 Executive summary

In October 2021, in its Net Zero Strategy, the UK Government set out that biomass has a role to play in its strategy for achieving net zero emissions by 2050.[1] The Net Zero Strategy followed a call for evidence on the role of biomass in achieving net zero,[2] responses to which highlighted the need for further public engagement on the uses of biomass and associated technologies, such as Bioenergy with Carbon Capture and Storage (BECCS).

Against this backdrop the Department for Business, Energy & Industrial Strategy (BEIS), in partnership with UK Research and Innovation's Sciencewise programme, commissioned the National Centre for Social Research (NatCen) and its partner, Eunomia, to deliver a public dialogue to explore the UK public's views on the role of biomass in achieving net zero. The evidence gathered through this dialogue and presented in this report, will inform the development and implementation of the forthcoming Biomass Strategy and associated policy development.

1.1 Dialogue objectives

The dialogue was commissioned in April 2022 with fieldwork in June and July 2022, and had the following objectives[3]:

1. To engage a diverse group of participants, broadly reflective of the UK public, in topic areas relating to the development of the Biomass Strategy.
2. To explore and understand participants' aspirations and concerns in relation to biomass sourcing (both domestic and imports), production and use across the economy.
3. To understand what values and perspectives shape participants' views to inform and help refine any future communications and engagement.
4. To define conditions of use in relation to sustainability frameworks (which could include areas like land, biodiversity, environmental impacts, ecosystem services, emissions, and social criteria) to help shape policy development in this space.
5. To determine participants' views of using biomass, particularly through BECCS, as a negative emissions technology in achieving net zero, to inform policy development in this area.
6. To help shape other aspects of Government policy and guidance as part of the forthcoming Biomass Strategy, and to inform future engagement.

1.2 Dialogue process

The role of biomass in energy production and its potential use to achieve net zero targets is complex and contested. Whilst this poses challenges for how to engage the public on this topic, it also makes it well suited to Public Dialogue – allowing participants the information, time and conditions to explore evidence and inform their opinions. The dialogue brought together a diverse range of individuals, broadly representative of the UK public, online across five sessions. An initial session introduced the subject, followed by three sessions of deliberation, which focused on building knowledge on aspects of biomass sources, use, and production and deliberating and scrutinising these. A fourth session

1 Net Zero strategy (2021) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf
2 BEIS (2021) The Role of Biomass in Achieving Net Zero: call for evidence.
3 Further details on the research questions generated from these objectives to guide the dialogue process can be found in Appendix 1.

concentrated on BECCS as a negative emissions technology. The final session brought participants together to determine principles and conditions, which they felt should underscore biomass policies.

Working with an advisory oversight group ensured that the information available to participants in these sessions could offer balanced coverage of the evidence as it stands – including more settled and contested areas of debate.[4] Participants therefore received these two types of information designed to deepen their appreciation of these complex issues. Subject specialists Eunomia covered the key elements of biomass based on a rapid evidence assessment. In addition, a range of other specialists presented evidence-based perspectives from relevant agencies and sectors, including Government, NGOs, academia, and industry. They examined facets of biomass use and delivery, particularly sustainability and BECCS, as well as highlighting the wider implications of their knowledge and research.

Whilst occasionally participants reported feeling overwhelmed by detail or jargon, they demonstrated engagement with the range of information sources in their subsequent discussions – picking their way through more established, as well as more developing, evidence and views from specialists. As the report shows, they sometimes found their evidence needs unmet or wanted to discuss other topics in the process, particularly renewable technologies. Nevertheless, participants immersed themselves in the subject and entered fully into the spirit of dialogue. A total of 109 participants took part, with 95 completing all five sessions and both the pre- and post-surveys – a high retention rate.

This report captures the ways in which participants approached the subject and how their attitudes shifted over the five weeks. We elicited and analysed their views through several methods, including a pre- and post-dialogue survey and ongoing exercises held during online sessions 2-4. Together, these pathways provided insights not only into how participants' views stood in relation to biomass use by the end of the dialogue, but what factors underpinned their attitudes, and what understandings ('frames') they developed about biomass through interacting with the material and each other.

Whilst the dialogue included participants recruited from 'affected communities' – people who self-identified as impacted by biomass sourcing or bio-based energy products/bioenergy production in their local areas – the analysis found no significant differences in views or recommendations between this sample and the general population. Everyone balanced the same local, national, or global factors as they formed their views. Therefore, the attitudes of 'affected communities' are not disaggregated in this report.

1.3 Key findings

1.3.1 The role of biomass in achieving net zero

Most participants felt **biomass has a role in achieving net zero. However, levels of concern about the potential environmental impact** of how biomass is sourced and produced increased as the dialogue progressed. Fewer participants in the post-dialogue survey allocated biomass a 'large role' in the UK's net zero strategy than we saw at the start, although the majority believed that biomass should play 'some' role.

Support for using biomass was largely driven by a **desire to do everything possible to achieve net zero**. This view superseded any specific benefit participants thought biomass may offer.

In coming to these views, three common understandings ('interpretative frames') came increasingly to the surface of discussions as participants navigated biomass' potential role in net zero: **concept, implementation, and impact.**

The **concept** of biomass as a renewable technology that would help achieve net zero ambitions

4 Information about the Oversight Group, including Terms of Reference and membership, can be found in Appendix 1: Project Governance.

was counterintuitive to many participants. As participants understood more about the sourcing and production processes involved in using biomass, they became more doubtful of whether it was a good option for reaching net zero targets. Participants responded more positively to biomass when specialists described sourcing from waste, which aligned more with what they understood of the principles and value of renewable sources of energy production.

On implementation, participants expressed concerns that the Biomass Strategy could become dominated by the profit motives of the energy sector, rather than the need to achieve net zero. However, they also expressed hopes that biomass could lead to cheaper energy costs for consumers.

To understand **impact**, participants wanted certainty and, especially, a clear consensus from independent experts that biomass will positively contribute to achieving net zero. Although they heard perspectives from a broad range of specialists, the state of the evidence and the contested views in some areas did not quite give them the certainty they were seeking. Participants also heard from specialists that BECCS has not been deployed at scale, which led them to question its feasibility. Participants remained uncertain overall about the strength of the evidence base for biomass impacting net zero.

1.3.2 Preference for sourcing from waste

Participants expressed a clear preference for biomass to be **sourced from waste** above the other sources they were presented with during the dialogue, which included food and feed crops, perennial energy crops, forestry residues and marine sources. When explaining their views, participants referred to some or all of the following reasons:

- Waste sourced from the UK, rather than imported from abroad, was viewed as a more reliable means of supply, with a lower environmental impact.
- Waste had advantages over forestry sources because it involved less complex production processes.
- Waste offered fewer challenging trade-offs in land use, compared with participant perception of the use of crops and forestry resources.

1.3.3 Concerns over sustainability

Participants heard perspectives from BEIS, academia, an environmental NGO, and a biomass certification scheme to support them to explore the current UK biomass sustainability criteria. After hearing this range of views, many participants were sceptical about the concept of ‘sustainable biomass’ as well as the feasibility of enforcing the current criteria. When explaining their views, participants referred to some or all of the following reasons:

- Lack of clarity on whether emissions from the sourcing and production of biomass compared favourably with those from renewables, such as wind power or solar energy.
- The complexity of the supply chains involved in biomass production and sourcing, especially from overseas, which many felt might make the sustainability criteria difficult to regulate.
- Uncertainty over whether all emissions from the supply chain and production are included in the UK’s existing sustainability criteria.
- Lack of assurances on how private companies would be regulated effectively through certification.

1.3.4 The feasibility of Bioenergy with Carbon Capture and Storage (BECCS)

Participants heard perspectives from academia, industry, and an environmental NGO on the potential role of BECCS in achieving net zero. Overall, they remained ambivalent about the role of BECCS in achieving net zero; recognising the potential benefits of BECCS, whilst remaining uncertain that its potential could be realised. When explaining their views, participants referred to some or all of the following reasons:

- There were few feasible alternatives that would produce the scale of emissions removal needed by 2050 to reach net zero targets.
- The evidence did not convince them that BECCS could be implemented at this scale to produce these results.
- The desire for greater certainty and scientific consensus that large-scale BECCS implementation is effective, feasible and safe.

1.3.5 Agreed principles and conditions

NatCen developed a set of principles and conditions that participants saw as foundational to future biomass policy, based on the elicitation material generated in Sessions 1–4 of the dialogue. The analysis produced six overarching principles, by grouping a range of common conditional statements found in response to the question-and-answer exercises.

Figure 1: Agreed six principles

Conditions relating to **cost and financing; feasibility and evidence base; and accountability, transparency, and trust** captured participants' desire for assurances around the evidence that drives decision-making and government investment, and how this is then communicated to the public. This particularly reflected their broader concerns about politicisation and oversight, as well as the commercial incentivisation and corporate behaviour they thought might ensue from the Biomass Strategy.

Conditions relating to **impact on the environment, prioritising natural resources, and impact on society** captured participants' requests for assurances around minimising local, national, and negative global impacts, reflecting their ongoing concerns about environmental protections and their belief that reaching net zero emissions targets was an urgent priority.

In Session 5, the participants reflected on whether these principles and conditions mapped well on to their discussions and concerns, and in small groups, each facilitator sought participants' feedback on this. The principles were broadly adopted, although in a few cases some minor adjustments relating to language and emphasis were requested. The conversations are described and discussed in Chapter 3.

1.3.6 Future engagement

During the dialogue, participants expressed views on information needs, which could support the wider public to engage with the role of biomass and net zero. These include:

- Raising awareness of the conditions under which biomass sourcing, use and production might be implemented as a sustainable energy source.
- Equipping UK publics with the information they need to understand how biomass use may influence their everyday lives.
- Clearly outlining the potential costs involved in using biomass, and how this might impact on UK consumers.
- Regular monitoring of the impact that biomass has on achieving net zero against transparent performance indicators.
- Regular and transparent reporting of performance targets to allow the public to assess how this compares to other renewable energy sources, such as wind or solar.
- Communication and intervention from publicly known and trusted scientists, independent of government.

Participants were keen to see how the conditions which were developed through the dialogue would impact the future Biomass Strategy. They wanted to see a connection between consultation and formulation of policy and strategy.[5] They also felt it was important for the dialogue started here, between policy makers and the public, to be continued in different forms and influence ongoing decision making. As the report highlights the many areas where participants wanted to input into specific policy options with regard to biomass, a citizen jury would be an appropriate next stage to build upon the exploratory views expressed during this dialogue.

5 An assessment of how the dialogue has informed policy making will be outlined as part of the overall independent evaluation of the project, which has been conducted by Ursus Consulting. This report will be published and made available on Sciencewise website in Spring 2023.

2. Introduction

2.1 Context

In October 2021, the UK Government published its strategy for achieving net zero emissions by 2050, with biomass named as part of the pathway.[6][7] The Biomass Policy Statement, published shortly after the Net Zero Strategy, highlighted that biomass use should be prioritised in accordance with certain core principles (e.g., compliance with current and emerging sustainability criteria). It also expanded on the role of Bioenergy with carbon capture and storage (BECCS).[8]

Responses to a call for evidence, ran earlier in 2021 by the Department for Business Energy and Industrial Strategy (BEIS), highlighted the need for guiding principles on the role of biomass in achieving net zero,[9] and identified that further public engagement was required to better understand public opinion on the uses of biomass, and associated technologies such as BECCS.

We know at the time of writing the Climate Change Committee's (CCC) recommendation that biomass can make a "significant contribution" to achieving net zero, but "improved governance" is essential and in the absence of this, "biomass production and use could, in some circumstances, be worse for the climate than using fossil fuels".[10] Existing evidence from the BEIS Public Attitudes Tracker survey on the public's views towards the role of biomass suggests consistent support for its use as a renewable energy source. However, there is limited detailed research on public awareness of biomass and how it is sourced and used for bioenergy. Evidence from the 2020 Climate Assembly UK highlighted that the public may have considerable concerns about the use of biomass and BECCS after learning more about the technology.[11]

Against this backdrop BEIS and UKRI commissioned a public dialogue, supported by UKRI's Sciencewise programme, which sought to understand views on the potential role of using biomass to achieve net zero by 2050.[12] The evidence gathered through this dialogue and presented in this report, will inform the development and implementation of the forthcoming Biomass Strategy and associated policy development.

The dialogue was commissioned in April 2022 with the sessions taking place online across June and July 2022. The dialogue had the following objectives[13]:

1. To engage a diverse group of participants, broadly reflective of the UK public, in topic areas relating to the development of the Biomass Strategy.
2. To explore and understand participants' aspirations and concerns in relation to biomass sourcing (both domestic and imports), production and use across the economy.
3. To understand what values and perspectives inform participants' views to inform and help refine any future communications and engagement.
4. To define conditions of use in relation to sustainability frameworks (which could include areas like land, biodiversity, environmental impacts, ecosystem services, emissions, and social criteria) to

6 Net Zero strategy (2021) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf
7 Definitions for key terms in this report such as 'biomass' can be found in the glossary.
8 BEIS (2021) Biomass Policy Statement.
9 BEIS (2021) The Role of Biomass in Achieving Net Zero: call for evidence.
10 Biomass in a low-carbon economy - Climate Change Committee (theccc.org.uk)
11 https://www.climateassembly.uk/report/read/index.html
12 UK Research and Innovation's Sciencewise programme co-funded the dialogue. Sciencewise enables policymakers to develop socially informed policy and ensure that policy is informed by the views and aspirations of the public.
13 More detail on the research questions generated from these objectives to guide the dialogue process can be found in the appendix.

help shape policy development in this space.

5. To determine participants' views of using biomass, particularly through BECCS, as a negative emissions technology in achieving net zero, to inform policy development in this area.
6. To help shape other aspects of government policy and guidance as part of the forthcoming Biomass Strategy and inform future engagement.

During this period, events related to energy and political stability had some influence on the way participants engaged with the question of the role of biomass. In February 2022 Russia invaded Ukraine, with one consequence being the impact on global energy prices.[14] The increasing price of energy and concerns around energy supply reported in the news during fieldwork were one important backdrop to the dialogue.

This added to recognised existing pressures, already in public awareness: the collapse of various energy companies in September 2021 and the ongoing supply chain impacts from Brexit and the pandemic.[15] In March 2022, the Government announced initiatives to help with the steep rise in energy prices. They followed these with further measures in May 2022, which were intended to assist households with the ramifications of Ofgem's predictions that the energy cap would rise again in October 2022.[16] Concerns about the fragility of energy supply, and reportage charting the rising costs of energy and other standards of living indicators, were prominent across the public sphere during this period. These issues also shaped how participants explored the role of biomass, and bioenergy in particular, during the dialogue.

During this time, the UK also experienced a period of rapid political change, which evidently textured participant viewpoints. June and July 2022 saw a series of ministerial changes and the resignation of the Prime Minister following a vote of no confidence.[17] These events occurred immediately before some public dialogue sessions and were referenced by participants in discussions. This related to trends of decreased trust in politicians, and is an important context to understand the emphasis given by participants to public accountability in the role of biomass and net zero.[18]

2.2 Methods

The project design developed through several stages of coordinated work with key stakeholders, including a Rapid Evidence Assessment and Stakeholder Workshops, which established the information and evidence context within which the dialogue occurred. We also established several means to engage with and understand the developing participant viewpoints as the dialogue progressed, including a pre- and post-dialogue survey, elicitation exercises, and ongoing facilitator observation feedback.

2.2.1 Public dialogues

Public dialogues differ from traditional qualitative research as they allow participants the necessary time, information, and discursive conditions to reflect on a topic in-depth and consider trade-offs. Dialogues are designed to enable members of the public to deliberate on specific policy questions, based on evidence provided by policymakers or specialists, who offer knowledge and insight relevant to the subject under review. This report refers to these experts as 'specialists' to acknowledge that such understanding, especially with regards to issues related to biomass use, sourcing and producing, may not be confined to purely 'scientific' realms, but exists and is

14 IEF (2022) Energy Market Impacts of Russia's Invasion of Ukraine (ief.org).
15 Carbon Brief Analysis: Why UK energy bills are soaring to record highs – and how to cut them - Carbon Brief.
16 Ofgem (2022) Jonathan Brearley's speech at Future of Utilities event | Ofgem.
17 ITV News (2022) Timeline of crises engulfing Boris Johnson's leadership | ITV News.
18 NatCen social attitudes survey (2021) bsa38_democracy.pdf (natcen.ac.uk).

generated across industry, NGOs, as well as in different fields of academia and policy areas.[19]

Dialogues show how participants views on important social or policy issues change in response to in depth engagement with robust information and other people. As they take place over extended periods, participant views can also be informed by their own reading into the topic of the dialogue, along with conversation on the topic with friends, family, and others outside of the dialogue group. The process may lead to a consensus among participants but is not designed to achieve this. Rather, this report lays out how informed opinions developed on this complex topic and how information (both specialist evidence, differing specialist and fellow participant positions on a given topic) shaped people's opinions. This contrasts to methods such as focus groups which typically provide researchers with a snapshot understanding of a public's 'top-of-mind' views; what they think in any given moment and context.

This project followed the Sciencewise guiding principles.[20] Core to these are:

- effective recruitment, event design, data management, and dissemination;
- robust data, effectively analysed and shared;
- appropriate engagement of key participants including publics, facilitators, and 'specialists'.

2.2.2 Project governance

Commissioned and managed by BEIS, UKRI and Sciencewise, NatCen led the delivery of the public dialogue, working with Eunomia who provided subject specialist expertise. Ursus Consulting were appointed to conduct an independent evaluation of the dialogue.[21]

An Oversight Group of representatives from academia, industry, environmental NGOs and government was convened by BEIS to provide scrutiny of the dialogue process and materials. The core remit of the Oversight Group as agreed in the Terms of Reference was to oversee the dialogue process and materials, and to help ensure that:

- The dialogue material was comprehensive and balanced, (that is, they would not foreground any singular perspective or interest) while also representative of the diversity of the views and positions in the subject area and accessible to participants.
- The engagement process was far-reaching, accessible, and targeted all relevant stakeholder groups.

The group convened three times to support the design of the dialogue itself and one final meeting to hear findings.[22]

2.2.3 Rapid evidence assessment and stakeholder engagement

Eunomia conducted a rapid evidence assessment (REA) and 10 stakeholder interviews to inform the development of dialogue information materials. The REA method and findings are available in Appendix 2.

This work enabled Eunomia to develop evidence-based materials to be used in the dialogue; a selection of which were piloted in a half day online stakeholder workshop. This workshop involved

19 See: Guiding-Principles.pdf (sciencewise.org.uk).
20 See: Guiding-Principles.pdf (sciencewise.org.uk) and Sciencewise-Quality-in-Public-Dialogue-August-2018.pdf
21 Ursus Consulting will publish their evaluation of this process six months after the publication of this report.
22 A full list of members and the Terms of Reference outlining the remit of the Oversight Group is available in Appendix 1: Project Governance.

stakeholders from across industry, academia, and NGOs[23] who were given specific remit to comment on materials developed to sustainability and BECCS, areas in which the evidence base is not yet settled. For all materials - they were asked their views on whether these represented a fair introduction to these key policy areas given the objectives of the dialogue. Eunomia incorporated these responses into the final design of the information materials.

2.2.4 Sampling and recruitment for the dialogue

The dialogue aimed to capture views that were 'reflective' of the UK's population. Participants were recruited by the agency Propeller to quotas outlined in the sample plan agreed with BEIS and Sciencewise and following comments from the Oversight Group.[24] To ensure the sample reflected a mix of views on the topic under discussion, NatCen used a screening questionnaire, with input from the Oversight Group, to build quotas for political affiliation, attitudes towards climate change and support for the use of biomass as a renewable energy source, among other criteria. Quotas for disabled participants and those experiencing fuel poverty were also included to reflect viewpoints of those for whom changes in energy delivery, and especially changes in energy pricing, may have considerable effects.

In total, 95 participants took part in all five sessions, with 100 taking part in at least four sessions. A total of 109 people began the dialogue. Of the 95 who completed all sessions, 31 came from 'affected communities', broadly defined in the questionnaire to include anyone affected by biomass sourcing, or bio-based products/bioenergy production, in their local area. These participants responded yes to the following question:

Biomass is any material of biological origin. Different types of biomass can be sourced from the UK and/or overseas. Biomass has many uses. It can produce bioenergy through being burned in a power plant or from being processed into a gas through anaerobic digestion and can be used to produce heat. It can also be used to create low-carbon fuels like biofuels and hydrogen for transport, or in other bio-based products like bio-plastics and in timber for construction.

Do you consider yourself to be affected by biomass sourcing, or bio-based products/bioenergy production in your local area?

This question was agreed with the Oversight Group to capture as broad a range of experiences as possible.

To enable us to explore whether participants from 'affected communities' held differing views to the rest of the general population sample, they were congregated in the same breakout rooms in sessions one and five of the dialogue. For sessions 2-4, they were randomly allocated to more mixed groups alongside the general public.

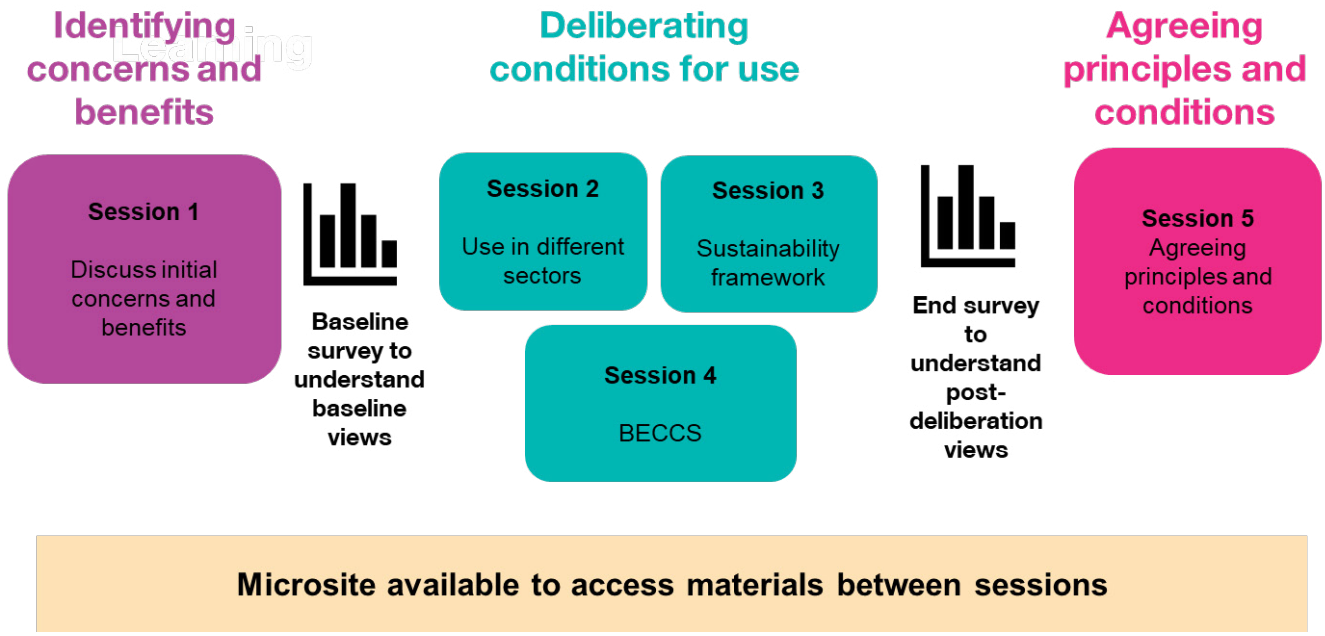
In analysis, we did not observe any significant differences in attitude or opinion amongst affected communities' participants, therefore their views have not been reported separately in this document. This may be due to all participants' capacity to imagine how they would feel if they were affected by biomass sourcing in their local area, which was a stance that came through particularly in the final session.

23 See Appendix 2: Rapid Evidence Review for full list of attendees.
24 Sampling criteria is detailed in Appendix 3: Sampling and Recruitment.

2.2.5 Dialogue design and delivery

The public dialogue took place on Zoom across five sessions: an initial session to explore the topic, three sessions of deliberation on different policy areas, and a final session in which participants agreed on a set of principles and conditions (see figure 1). We used a mixture of plenary and small group discussions (with a maximum size of 7) across each session[25]. Alongside these sessions, participants could access all materials via a microsite on the NatCen website. Further data was gathered through a survey which was sent following the first and final sessions.

Figure 2: Overview of the dialogue design



The role of biomass in achieving net zero was likely a new concept to many participants, and it is an area where there are conflicting viewpoints.[26] Therefore, the design of information materials needed to balance providing enough information to support participants to develop a view on the role of biomass in achieving net zero, without overwhelming them. It also had to acknowledge different perspectives without overloading participants with the detail of the main areas of contention.

Specialists from different sectors were invited to speak on the more contested policy areas of biomass sustainability and BECCS. Eunomia's contributions preceded those of specialists so that participants were able to explore areas fundamental to biomass before engaging with perspectives. Eunomia presented material to the whole group on the following:

- Session one: An explanation of biomass and its relationship to net zero.
- Session two: Detailed information on the sourcing, production and use of biomass.
- Session four: A detailed explanation of BECCS

Eunomia colleagues also moved between breakout rooms to answer clarifying questions about what people had just heard. Specialists were briefed to provide perspectives that could represent benefits and illuminate concerns, but were not asked to advocate for any position. This approach was taken because the purpose of the dialogue was exploratory. It aimed to inform policy development, rather than make recommendations on specific policy options. It thus supported

25 See Appendix 4: Dialogue Design for a sample session plan and slides.
26 Reported awareness and confidence in the subject was asked in the pre/post survey and is available in Appendix 3.

participants to navigate the complexity of the potential role of biomass, rather than advocating for or against its use. In this way, and as was explained to participants, the role of participants would be to try and make sense of the different perspectives to form their own view on the role of biomass.

As per the design, most specialist input came in sessions three and four once participants were more confident in the basics of biomass (achieved in sessions one and two). This approach intended to support participants to make sense of potentially conflicting or contested arguments relating to sustainability and BECCS, and here we also designed in a short Q+A session to aid this exploration. The specialists' contributions are detailed below:

- Session one: An introduction to biomass
  - Professor Patricia Thornley spoke (live in session one but recorded for session two) on the topic of 'areas to consider regarding biomass and net zero'.
- Session three: Sustainability
  - Dr Anna Mikis from BEIS talked about the biomass sustainability criteria.
  - Dr Mirjam Roeder and Dan Taylor from Aston University talked about the sustainability of biomass more broadly.
  - Mair Floyd-Bosley from the Royal Society for Protection of Birds (RSPB) talked about the environmental impact of using biomass (contribution via pre-recorded video).
  - László Máthé, from the Sustainable Biomass Program, talked about certification schemes for sustainable biomass.
- Session four: BECCS
  - Dr Nem Vaughan from the University of East Anglia talked about the possibilities for the role of BECCS.
  - Dr Nick Primmer from Future Biogas talked about the current industry deployment of BECCS (contribution via pre-recorded video).
  - Dr Doug Parr from Greenpeace talked about the environmental impact of BECCS.

All materials were made available on the NatCen microsite the day after the session so that participants could revisit information.

2.3 Analysis and interpretation

Data was generated through three main routes: a pre/post survey, session-based exercises, and detailed notes from breakout rooms. NatCen took a thematic approach to analysing all data, identifying themes around the benefits of, and concerns about, the role of biomass in achieving net zero.

2.3.1 Pre and post-dialogue surveys

To understand how views evolved during the dialogue, participants completed a pre-dialogue survey after session one and a post-dialogue survey after session five. The same questions were used in each survey to measure levels of support for, and concern about, the role of biomass in achieving net zero. This allowed NatCen to establish baseline attitudes as well as assess any impact the dialogue had on participants' views.

2.3.2 Session-based exercises

Facilitators logged emerging benefits, concerns, questions, and principles live in sessions one to four, via an online collaboration platform and in a spreadsheet. These gave rise to the principles and

conditions which participants arrived at in relation to the potential role of biomass in net zero and were discussed in detail in session five. These were gathered through prompts or open questions designed to elicit conditional responses; for example, asking 'using biomass to achieve net zero is a good/bad idea when…' In total, from the spreadsheet log, over 500 individual benefits, concerns, questions, and principles were logged and then synthesised into six themes.[27] Two analysis sessions were held with facilitators to refine a set of principles and conditions under each of these themes.

2.3.3 Detailed breakout room notes

Following the above analysis sessions, NatCen established codes to conduct a thematic analysis of the breakout room discussion notes, allowing us to explore and understand participants' viewpoints in greater depth. NatCen utilised these notes to understand the reasoning behind the perceived benefits and concerns.

2.4 How to read the report

The substance of the dialogue is discussed over seven chapters and a conclusion. A set of appendices includes material presented during sessions, as well as examples of the data created during the dialogue. The findings sections address the following:

1. Overview of attitudes towards the role of biomass in achieving net zero
2. The principles and conditions that should shape the role of biomass in achieving net zero.
3. Participant views on the sourcing of biomass.
4. Participant views on the production and use of biomass across the economy.
5. Participant views on the sustainability of biomass.
6. Participant views on bioenergy with carbon capture and storage (BECCS).
7. Future engagement.

Each chapter begins with a key findings box, and ends with a discussion of how the themes identified connect to the development of the principles and conditions the public want to inform the role of biomass.

Anonymised participant quotes are used throughout the report to support insights. These have been selected to illustrate findings.

2.5 Glossary of keywords

Biomass is a resource which originally comes from plants or animals. It can be used for producing energy or materials.

Bioenergy is energy extracted from biomass.

Net Zero is a balance between carbon emissions entering the atmosphere and carbon emissions being removed from the atmosphere.

Carbon neutral describes something which does not add carbon dioxide (CO2) to the atmosphere, either by not producing emissions, or by removing an equivalent amount to what is produced.

Carbon negative describes something which removes more carbon dioxide from the atmosphere than it produces.

BECCS – Bioenergy with Carbon Capture and Storage – The process of capturing and permanently

27 See Appendix 6 for examples of elicitation materials generated through the dialogue.

storing CO2 from biomass energy generation.

CCUS – Carbon Capture, Usage and Storage - CCUS involves the capture of CO2 from large point sources, including power generation or industrial facilities that use either fossil fuels or biomass for fuel. The CO2 can also be captured directly from the atmosphere.

Relevant Organisations

BEIS is the Government department for Business, Energy and Industrial Strategy.

The **Sciencewise** programme helps to ensure policy is informed by the views and aspirations of the public. The programme is led and funded by UK Research and Innovation (UKRI) with support from BEIS.[28]

IPCC is the Intergovernmental Panel on Climate Change, a United Nations body made up of hundreds of scientists from across the world which represents the internationally accepted scientific authority on climate change.

CCC is the Climate Change Committee, the UK's independent adviser on tackling climate change.

28 https://sciencewise.org.uk/

3 Attitudes towards the role of biomass in achieving net zero

About this chapter

This chapter provides an overview of participants' attitudes towards the role of biomass in achieving net zero and how these evolved over the dialogue. It reports the key information from the dialogue that resonated with participants and helped shape their views, as well as our findings regarding the interpretative frames they used to bring biomass to life, as a topic they previously knew little about. The views of participants from affected communities do not appear separately in this chapter because no significant differences were observed between them and other participants.

Key themes

Most participants felt **biomass has a role in achieving net zero, despite expressing significant concerns about the potential environmental impact** of how biomass is sourced and produced.

Support for using biomass was driven by a **desire to do everything possible to achieve net zero rather than any specific benefit of biomass**. With the balance of information provided in the dialogue, participants concluded that it was still worth using biomass as it may be able to play some role in achieving net zero.

In addition to using the evidence to inform their assessment of the use of biomass in net zero, we saw that participants drew on three interpretative frames to reach conclusions: **concept, implementation, and impact**.

The **concept** of biomass as a renewable technology is counterintuitive to many participants. Participants questioned how the production and extraction processes involved in using biomass make it a good option for achieving net zero. However, when sourced from waste, participants were more positive about biomass.

When implemented, participants expressed their concerns that the Biomass Strategy will become dominated by the profit motives of the energy sector rather than the goal of achieving net zero. They also expressed hopes that biomass could lead to cheaper energy costs for consumers.

To understand **impact**, participants wanted a clear assessment from independent experts that biomass will make a positive impact on net zero targets. Instead, during this dialogue specialists provided different and sometimes contradictory perspectives on the balance of evidence available. Participants felt uncertain about the strength of the evidence base for whether biomass can contribute to net zero.

3.1 The role of Biomass in achieving net zero

Participant views on the role of biomass were contextualised within their wider view of the urgency of meeting net zero targets by 2050. In the final session participants were asked to reflect on how their views had evolved throughout the dialogue, and whether after everything they had heard, they felt biomass should have a role in achieving net zero. In these conversations, and in open text responses to the post-dialogue survey, participants tended to think it should. When asked to explain why, participants mostly pointed to the need to do everything possible to reduce emissions, rather than referencing benefits of biomass.

"I started with an open mind…I had heard of biomass, but I didn't really know much…. As I've gone on, I've heard more of the negatives and they do put me off. Then again, I feel it's the only choice. It will contribute to our goal of net zero."

This may have allowed participants to both accept a role for biomass and hold concerns about its impacts. Trends in the pre- and post-dialogue survey show that levels of concern remained high at the end of the dialogue (68% were either 'very' or 'fairly' concerned), but support for biomass having 'a' role in net zero also remained high (18% strongly agreeing and 54% agreeing). The extent of this role reduced for some after participating. In the post-survey, although the majority believed biomass should play 'some' role in achieving net zero, there was a decrease in participants who thought that biomass should have a 'large role' (dropping from 25% to 9%) and an increase in those thinking it should have a 'very small role'. This latter proposition was selected by 30% of survey respondents by the end of the dialogue, an increase of 14% on pre-dialogue results.

Contributions from specialist speakers influenced participants' views in certain areas. Participants did not identify clear or convincing alternatives to the strategy of using biomass with carbon capture and storage (BECCS) in the dialogue material. Some participants referenced the Greenpeace specialist in these conversations, who in session four articulated potential downsides to BECCS. When participants questioned the specialist about alternatives , they were told that there are currently few viable carbon emissions capture technologies that can achieve the GHG emissions reductions that would fulfil net zero targets. However, participants' views also reflected their overall acceptance of action on climate change and their desire for a serious commitment to be made by the UK Government.

3.2 Benefits, concerns, and aspirations

Whilst the necessity for urgent action on climate change was a significant context for overall opinion, participants displayed nuanced and varied views, depending on what elements of biomass use were under discussion. In the first dialogue session participants were given a definition of biomass and how its sourcing, production and use could contribute to net zero. They were then asked what key benefits they saw in this use, and what concerns they had, as well as what questions they would like answered on the topic. In session two, participants were asked again about their perceptions of using biomass to achieve net zero after learning more about its sourcing, production, and use. In the final session participants were asked to reflect on how their views on its benefits and concerns had evolved.

As the dialogue progressed, participants tended to emphasise their concerns with biomass over its benefits. This was not necessarily an evolution of opinion away from appreciating potential benefits: the relative stability of support for biomass in the pre- and post-survey suggests participants remained alive to the value biomass may have to achieving net zero. However, as the complexities became more apparent, questions and concerns dominated discussion and the surveys also indicate increase in concern by the end of the dialogue.

"I've got more questions (at the end of the dialogue), and it's no longer biomass, it's which one of the 30,000 flavours of biomass do we choose from?"

NatCen observed that three key common understandings ('interpretative frames') (figure 3) became increasingly apparent as the sessions progressed. These came to dominate the conversations and increasingly influenced how participants dealt with the complexity of the information.

The **concept** frame relates to the classification of biomass as a renewable technology. Although biomass was considered preferable to fossil fuels, participants struggled with the idea of it being renewable because of the greenhouse gas (GHG) emissions emitted through its sourcing and production. However, biomass sourced from waste felt like a more intuitively renewable energy solution for participants.

The **implementation** frame relates to how biomass would be used. Biomass implementation was often framed by participants as being at risk of influence by profit-making companies and vested interests, which led to a series of concerns related to cost, financing, and transparency.

The **impact** frame relates to whether biomass, considering how it can be sourced, produced, and used, would impact net zero. Participants were keenly aware of the importance of achieving net zero by 2050 as well as the challenge of reducing GHG emissions quickly and effectively.

Figure 3: Three interpretative frames used by participants to develop views on the role of biomass

3.2.1 Concept: Biomass as a renewable technology feels counter-intuitive

The first interpretative frame related to biomass as a renewable technology. In the first session participants were presented with an explanation of biomass as a low carbon energy source, and how its use can help achieve net zero. Following this explanation, biomass appealed to many as a versatile and renewable source of energy, which could simultaneously reduce waste and absorb CO2 through the planting of crops. In fact, in the opening session some participants noted that biomass may be a more reliable source of renewable energy compared to other sources such as, wind and solar that were perceived to be weather dependent.

"It's [more] reliable compared to other renewable energy sources and cleaner compared to fossil fuel sources."

However, as participants learnt more, their concerns about the sustainability of biomass grew. They felt that the production processes and importing of sources involved would release carbon, and

hence did not perceive this as sustainable or 'green'.

Participants requested data comparing biomass against other renewables, which they understood to be 'greener' and more sustainable. BEIS and Sciencewise considered this but were wary of repeating previous climate dialogues which looked at the uses and merits of different energy technologies. Additionally, it was challenging to produce the comparative data within the project timeline given the numerous ways biomass can be used. Therefore, participants did not spend time comparing the relative sustainability of biomass to other renewable energy sources.

For many participants, these concerns remained at the end of the dialogue. Many voiced worries over what they thought could be potentially significant environmental impacts, created by the import of wood pellets and the global impacts to ecosystems.

"The biomass plants are going to be quite substantial. Habitat restoration sounds great, but where are they going to be building these plants? Surely, they'll be destroying habitats to put them there in the first place. It's just not very clear, is it?"

"There have been some things that have been said that have just thrown up red flags for me. Like the fact that we're bringing in pellets from Canada and, well, isn't that increasing our carbon footprint? The planes flying, all of that, the boats, whatever, sailing over, that's going to cause carbon dioxide [to be released] into the atmosphere."

One way biomass was viewed as intuitive as a renewable technology was when sourced from waste. In session one, participants identified bioenergy's exploitation of waste (i.e., animal, food, biowaste) as a clear benefit, something emphasised throughout the dialogue.

"Using stuff that would be wasted anyway seems a no-brainer."

Some also noted that the different routes to biomass production – 'crops, trees, waste' – offered greater flexibility in sourcing compared to other energy sources. However, this benefit did not feature when participants considered sourcing in more detail (something discussed further in chapter four), and neither did it emerge as a benefit in the final session. This may be because, when sourcing was explored, participants compared sources and concluded that waste was preferable, which rendered other sourcing moot for the remainder of the dialogue.

3.2.2 Implementation: The energy sector is profit-making and may not focus on net zero

The second interpretative frame that emerged was the role of profit within the energy sector. Specific costings were not examined in the dialogue, but participants imagined that establishing and maintaining biomass production, sourcing and use in the UK would involve considerable investments and be delivered by profit-making companies. Although other sectors were referenced by participants as comparators (for example, the role of private companies in the NHS), the frame of profit-making focused largely on the energy sector. This perception about biomass investment and delivery led to concerns that profit, rather than the achievement of net zero, would drive decisions around the role of biomass. Participants were aware that the Government has a role in regulating the energy market but displayed little trust in the effectiveness of this regulation.

"I just get this feeling that 50 years down the line they're going to be going like, 'oh, these great big biomass companies have got us' […] they'll be the new oil companies."

This dialogue took place during a cost-of-living crisis where the cost of energy (among other household expenditures) increased significantly, and news coverage of energy security was prominent. No information was provided in the dialogue regarding the potential impact of biomass on these issues, but throughout, participants returned to a hope that domestic supply of biomass could potentially reduce the cost of energy and make energy supplies more reliable because it could exploit new or free resources, such as waste.

3.2.3 Climate change is urgent but hard to tackle

The final interpretive frame was the perceived contribution of biomass to achieving net zero. Participants' pre-existing concerns about climate change[29] grew throughout the dialogue as they were presented with information that emphasised the importance of achieving net zero by 2050. At the first session participants expressed a desire to hear from a range of experts – especially scientists and environmental NGOs – who they believed would offer an independent assessment of the role that biomass should play in net zero. Well-known scientists, such as David Attenborough and Chris Whitty, were referenced as trusted figures who may be able to tell them definitively whether biomass will or will not have a positive impact on net zero.

As outlined in the introduction, there are differing interpretations of the evidence base for the role of biomass. The dialogue was designed to offer participants a range of perspectives from specialists rather than the definitive independent assessment that some requested. Participants heard perspectives from government, academia, industry, and environmental NGOs to enable them to explore contested areas of biomass sustainability criteria and BECCS.

After hearing different specialist perspectives participants were left uncertain about the evidence base for biomass and net zero. This uncertainty was driven by two factors. The first, reported in more detail in chapter six, was a contradiction that participants identified between the BEIS and RSPB specialists regarding the UK sustainability criteria. The second, reported in more detail in chapter seven, was a perception based on academic and Greenpeace specialist input, that BECCS technology is still unproven at scale. The perceived lack of consensus and proof on two important aspects of biomass' potential role in net zero led to more requests for information, and clarity as to whether biomass really would impact net zero.

Throughout the dialogue people asked for facts and figures and more data, wanting certainty from trusted independent experts that it is a 'good' or 'bad' idea to use biomass to achieve net zero.

"It all seems to be 'arguably' – it is, or it isn't."

Despite these concerns over certainty, the technology developed as part of using biomass to achieve net zero was identified as a potential benefit throughout the dialogue. At the start participants mentioned the creation of artificial land for biomass crops, and hydrogen-fuelled cars or planes. By the final session, some still expressed a view that further investment in biomass may develop positive solutions for achieving net zero.

"I think it's a little bit suck it and see…what develops over the next decade."

3.3 Conclusion

This chapter presented how participants explored the role of biomass through three interpretative frames related to the concept, implementation, and impact of biomass.

29 Participants were recruited to match national trends in concern for climate change (see Appendix 3 for full breakdown: over 80% reported being concerned about climate change).

Ultimately, participants concluded that due to the importance of reducing emissions by 2050, biomass should play a role in achieving net zero. The nature of its role should minimise the concerns that emerged around the concept of biomass negatively impacting the environment and society, the implementation being dominated by profit-making and the evidence of impact being uncertain. Equally, its role should maximise the effective use of waste, which was identified as a benefit of biomass.

The next chapter outlines the principles and conditions that emerged from these concerns and that should inform the Government's Biomass Strategy.

4 Principles and conditions

About this chapter

This chapter outlines the principles and conditions that were presented to participants in the final dialogue session for discussion and agreement. NatCen developed these by analysing the benefits, concerns, and requests for information that participants conveyed to facilitators in each of the first four sessions. We presented these as draft principles and conditions in plenary and tasked participants with discussing them further in breakout sessions, to affirm that they represented participants' beliefs about the use of biomass or suggest amendments.

This chapter presents the principles and conditions in their final agreed wording, along with a summary of participants' discussions on them. In the few instances where changes were made following the final session these have been highlighted.

Costs and financing

Feasibility and evidence base

Trust, transparency and accountability

Impact on the environment

Prioritising natural resources

Impact on society

Key themes

By the end of the dialogue, participants agreed that these principles and conditions were the right ones for the Government to consider when developing the Biomass Strategy.

Four principles and conditions reflect participants' desire for assurances around the evidence that drives decision making and government investment, and how this is then communicated to the public. These were: cost and financing, feasibility and evidence base, accountability, and transparency and trust.

The remaining three principles and conditions reflect participants' requests for assurances around minimising local, national, and global impact. These were: prioritising natural resources, considering the impact on the environment and considering the impact on society.

Participants wanted more precise language to ensure the principles and conditions were adhered to. Some objected to terminology that left too much room for interpretation (e.g., 'taken into account', 'minimised').

4.1 Costs and financing

Throughout the dialogue, participants believed the implementation and use of biomass would necessitate large infrastructure projects. This view sparked a range of concerns about potential high and spiralling costs, the scope for excessive profit-making, and worries over the influence of large corporate entities on the Biomass Strategy. Although information on potential funding for or costs of biomass was not provided, participants believed the cost would be high. Through analysis of these concerns, NatCen developed a set of principles and conditions relating to how biomass would be financed, where the funding burdens would fall, how decisions about the scale of public investment would be made and managed, and how the profit-making incentive of private companies involved in implementing biomass would be managed.

Figure 4: Agreed principles and conditions for cost and financing

Emphasis and discussion

When discussing the financial impact on consumers, some participants wanted the principle to be firmer and state the specific need for laws or regulations to ensure that the UK taxpayer would not be burdened at all. Others believed it was acceptable that biomass would be funded in part through public funds (and therefore at some cost to the taxpayer) but specified that energy companies should not pass on any costs to consumers.

"Right now, the needs of taxpayers are more important."

"This is money making – and they [companies] should pay for that."

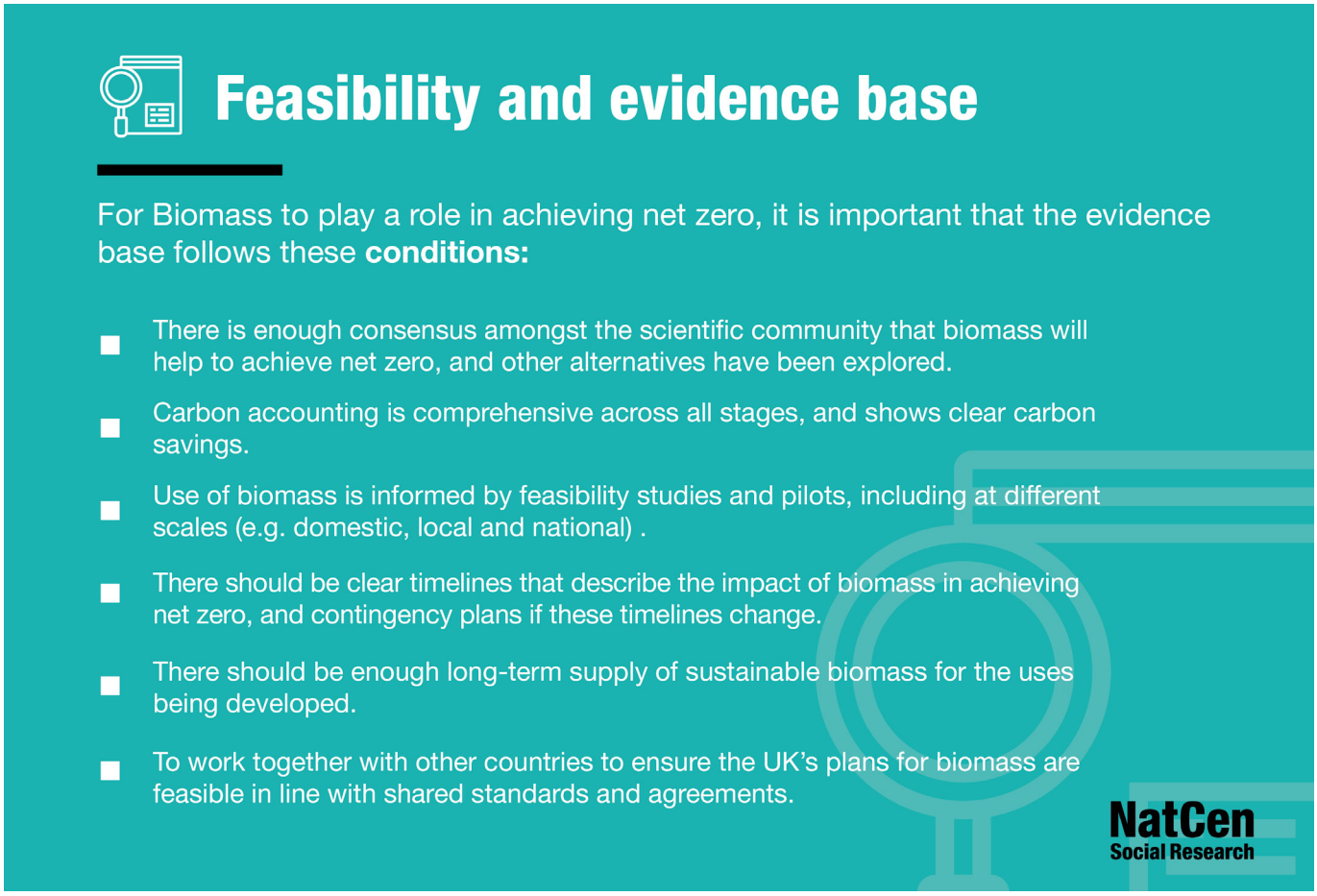
When discussing commercial profit and transparent funding, participants recognised that markets would necessarily be created as part of using biomass, which would involve incentivisation. The discussion centred around how to reduce the risk they identified that seeking excess profit might drive decisions about biomass. Suggestions included capping the amount of return that companies could make, giving oversight of biomass cost-benefit analysis to an independent body, and expanding the principle of funding transparency to include specifics, such as the publication of spending levels and the need for public accounts filing.

"I don't want it to be driven by profit, I want it to be driven by the desire to achieve net zero."

4.2 Evidence and Feasibility

Evidence was a major preoccupation for participants. Participants identified contradictions or noticed inconsistencies between some specialist input around the sustainability of biomass used in the UK. Many understood the evidence base around BECCS to be unproven. Throughout the dialogue participants continually requested clear evidence that would prove that biomass would positively impact net zero. Through analysis of these requests for information and concerns recorded throughout the first four sessions, NatCen developed a set of principles around the type of evidence participants felt was needed to provide more certainty on the feasibility of biomass's impact on net zero.

Figure 5: Agreed principles and conditions for feasibility and evidence base



Emphasis and discussion

Discussion of feasibility came through in a focus on how the UK would work together with other countries around biomass, something participants gave different degrees of emphasis to. Most recognised that if biomass is to have an impact on achieving net zero, then some global cooperation is necessary and that this would likely need to be enforced by a trustworthy global body. Others doubted the feasibility of applying standards globally (a theme discussed in more detail in chapter six).

"Global warming, it's in the name, it's global....Ideally: try not to get your hands dirty promoting bad practices in other countries. Try to at least put a standard."

"I just don't see how the working with other countries is going to work at the moment, [some have] stricter laws when it comes to regulation and worker standards."

When discussing principles and conditions around carbon accounting, timelines, pilots, and consensus, participants emphasised the need for these to be specific and detailed. This reflects their concerns that the evidence-base for using biomass is unproven and contested. Examples of these requests included detail on how carbon will be measured and annual targets. Some wanted a clear proposal about how 'more than enough' biomass supply over the long term would be achieved. They wanted details on what kinds of standards would be implemented and how these would be agreed.

"I don't disagree with any of the bullet points, but what I'm missing behind pretty much all… is how are we actually going to implement this."

4.3 Trust, transparency, and accountability

Over the course of the dialogue, participants voiced concerns about whether the Government and private companies could be trusted to implement plans for biomass effectively and ethically. These concerns partly reflected lack of trust in the ability of government to deliver large infrastructure projects to time and budget, and partly the worries about profit-making motives of large energy companies and how these might conflict with achieving net zero. NatCen analysed concerns logged by facilitators related to these issues to generate a set of principles and conditions that reflected participants' desire for strong oversight and regulation. Participants validated those on trust, transparency, and accountability in the final session.

Figure 6: Agreed principles and conditions for trust, transparency, and accountability

Emphasis and discussion

The dialogue sessions took place during a period of rapid political change, including the run-up to the resignation of the Prime Minister of the time. Participants referenced news related to this context and emphasised that trust in the Government and politicians was at 'an all-time low'. Participants' ongoing concern with the motives and actions of politicians and corporations, which was still evident in the last session, led NatCen to add 'accountability' to the theme. Participants wanted both transparency and accountability to build trust or, at least, manage mistrust.

"Is that a real thing – an honest government?"

Participants felt that short-term political agendas should not, in principle, interfere with the Biomass Strategy. However, they disagreed about whether this principle could be reflected in practice. Many believed that politics would inevitably influence how future governments approached biomass or found it difficult to see how biomass could even be free from short-term influence, when it was part of current government policy. Some raised the question of whether a national strategy or pledge might be made, which could help support biomass as a cross-party initiative.

"It's going to be a political issue and tool that people will use to manipulate in the coming years to achieve their own ends."

"It should be a big national strategy, like this is what we're going to do. Whoever is in power for next year or two years or whatever, this strategy is for the next 15 or 20 years...should be approved by all political parties."

When discussing principles related to regulation, participants agreed that evaluators should be a mixed group of scientists and other specialists who are independent of government. Perceptions of independent regulation are discussed in more detail in chapter six, but similar emphasis was given here to the involvement of environmental NGOs with some disagreement over whether industry should have a role. Many wanted the principles regarding 'sanctions' to express specific, actionable, and judicial penalties, e.g., jail time, in addition to fines or restrictions of permits or licenses. This highlighted the belief that sanctions should be strong enough to disincentivise companies from ignoring regulations.

These conversations suggest that confidence in existing energy regulation is limited, and participants wanted biomass to be regulated outside of self-interest.

"Ofgem's reputation [is] in the bin over the way it's handled energy companies."

4.4 Impact on the environment

Throughout the dialogue, participants found it difficult to reconcile the potential impact of biomass on net zero with the environmental impact of the industrial processes involved in using biomass. This counterintuitive conceptual challenge informed our analysis, through which we developed a range of principles and conditions, that spoke to participants' desire to maximise the positive environmental impact of biomass and minimise the harm.

Figure 7: Agreed principles and conditions for impact on the environment

Emphasis and discussion

Participants emphasised the importance of protecting the environment and preventing commercial companies from damaging natural resources. Some wanted stronger language than 'minimised'; they wanted biomass to positively contribute to better wildlife habitats and improved ecosystems. For many, simply stating that there would be 'consequences for organisations' that caused environmental damage did not go far enough. Participants referenced water companies' continued pollution of rivers, despite the fines already levied, as evidence that private companies continue to damage the environment despite so-called 'consequences'.

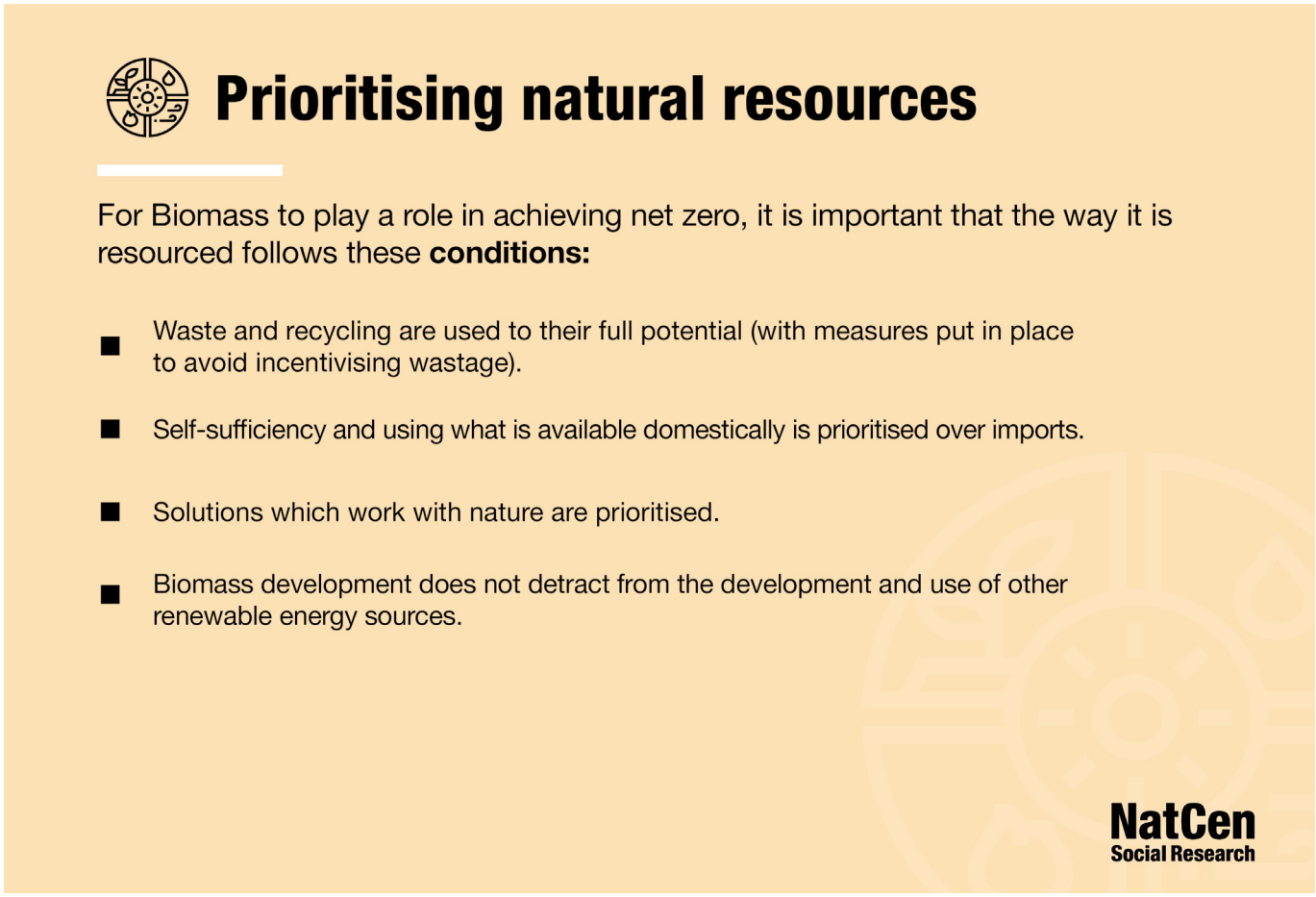
"I just can't get my head around it, that it causes damage and environmental impacts"

4.5 Prioritising natural resources

Throughout the dialogue, participants expressed a preference for sourcing biomass from domestic waste. Participants also continually requested information on how biomass compared to other renewable energy sources, which they saw as involving fewer industrial processes and therefore being more natural. To maximise the perceived benefits of biomass from waste and to acknowledge the concerns over the effectiveness of biomass in relation to other renewable sources, we developed a series of priorities and conditions based around the prioritisation of natural resources.

"The whole thing about this, if we could work nature in that we're not fighting and going against it... If we can work with it and let nature actually work for us"

Figure 8: Agreed principles and conditions for natural resources



Emphasis and discussion

Participants emphasised the importance of the principle related to waste and recycling, as well as developing biomass alongside other renewable energy sources, which they felt posed less risk to the environment.

More debate occurred around the principle of self-sufficiency and using what resources that are available domestically. Not all participants agreed that this was a de facto priority, as overseas options might be more sustainable than domestic sources. This reflects engagement with the information explored in session three, and detailed in chapter six, that importing biomass can be sustainable.

"Sustainability matters more than domestic sourcing…it should be about that, more than where they come from."

Others felt that domestic sourcing was inherently more sustainable. These participants stated that it simply made sense for local biomass plants to draw on resources in the immediate surrounding area. They cited a coastal biomass plant using wood pellets, rather than seaweed or other coastal waste, as an example of sourcing that doesn't make sense in terms of sustainability.

4.6 Impact on society

Participants recognised there would be local, national, and global impacts of using biomass to achieve net zero, and expressed concerns related to these throughout the dialogue. These concerns mostly focused on the potential negative impacts on health in areas near to biomass production and the safety of technologies involved in bioenergy plants, bioproducts and BECCS. NatCen analysed these concerns, and developed a set of related conditions to reflect participants' desire to reduce negative impacts on local communities and coordinate globally to reduce harms to communities in other countries.

Figure 9: Agreed principles and conditions for impact on society

Emphasis and discussion

The discussion over the principles and conditions within this theme was longer and more fraught than with the other themes. Regarding 'jobs created in the biomass industry,' there was disagreement over whether this was a necessary or 'nice to have' principle or condition. In some of the small group discussions, participants agreed that biomass jobs might be riskier, or more important to the country, than others, therefore justifying special consideration. Others felt that biomass jobs should be treated like any other occupation: they would be covered by existing employment rights, and health and safety legislation. Employers should ensure that any potential detrimental impacts on workers are either managed or mitigated and the market will decide whether biomass jobs needed incentivisation (e.g., higher pay).

"It's not a condition that jobs should be well paid, secure and safe. That's a principle that's nice to have. It should be driven by Net Zero, not by employment stats."

Echoing discussion of global regulation in the accountability theme, when discussing 'impacts on society at a global scale,' some felt this should not be emphasised because there was little scope for the UK to influence global impacts.

"It's very important, I think. We don't care enough about it unless it's in our backyard, but I think in an ideal world, you'd have it at the top, but we know that that's not what's going to happen. In our hearts, we'd want it at the top but unfortunately, we don't have the power."

"I think this is one where we are going to have to agree to disagree."

In the draft version presented to participants, the final principle and condition originally read 'impacts on society at a global scale are considered in relation to climate justice'. In their discussions, participants interpreted 'climate justice' very differently to each other, but no alternative phrasing was suggested. Most understood it as a desire to limit the potential of the UK Biomass Strategy to exacerbate global inequalities. For some, it communicated a belief that larger countries (e.g., China, India, USA) should take a just and proportionate role in developing technologies to achieve net zero, rather than what they felt were comparatively smaller countries, like the UK, taking too great a share of the burden. Others thought it described measures to ensure global accountability systems to sanction and deter corporate bad behaviour. As 'climate justice' was interpreted differently by participants, we removed it from the principles and conditions with the agreement of the participants.

4.7 Conclusion

By the end of the dialogue, participants agreed that these principles and conditions were the right ones for the Government to consider when developing the Biomass Strategy.

Much of the discussion of the principles and conditions focused on requests for more details and emphasising their importance in providing assurances around minimising local, national, and global impacts, as well as ensuring the evidence that drives decision-making and government investment is communicated to the public.

The following chapters provide more detail on the concerns and benefits of the different aspects of biomass. At the end of each, we highlight which of the six principles and conditions discussed here emerged from that area of discussion.

5 Sourcing Biomass

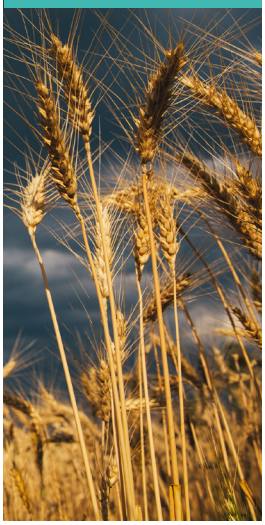
About this chapter

This chapter reports participants' views on sourcing biomass, focusing on five different options. During the second dialogue session, participants were presented with information about each source, before exploring their perceived benefits and concerns in breakout discussions.

The sources discussed in this chapter

Waste

Food and feed crops



Perennial energy crops

Forestry and forestry residues

Marine

Key themes

Participants were not given criteria to assess sources. However, they tended to rely on the following perceptions: the reliability of the source, its potential impact on the environment, and how land would be used to grow or produce it. Participants expressed a clear preference for **waste** as a source of biomass compared to others because they saw it as:

- A more **reliable supply** compared to other sources that were considered finite.
- A lower **impact source on the environment** compared to others that were understood to involve more production processes.
- Not detracting from other **uses of land** in the way that using crops and forestry residues for biomass would.

Sourcing biomass domestically was preferred to sourcing it internationally as it was perceived to be more sustainable and involve lower emissions.

The concerns and benefits expressed about all biomass sources contributed to the development of the following principles and conditions:

Costs and financing:

Concerns were raised that profit, rather than the achievement of net zero, would drive decisions about source production and land use, as well as the potential impact different sources could have on energy prices.

Feasibility and evidence base:

Participants wanted more information about the efficiency of sources – for instance, how much land might need to be dedicated to produce a certain amount of energy – to evaluate the pros and cons of each source.

Impact on the environment:

The emissions involved in the production and importing of sources was a concern.

Prioritising natural resources:

Using waste and prioritising domestic sources were considered key benefits of biomass.

Impact on society:

Concerns were raised about the impact of production processes, as well as the trade-offs involved in making land use decisions.

5.1 Waste

During the session, participants were shown a slide summarising how biomass can be sourced from waste products including food waste, used cooking oil, agricultural waste and sewage gas, and told nearly 50% of domestic biomass sources comes from waste and residues. In the discussion that followed, participants focused on household waste. Waste was understood to encompass other things that are already being produced but otherwise go unused and are thrown away. Participants were in favour of sourcing biomass from waste because it was viewed as readily available, and using it for biomass was a productive way of doing something "good" with waste that would otherwise damage the environment.

However, participants did not always identify sourcing waste (thereby minimising environmental damage) as a benefit. Concerns were raised that this approach might incentivise wasteful behaviour, create harmful emissions, and impact detrimentally on those living near waste processing facilities. Participants also wanted clarity on the costs associated with sourcing biomass from waste. The following sections outline the benefits and concerns that participants associated with sourcing biomass from waste, first covering those related to supply and feasibility before looking at the environmental implications.

5.1.1 Supply and feasibility

Participants viewed waste as an abundant source that is "already there" and will remain consistently available. This was based on a perception that large quantities of waste are already produced and would be for a long time. Thus, waste was viewed as an easy way of sourcing biomass that does not "reinvent the wheel" and require additional production processes.

"With waste, we are constantly producing it and if it could be used for biomass then it should be our priority."

Some participants commented that since people are already familiar with recycling, and waste is currently being used to create biofuel for transport, the infrastructure is already in place to feasibly source biomass from waste. A few participants referred to vehicles they had seen in the information presented that were powered by waste cooking oil to make this point. For these individuals, the process by which waste can be made into biofuel was viewed as already established and therefore sourcing biomass from waste appeared more straightforward when compared to other potential sources.

Although participants were provided with information on many sources of waste, domestic recycling, and waste collection (particularly, household and food waste), were most commonly referenced with regards to biomass. Some concerns were raised about the ability of councils to efficiently collect waste for biomass, based on their experiences of waste collection. Some participants explained how their food waste is not currently collected for recycling in their area, making them doubt that councils would collect waste for biomass. There were concerns about council bureaucracy and private contractors

preventing coordination in waste collection, ultimately limiting what could be available for biomass.

Limits to the supply of waste were discussed, such as difficulty in encouraging people to sort their waste and efforts to reduce amounts of waste produced. Participants expressed different positions on this subject and referred to their experiences of sorting waste and waste collection in their local area to explain their views. For example, it was suggested that many people do not recycle and are reluctant to sort their waste, which could limit waste available for biomass. Others referred to current government initiatives to reduce amounts of waste, which were viewed as inconsistent with the idea of sourcing biomass from waste. Participants understood, therefore, that sourcing waste for biomass may place the strategy at odds with other waste reduction schemes: if these efforts were successful, there would be less waste available for biomass.

"If they're successful in one - in reducing waste - clearly that has an impact on the amount of biomass sources available."

Participants raised general concerns about the perceived cost of sourcing biomass domestically from waste. Questions were raised about who would be receiving incentives for providing waste, with some concerned that private companies collecting the waste could be paid twice – by the Government and by the waste provider. There was uncertainty about costs to the individuals, underpinned by a desire to minimise costs for the consumer.

Participants wanted more information on the costs of sourcing and processing biomass from waste, versus the potential energy generated to evaluate overall benefit.

"How much would it cost to actually process all this waste in comparison to how much energy we get from it?"

5.1.2 Environmental impact

Some participants thought sourcing biomass from waste had a low impact on the environment compared to other sources of biomass. It was considered less environmentally destructive and a way of saving land space in comparison to sources that would be produced specifically for biomass, such as growing energy crops. Some claimed that using waste to generate energy was 'natural' and, therefore, positive, alluding to lifecycle processes in nature.

Where waste in general was understood as having a negative impact on the environment, sourcing biomass from waste was appraised as a potential solution that could result in less waste going to landfill.

"I like using the problem of waste to create a solution."

However, participants were concerned about the potential for harmful gases or emissions to be produced in sourcing biomass from waste and thought about how collection processes might exacerbate this. They referred to emissions resulting from the transportation of waste to processing facilities or gases released from decomposing waste, which would worsen if produced at scale and left too long before processing.

Some participants were concerned about the safety risks of handling and processing waste. For example, concerns were raised about the chemicals involved in the production of biomass from waste potentially harming communities living near processing facilities or polluting local rivers and hurting wildlife.

There were further concerns about the location of waste processing facilities, mainly relating to the possible smell making these areas undesirable places to live. Many participants expressed opposition to these sites being near their homes.

“You wouldn’t want it on your back door.”

Participants were also concerned that sourcing biomass from waste potentially incentivised wasteful behaviour, both at the individual and industry level. Some thought, for example, that companies currently producing large amounts of waste would use this strategy to effectively “greenwash”: e.g., avoid taking waste minimisation measures under the cover of sustainability. These concerns were underpinned by the widely held view that waste production is an environmental problem and should be reduced – even where it might supply biomass and be put to “good use”. Whilst most participants were in favour of using waste for biomass, some believed that the need for behaviour change regarding waste production should take precedence and would better contribute to environmental needs and net zero targets.

5.2 Food and Feed Crops

Participants were presented with information about how annual crops such as sugar beet, maize and wheat can be grown domestically or imported to be used as a source of biomass. The information also stated that there is potential for domestic biomass to meet up to 10% of the energy demand by 2050, and that currently 2% of arable land in the UK is dedicated to growing crops for bioenergy as of 2020.

Participants tended to speak generally about the benefits of growing "crops" for biomass and did not always distinguish between perennial energy crops and food and feed crops. They also expressed similar concerns for both sources, including worries over land use efficiency and the potential conflict between growing crops for food consumption and biomass sourcing. Concerns specific to food and feed crops included an intuitive opposition for using food crops for any purposes other than to feed people. While some benefits of sourcing biomass from food and feed crops were mentioned, these assumed that by-products from agricultural processes might be used – these benefits no longer held when thinking about growing crops solely for use as a biomass source.

5.2.1 Supply and feasibility

Some participants raised concerns around the feasibility of growing food and feed crops for biomass in the UK. There was a suggestion that some crops might grow better in other climates and that the UK is not best placed to grow the crops needed for biomass to meet its energy needs. Importing these crops from nations with greater abundance was not seen as a solution to supply due to the energy required to transport them.

Although it was explained how food and feed crops are grown specifically as a source of bioenergy, there remained confusion for some participants on whether by-products from food crops would be used for biomass. Some participants thought that residues from food and feed industries would be a reliable source of biomass and an environmentally sound option for supply. Participants were less supportive for growing crops for the sole purpose of sourcing biomass.

5.2.2 Land Use

Participants were concerned about the impact that dedicating land to grow crops specifically for biomass would have on the availability of food. Participants were not presented with data to support them to explore land use for food and energy supply, but many argued that where food crops can be grown, feeding people should be prioritised over using these as a source of bioenergy. Some people pointed to food scarcity, with some concern about driving up prices of food and contributing to the creation of food deserts. Others felt that using food crops for biomass was "burning food".

"There's so many people in the world dying of starvation that I don't think we should be burning food for fuel. It doesn't sit right with me."

For some participants these views were absolute and applied irrespective of whether only a small amount of UK arable land – referring to the 2% figure from 2020 they were presented with during the session – would be dedicated to growing food crops for biomass.

"It's only two percent of land, but if it can feed people, I don't think it should be used."

Participants also raised questions about the efficiency of using natural resources to grow feed and food crops for biomass when compared to the amount of energy they could provide. Participants asked how much water – which participants viewed as a scarce resource – would be needed and how much land is dedicated to grow these crops. Some participants thought this was a poor use of land because only a very small amount of energy would be produced when compared to the amount of land that might be required.

"It doesn't make sense when it's such a small amount of energy. It doesn't sound like it's going to make much difference – it's not the same amount that coal produces. You've got to make sure that you can feed the population."

5.3 Perennial Energy Crops

Participants were presented with information on perennial energy crops, including the ways in which they differ from food and feed crops – for instance, how they cannot be used for food and can be grown year after year. Many of the concerns raised about sourcing biomass from perennial energy crops were similar to those mentioned in the above section on food and feed crops. However, participants thought that perennial energy crops, which regrow after harvesting, would allow for a more consistent supply of biomass.

5.3.1 Supply and feasibility

Participants thought that sourcing biomass from perennial, rather than annual, energy crops, was more justified because these regrow. However, concerns were raised about the long-term reliability of these crops relating to how hardy they are and whether they are flood resistant. Participants also had similar concerns to those raised about food and feed crops in relation to whether these crops are best suited to be grown in the UK.

"I think with perennial energy crops, that's a constant source of biomass so it seems like a no-brainer."

5.3.2 Environmental impact

Some participants were concerned that incentives would result in land no longer being managed in a way that prioritises the natural environment due to a focus on profit. This was viewed as being potentially harmful to wildlife.

"If farmers and those managing the land are incentivised on energy, the environment itself, plus animals, is a concern for me."

There were further concerns about the environmental impact of the crops themselves due to uncertainty over whether the energy crops grown domestically are species native to the UK. If not, it was suggested that growing them could make areas uninhabitable for wildlife.

"[If] it's not a natural crop to here, it's not going to help local wildlife. We'll end up with big expanses of bird and insect free areas because they can't live in that environment."

5.3.3 Land use

Concerns were also raised that farmers would be pressured into making decisions that could impact food supply, the natural environment, and the broader economy. For instance, if it became more lucrative to grow energy crops than to grow food, food security might be threatened. These concerns were similar to those mentioned above about environmental impact and related to general uneasiness about land being used and managed in a way that maximises profit, potentially at the expense of meeting basic needs.

"Aren't you going to get all the farmers saying they're not going to grow any food anymore? What is the impact of these things on real life?"

As with food and feed crops, growing perennial energy crops was considered a potentially inefficient use of land. Participants were not presented with information about how much land would be needed to generate a certain amount of energy from perennial crops, but participants were concerned that a large amount of land would potentially be required to supply only a small amount of energy. There were more specific efficiency concerns raised about whether the land could be cultivated year after year, or whether it was necessary to have a rest period.

Furthermore, while participants were informed that currently only 0.06% of cultivated land in the UK is dedicated to growing perennial energy crops, there were concerns about the total amount of land that would be needed, and whether this would limit the amount of land available for other uses such as housing. These arguments were typically framed in the context of the UK being a small country with a limited amount of land available.

However, participants did not always consider growing perennial energy crops for biomass as an inefficient use of land. Where these crops could be grown on otherwise unused land that cannot be used to grow food, it was considered a good use of resources. Whilst participants raised this point in regard to perennial energy crops, these arguments suggest a desire amongst participants for efficiency in land use for energy and the prioritisation of natural resources.

5.4 Forestry and Forestry Residues

Participants were presented with two different ways of sourcing biomass from forestry. The first, sourcing from forestry residues, involves using small branches and thinning's left from forestry operations and residues and waste derived from wood processing industries to produce wood pellets. The second, Short Rotation Forestry (SRF), involves growing trees specifically for biomass. In the discussion, some participants voiced confusion about how forestry would be sourced and there was uncertainty about which method is currently used to source biomass. Whether participants thought forestry for biomass was being grown specifically to be cut down (as in SRF) or whether by-products were being used (as with sourcing from forestry residues) informed their opinions on the environmental impact of forestry for biomass, and thus their overall support for it.

Some participants believed that SRF led to poor land use and greater environmental impact than sourcing from forestry residues. However, other participants had concerns about importing these forestry residues on the grounds of sustainability, cost, and efficiency. More than with other sources, concerns about sourcing biomass from forestry were considered running counter to the goal of achieving net zero, primarily due to the perception of emissions from combusting wood and importing wood pellets.

5.4.1 Supply and feasibility

Participants were not presented with information around how much energy could be generated from forestry, which made it difficult for some to evaluate whether it should be used as a source. If proved to be an efficient way of generating energy in terms of land required, some participants said they would support its use.

"If we're only using a small amount of land then how much energy are we actually getting from that? If we only need to plant a small amount and we get lots and lots of energy from it, then I think that's really good."

Participants however voiced doubts about the feasibility of sourcing biomass from both forestry residues and SRF. Some queried whether there was enough land available in the UK to grow the trees needed for SRF. Furthermore, participants stated that if forests were constantly depleted, so would the potential by-products from forestry operations and wood processing operations, impacting the amount of forestry residues available for biomass.

The time taken for trees to grow and mature also raised concerns around efficiency, with some viewing this timeframe as too slow to help meet the 2050 net zero target. However, one participant noted as a benefit that the 20-year timeframe for SRF is at least known, whereas timeframes for other sources of biomass might be less certain.

Discussions of importing forestry residues dominated the conversation around forestry, with

participants expressing strong views that the UK should not become reliant on international imports to source biomass. Frequent references were made to session slides that explained how wood pellets made from forestry residues were imported from the USA and Canada and other countries, with 33% of all biomass used in the UK in 2020 coming from imports.

Some participants thought that importing generated too many trade-offs in terms of environmental impacts and energy inefficiency. Transporting biomass over large distances was perceived by some as producing high emissions levels, which was viewed as unsustainable and counterproductive to achieving net zero. Some participants suggested importing from nations nearer to the UK to reduce costs and GHG emissions, whilst others completely opposed importing biomass sources. Concerns were also raised about the costs associated with importing forestry sources, with some suggested that a dependence on imports would be risky and costly.

"A lot of this stuff seems counter-productive… Why are we importing it from America? The cost of that. I understand why we need to import – we haven't got the forests – but why aren't we importing from Scandinavia? It's nearer. Why America?"

Generally, participants valued self-sufficiency and prioritising domestic sources over importing. Some believed that countries should use what they have available domestically to meet emissions targets. However, some of the rationale behind the resistance to importing remained unexplored: participants implied that even if concerns relating to cost, sustainability and efficiency were addressed, they would still be opposed to importing wood pellets. While we cannot be sure, this could have related to issues of national identity or identity politics, manifesting as pride in national resources, for example.

"If Canada and the US have all these wood pellets, doesn't it just make sense that they should use that to make their contribution to net zero, and then we can use what we have to make our contribution to net zero? The importing, that's so much fuel – there's no point."

5.4.2 Environmental impact

Participants considered sourcing biomass from forestry residues as beneficial because of its lower environmental impact, while SRF raised concerns for some participants that it would lead to deforestation and therefore become environmentally destructive (indicating they did not necessarily recognise that these are purposely grown trees, not existing forests).

"You wouldn't want it to turn into deforestation where they're cutting trees down and saying they'll regrow them."

It was explained to participants how wood pellets are combusted in domestic and non-domestic biomass boilers to generate heat, and combusted in large power stations to generate electricity. Driven by a desire to minimise environmental impact, some participants were completely opposed to forestry sourcing based on the emissions resulting from this combustion. For some, this echoed their general concerns about the environmental impact of biomass, but others raised concerns about burning wood specifically, believing this was more polluting than fossil fuel sources.

"They've [unspecified source of information] announced that burning wood produces a lot more pollution than burning coal, and yet here we are saying that we're going to be burning forestry products as biomass."

Participants referred to the ability of trees to absorb and store carbon to argue that it is wrong and counterproductive to cut them down for biomass use. However, one participant suggested that,

because of this capability, any growing of trees could only be a good thing as they will act as a carbon store until they are cut down. While having different implications for support of forestry as a biomass source, these arguments reflect the overall preference among participants to reduce GHG emissions. Whether they viewed sourcing biomass from forestry as a good idea depended on its perceived impact on this.

5.4.3 Land use

As in discussion of other sources, concerns were raised about whether sourcing biomass from forestry is the best use of land. These concerns were directed at SRF, rather than sourcing from forestry residues, and stemmed from participants' perceptions (rather than from evidence provided) that greenbelt areas would be threatened if more land is dedicated to SRF. There were also concerns that this would mean land could not be used for other purposes, such as food. Land was framed as a limited resource requiring careful consideration before being taken away from other uses.

"I'm conscious of the fact that the land is a key resource here and using it in this way means we cannot use it in other ways."

Consistent with the arguments raised when discussing growing crops for biomass, participants views varied depending on how much natural resources were prioritised and valued. If SRF were to make use of land which is currently unused or at least not used where things such as food are grown, then it was considered by some to be a good biomass source.

Participants expressed a preference to maintain forests in the UK, however there was not agreement on the impact of this for sourcing biomass from forestry sources. Some expressed a preference for living near a forest grown for biomass rather than a waste processing facility, implying higher social benefit for forestry over other sources. Others were concerned about SRF's potential to contribute to deforestation, and so opposed sourcing biomass this way to preserve woodlands. These participants understood SRF to mean cutting down trees in existing forests, rather than purposely grown trees.

5.5 Marine Sources

The information presented to participants explained that marine sources of biomass, such as algae, seaweed, and kelp, are not currently widely used and this potential remains to be explored. Some participants remained hopeful that further development could result in an abundant supply of biomass with minimal costs and environmental impact. The key concern raised was the potential impact on marine life. Overall, participants wanted more information to allow for a more comprehensive discussion on benefits and concerns.

5.5.1 Supply and feasibility

The framing of marine sources of biomass as being currently under development led participants to assume there was little information or research available here. For some, this meant it was "the way forward" and an area needing further investment. Others had concerns about unknown risks, raising questions about costs, feasibility, efficacy, and impact.

"It sounds new, so I wonder how much time and energy would have to go into harvesting those sources and we don't know how much we would get out."

Participants referenced the vastness of the ocean to argue that there is an abundance of marine biomass material available. As the UK is an island, participants thought we are particularly well positioned to access these resources, with many assuming they would be free to harvest. These points led some to conclude that marine biomass sources should be prioritised over others.

"We're an island so to me it makes sense to use it, as long as it's not stripping the ocean and it replenishes itself. Why aren't we looking into this more, rather than planting trees?"

5.5.2 Environmental impact

Participants were concerned about the potential negative impact on marine life from using marine sources. They explored concerns about the long-term implications for ecosystems, such as whether this would involve "robbing" the ocean of what it needs, and whether harvesting materials would harm wildlife. Support for sourcing marine biomass was contingent upon it not having a detrimental environmental impact.

"I was concerned about the sea stuff because I don't want to pillage the sea and upset the ecosystem. I wasn't sure if seaweed and all that was a problem. If it wasn't bad for marine life and we could do stuff with that then 'happy days', but I wouldn't want to harm the sea."

Some were hopeful that marine sources would have a comparatively low environmental impact. Harvesting marine sources was considered less resource intensive when compared to perennial energy crops and food and feed crops, as water would not be needed to grow anything new. As with waste, participants thought marine sources required no additional production effort, or destruction. Furthermore, some believed the ocean had the ability to self-sustain and “replenish itself". They considered marine biomass sources to be sustainable for those reasons.

A few viewed algae and seaweed as an environmental problem that biomass sourcing could potentially solve. They referenced experiences in local areas, such as harmful algae that one participant mentioned having in a nearby lake. Based on their own experiences, some participants referenced the need to “clean up” seaweed from beaches, which suggested to them that marine biomass sources should be harvested.

5.6 Conclusion

Participants expressed a strong preference for waste as the most intuitive source of biomass, including household waste and by-products from industrial and agricultural processes. Compared to other sources, participants thought waste was a reliable supply, impacted less on the environment and did not involve trade-offs with other uses of land such as food, housing, or fuel.

The sourcing of other types of biomass, especially imported forestry residues, was seen by participants as more damaging to the environment than waste, which was understood as more sustainable and available domestically.

A key concern in discussions centred around whether biomass sources would be produced domestically or imported. Sources that were viewed by participants as being available in large quantities domestically, such as waste and marine sources, were often favoured over those that involved importing, such as forestry residues.

Participants acknowledged that their preferences were made without hard data on the potential impact of each source, and many requested information on the efficiency of each source (for example can all produce similar amounts of energy) to evaluate the best source of biomass.

6 Production and use of biomass across the economy

About this chapter

This chapter explores participants' views on the role of biomass in six areas: electricity, heating, transport, materials, industry, and hydrogen production. During the dialogue, participants were presented with information about these uses, including the processes involved in producing the energy or materials needed for each from biomass sources. They explored the perceived benefits of and concerns about each use in breakout room discussions.

Key themes

Participants principally evaluated these uses through a prioritisation exercise before explaining their underlying thinking. This focused on how these uses might meet energy and industrial needs rather than achieving net zero. It suggested that the impact of uses on achieving net zero is less intuitive, and the public could benefit from more explicit information here.

When evaluating each use and how it might meet the nation's needs, participants commonly focussed on cost and overall risks. Nevertheless, the discussion developed the following principles and conditions:

Costs and financing:
Concerns were raised about the impact on energy prices, with participants wanting to prioritise uses that minimised costs to the consumer.

Feasibility and evidence base:
Concerns were raised about the capacity for biomass to support larger scale use in heating and industry. For other uses such as hydrogen, participants felt they needed more information to form a view.

Trust, transparency, and accountability:
Participants wanted more information about processes associated with biomass use, particularly regarding financing in industry, to ensure transparency and equitable implementation.

Impact on the environment:
Concerns were raised about the environmental impacts, particularly around the emissions of some uses.

Impact on society:
Participants identified benefits of different uses, such as electricity and heating, based on whether they met basic needs and had a positive impact on society.

6.1 Electricity, heating, and transport

Participants were presented with information about how, in the UK, the majority of biomass is currently used for bioenergy: 66% of all biomass is used in electricity generation, 20% in heating, and 10% in transport. Though presented distinctly, participants often discussed these uses together, frequently raising the same benefits and concerns. Participants tended not to discuss the role of bioenergy use in these sectors to achieving net zero, which suggests that arguments for and against this were not intuitive based on the information provided. Instead, they discussed biomass in the context of the current energy crisis, and so focused on the potential impact on fuel costs and the capacity of biomass to meet the nation's energy needs. Discussions of biofuels used in the transport sector were the exception here. Participants connected this more directly to net zero, based on biofuels' potential for creating sustainable road and air fuel.

6.1.1 Impact on net zero

Participants thought using biomass for electricity generation should be prioritised over other uses because it has multiple applications; for example, heating homes and powering electric cars. However, this view was not unanimously held, with some suggesting a need to focus on transport separately to electricity generation. They cited the cost of electric vehicles to argue that focusing on electricity generation alone, to the exclusion of broader infrastructural issues, will not allow a transition from conventional fuel sources.

Participants made the same argument in relation to bioenergy heating, claiming this should be prioritised given the widespread need for heating at a household and industry level. As with electricity, participants saw that bioenergy heating met several societal needs.

"Heating is used in every home in Britain and in lots of processes for industry. It's used for everything so if it could be used as heating, then that's a huge thing."

Similarly, participants thought that using biomass to produce transport fuel could be impactful due to most people and industries' daily reliance on transport. Given this dependence, some thought it was a good place to start with biomass use as it would have a trickle-down effect.

"You could argue transport is potentially the more important factor of it all. It's like a flow diagram with all the rest; you could build it round transport."

Arguments about the impact of prioritising electricity and heating were rarely linked back in discussion to emissions reductions or their potential contribution to achieving net zero. Instead, these prioritised uses were seen as a way of generating more supply of something that will always be in demand. When similar arguments were made for transport, they were more clearly framed in

terms of environmental impact and the capacity to reduce emissions.

Aviation was recognised by participants as a significant source of pollution, and biomass was viewed as a way of decreasing this. Participants preferred biomass be used for the modes of transport they perceived as being the highest emitting, such as aviation and diesel-powered road vehicles. Participants were also in favour of using biomass to replace other sources of electricity generation that were perceived as less sustainable, such as gas.

"That just stuck out to me because obviously it's a big issue. It's a big contributor to carbon emissions and things like that. That would obviously be amazing if it was able to help with that and bring that air travel down because it's not going to stop any time soon."

Participants referred to their own experiences of using transport to relate the impact that biomass could have back to their own lives. They highlighted the potential for bioenergy fuels to ease concerns about the environmental impact of their lifestyle choices. By making some forms of travel more sustainable, it was perceived as reducing the need for behaviour change.

"I travel a lot, and so I am quite conscious of my environmental impact in taking airplanes and things like that. It would be nice to know that they're using more sustainable means for fuel."

6.1.2 Cost

Considerations of cost to the consumer dominated discussions about these biomass uses, contextualised within the current cost of living crisis. Participants were hopeful that if biomass for electricity production was prioritised, then a greater supply of electricity might replace dependence upon finite sources such as gas and lead to lower costs.

"If it's going to reduce our energy costs and we can move away from using finite resources that we have, then all the better for everyone."

Support for using biomass for electricity generation was often dependent upon reducing costs for individuals, and the same condition applied to using biomass for heating. Participants felt that using biomass for heating needed to be affordable or people would not use it (unless forced to).

"What is the point in using biomass to generate heat for our home if it's, one, going to cost more than the current option, be it gas or electricity…"

Using a similar logic, participants hoped that using biomass for transport would bring down the cost of petrol and diesel, thereby reducing costs associated with owning road vehicles. Some participants referenced the information materials which explained that McDonald's currently uses biomass from used cooking oil to power its vans to suggest it must be an affordable option, because a business would not use it if it were not affordable. Some hoped air travel could also be made cheaper, making it accessible to more people. Using biomass for transport was seen by some as an alternative to expensive electric cars. They believed that in the future, electric cars will become cheaper, but until then, biomass could help reduce costs overall. Whether biomass for transport would be cheaper than current fuel sources was rarely discussed, but participants nonetheless assumed that this could be the case.

However, concerns were raised over the cost of transitioning away from conventional sources of energy for electricity, heating, and transport, towards biomass sources. For example, participants had questions about the costs associated with replacing or adapting power stations and

adaptations required to heat homes with biomass. One participant referred to their own experience of wanting to heat their home with solar power, but not being able to because of the cost. There were concerns it would be the same for biomass, with questions raised over what subsidies might be available to help individuals make this transition.

6.1.3 Risks and concerns

Some concerns were raised about the feasibility of using biomass sources to meet the nation's energy needs. For example, there were concerns about the quantity of electricity that it would be possible to generate from biomass sources, leading to reluctance to rely too much on them. Some participants referred to a statistic in the information provided - that domestic biomass could meet up to 10% of demand by 2050 - as a low number, and this could have informed the perception that the nation's electricity needs may not be met through biomass.

Some were concerned that using biomass for heating and electricity generation could incentivise high energy usage, where people feel justified in using more because it comes from a renewable source. There were similar concerns that using biofuel in aviation could encourage further air travel. This was viewed as unsustainable where biomass was viewed as a scarce resource, with some highlighting the need to prioritise behaviour change.

"Biomass is also a scarce resource. It would still not give us a free-for-all to say emissions are lower so therefore we can fly as much as we like."

However, others argued that fuelling transport from biomass sources negated the need for behaviour change. Some participants thought the potential to sustain current levels of transport use by making it less harmful to the environment was beneficial and could have a positive impact on the UK economy.

"Using biomass would give us a chance to retain transport at current levels and therefore keeps us economically competitive."

As with the discussion around biomass sources, concerns were raised about the role of imports. One view was that biomass could reduce dependence on imports by increasing domestic electricity production, thereby increasing self-sufficiency. Using biomass for transport was similarly presented as a means to meet fuel needs domestically and be less dependent on imported fossil fuels. This was framed as a benefit and a means to establish a more reliable supply chain. At times this argument was contextualised with reference to the Russian invasion of Ukraine.

"As the Ukraine invasion has shown, we have to be a lot more independent on the use of fuels, and if biomass is one way to do it, then that's fine."

There were further concerns raised about how a transition away from traditional energy sources to biomass sources would be implemented, with participants concerned that implementation would not be uniform and equitable. One view was that if individuals are expected to transition and adapt to transport fuelled by biomass, then industry should also have to make this transition.

"If we all had to convert and use it for our cars, yet we keep seeing cruise ships and tankers and heavy lorries churning out diesel, that would feel a bit unjust and unfair."

A further concern was raised around how heating homes with biomass would work at the household level. Some requested more information and a need for clarity in this area. Some also

expressed confusion, particularly over the role of heat pumps and whether individuals would be required to install them in their homes. Others were familiar with how biomass was used for domestic heating, and used their existing knowledge to suggest that current uses could be scaled up to be used by businesses – one participant referred to a friend who uses biomass to heat their home to make this point.

6.2 Materials and products

Participants were presented with information explaining how bioproducts – products made wholly or largely from biomass – can replace materials heavily reliant on fossil fuels. This would be either by using the biomass directly, such as in bamboo or timber furniture and construction, or by processing biomass into a new product such as bio-based plastic. The key benefits participants associated with these uses related to the potential to replace products currently viewed as unsustainable and to reduce plastic waste. In terms of concerns, participants raised questions about the safety and quality of bioproducts.

6.2.1 Impact on net zero

Participants were hopeful about the potential for bioproducts to replace less sustainable materials such as plastic with biodegradable alternatives, such as for use in food packaging. They saw this as a way of reducing the amount of plastic waste and household waste currently being generated. Some participants linked this benefit to establishing a circular economy.

"That to me again is a no-brainer; it's like, well, why aren't we doing that already? If you can make stuff out of environmentally friendly materials, why would you not do that?"

Using biomass to create products to be used in construction was seen by some as going together with using biomass for heating. If biomass were used to create insulation, it could help homes become more energy efficient. Some participants wanted legislation to enforce the use of sustainable insulation made from biomass, where planning departments could specify that only certain materials can be used in new buildings.

6.2.2 Risks and concerns

One participant expressed concern that if the process to produce sustainable bioproducts is rushed, the products will be of poor quality and not be as fit for purpose as plastic. This could result in replacing the "mess" of plastic waste with a different issue later down the line.

Participants also did not want to compromise on the quality of products they use and were hopeful that bioproducts could provide a good alternative. For these participants, their support of using biomass for materials and products was dependent upon the quality of these products being as good as those made from conventional materials, such as plastic. Some used examples of products they are already familiar with that are made from plants, such as bamboo clothing, to suggest that bioproducts could be better quality than alternatives.

Participants were also concerned about the safety of certain bioproducts. Fungi was presented to participants as a potential source of food packaging, but some doubted the safety of using such materials on food. Although not presented to participants as a current use of biomass, participants had concerns about using bioproducts as insulation in buildings, believing that they might pose a fire risk.

Support for the use of bioproducts was, for some, dependent on the working conditions in the factories where these products are made, motivated by a desire to avoid the exploitation of workers and establish ethical production processes.

"There's a moral and social side to this as well."

6.3 Industry

Participants were presented with information summarising how biomass is used in industrial processes, including in the production of cement, textiles, paper, and food, with the potential to help decarbonise hard-to-electrify processes. Prioritising biomass for industrial use was an effective way of reducing emissions and a means by which to distribute the responsibility of achieving net zero. The key concerns of using biomass to support the decarbonisation of industrial processes related to feasibility and costs, with more information desired about the associated costs, especially how industrial use would be funded.

6.3.1 Impact on net zero

As in the discussions about other uses of biomass, participants referred to the potential impact that using biomass in industrial processes could have on the nation's needs for energy and essential goods rather than relating the impact back to net zero. For industry, this argument was made with reference to scale, both in terms of how much energy is used in industrial processes and how much of the things we consume come from these. In this respect, prioritising industry was viewed as potentially creating a ripple effect.

"Industry, to my mind, is the bedrock because industry then produces all the other things ultimately that we use."

Some participants related this to the desire to reduce emissions, with any positive changes made at industrial level being more impactful than those made at a household level. Although not explicitly mentioned, this implies that some participants thought that industrial changes would more effectively achieve net zero emissions.

6.3.2 Cost

Concerns were raised about the cost of supplying industries with biomass and how it would be funded. One view was that industries should be expected to find their own sources of biomass. At times this argument was framed in terms of biomass being a scarce resource and that using it for industry might mean it is less available for other uses. One participant referenced his own company using coffee waste to heat their factory and suggested that others should be encouraged to do the same.

"We should be charging industry even more because we want to use the biomass somewhere else, so is there a focus on getting industry to look after itself rather than relying on biomass?"

A related concern was that private investment into biomass would result in some industries being supplied with biomass over others, with investors expecting a return on their investment. Participants wanted clarity on which industries would be prioritised in this scenario and how equitable this would be, as well as whether and how companies would be encouraged to use biomass, and who would pay for the transition.

"If you've got big business investing in this area, they're going to want to expect to use the biofuels that they're investing in. Other companies who aren't investing in that might not

necessarily have the same opportunities."

Another view was that using biomass in industrial processes would be a way of sharing the responsibility of reaching net zero throughout society, and a way of "sharing the pain around" between the consumer and private companies. This view assumed that other uses for biomass might result in costs for the consumer, and that industry should not be protected from having to pay for the cost of transitioning to biomass energy sources and should instead be expected to adapt along with individuals.

"Electricity generation, heating and transport are all going to hit us, as the private consumer, in the pocket... I think everyone needs to stand up and be counted. So big industry needs to alter their processes as well."

6.3.3 Risks and concerns

Concerns were raised about the feasibility of using biomass as a replacement for fossil fuels in industry. During this session, participants were told how biomass is used to generate heat for industrial processes, but there were concerns about whether this could produce the heat required for certain processes such as steel production. This view was rooted in general scepticism, rather than any potential negative impact of using biomass in industry.

Another view pertaining to feasibility was whether there are sufficient sources of biomass to provide the substantial amount of energy required for industry, and how long it would take to generate this. Participants saw industry as requiring more energy than other potential uses, casting doubt over the ability to source enough biomass to power industrial processes. Participants wanted more information on the potential for biomass to be used in industry, with some unsure or unconvinced about its use here.

6.4 Hydrogen

Participants were presented with information explaining how hydrogen had a wide range of potential uses, including for industry and transport, and biomass might play a role in transitioning hydrogen production away from dependence on fossil fuel energy. It is worth noting that hydrogen was covered quickly in the information shared on uses and as part of the information presented on bioenergy with carbon capture and storage (BECCS), meaning some participants may have done their own additional research. This may explain the different observed levels of understanding among participants on this topic.

Hydrogen production was unfamiliar to many participants and many expressed uncertainties in considering the role of biomass here. Some participants thought it would be highly impactful on achieving net zero, and by replacing fossil fuels with biomass, it would contribute more substantially to reducing emissions. Key concerns included safety and a lack of research around hydrogen production when compared to other uses that were viewed as more established.

6.4.1 Impact on net zero

If participants believed that biomass use would make hydrogen production more environmentally friendly, they became more open to using biomass in this way. Some explained that their understanding of how hydrogen is currently produced was that it is carbon intensive and reliant on fossil fuel sources. For these participants, using biomass here was as a way of decreasing reliance on fossil fuels, and so they were in favour of using biomass for hydrogen production.

"That seems like a very, very good way of using biomass. Hydrogen is the ultimate zero-carbon. You can use it for many different things… I think at the moment that the hydrogen produced is actually from high-carbon sources, so I think by using biomass, it would reduce the amount of carbon used in the first place. If we can generate more hydrogen, that would be a big benefit."

However, some participants had a preconception that hydrogen used a lot of water – a scarce resource – in its production, thereby making it unsustainable, even if replacing fossil fuels with biomass. Participants reported uncertainty around what this process would involve but claimed that if water was not used, then they would support using biomass for hydrogen production. Conversely, others thought that water was produced as a by-product in generating hydrogen, which was viewed as beneficial.

"It uses up our water, which we only have a finite amount of. For now, it will be fine, but isn't that the point of what we want to get away - we want to stop using all our resources until they're extended."

Consistent with arguments in favour of other uses of biomass, some participants referred to hydrogen as having potentially considerable benefits. This was due to the wide variety of things that hydrogen can be used for, such as for transport and in industrial processes; provided hydrogen can be produced in a sustainable way, this was considered a key benefit.

"Surely if you could make as much hydrogen as possible, you could also use that for heating, transport, electricity generation and for industry as a source of fuel, if that's clean. If they can make more of it clean, then surely it can be used everywhere. It can trickle down".

6.4.2 Risks and concerns

While there was uncertainty around some risks associated with hydrogen production, participants were clear on their concerns about safety. The information provided to participants explained how hydrogen is highly flammable and volatile. While hydrogen was not presented as a dangerous use of biomass, some participants voiced concerns, for example regarding the location of hydrogen production facilities. One participant commented that the UK does not have enough land available to position a hydrogen plant far enough away from where people live, and so an accident could be catastrophic. They thought it was "very unstable and very dangerous".

More so than with any of the other sources, participants felt they didn't have sufficient knowledge of how biomass related to hydrogen production, and what hydrogen could be used for to offer a more in-depth view on their sense of the benefits and concerns. Some viewed hydrogen as "the future", viewing it's use as inevitable, with some believing that it was a new area with a lot of potential. However, a lack of familiarity made others wary, reporting that the benefits of using biomass for hydrogen were less clear than for other uses.

6.5 Conclusion

Relating biomass use to achieving net zero proved challenging for participants who instead evaluated each of the six uses presented in relation to the nation's needs, primarily in terms of energy production, transport, and the heating of homes. The more widespread the use was perceived as being, typically, the more participants thought it should be prioritised as a use of biomass. A key concern within this context was keeping costs low at the household level with regards to electricity, heating, and fuel. A further concern relating to cost was around how biomass

for industrial use would be funded, with requests for further clarity and evidence-led assessment of whether there would be enough resources to meet all these uses.

Other risks raised were associated with the ability of biomass to meet the nation's needs for electricity and essential goods, with concerns voiced about becoming too dependent on biomass at the expense of reliability.

Participants requested further information to enable them to evaluate all uses discussed, particularly with regards to how much biomass would be required to power each use and how energy efficient this would be compared to traditional sources used for the processes and uses discussed. Participants found materials and products the easiest to evaluate. However, participants reported limited understanding of biomass for hydrogen, with more information needed for them to make an informed opinion.

7 Biomass Sustainability Criteria

About this chapter

This chapter outlines participants' views on the current criteria used by the UK Government to ensure the sustainability of biomass. To help participants explore this they heard five-minute presentations from the following four specialists (slides used by each specialist are available in appendices):

- A specialist from BEIS outlined the current sustainability criteria used by the UK Government, including a high-level overview of the current land and greenhouse gas (GHG) criteria.
- A specialist from academia provided a broader view of the factors that contribute to the sustainability of biomass.
- A specialist from an environmental NGO (RSPB) outlined concerns that their organisation has regarding the current land and GHG criteria used by the UK Government. This contribution was pre-recorded.
- A specialist from a biomass certification scheme (Sustainable Biomass Program) outlined how their sustainability certification scheme worked.

The presentations were delivered in plenary, so all participants heard the same information. After their presentations, the three specialists that attended in person (representatives from BEIS, academia and the certification scheme) participated in a twenty-minute question and answer session. Participants then went into breakout rooms to discuss their views.

Key themes

After hearing the range of perspectives participants remained sceptical about the concept of 'sustainable biomass' as well as the feasibility of implementing the current criteria.

In particular, the emissions created in the sourcing and production of biomass were seen as intuitively unsustainable. Participants felt other renewable sources, such as wind and solar, must be more sustainable because they were perceived to involve fewer production processes and therefore emissions. Data comparing the sustainability of biomass to other renewables was not provided to participants, so this view was based on participants own knowledge and beliefs.

In terms of implementation, many were sceptical, given the complexity of international supply chains, that it is possible to ensure that all elements conform to the sustainability criteria. This was in part driven by people's pre existing opinions about the difficulty of regulating supply chains, and partly by information shared by the specialist from the RSPB who highlighted

instances of land use, that based on their information, did not conform to UK sustainability criteria.

Most participants felt the UK's land and GHG criteria covered the right areas. However, when discussing GHG criteria, participants perceived there was a contradiction between specialists. The BEIS specialist outlining the criteria stated that emissions from the supply chain and processing are counted, whereas the specialist from the RSPB provided information that stated some emissions are not included in the criteria. The latter perspective resonated with participants' concerns about the criteria and led them to conclude that it is important all emissions are included in the criteria.

To ensure the sustainability of biomass, participants wanted a mix of organisations regulating private companies to ensure the focus remains on net zero.

The discussion on sustainability criteria contributed to the development of the following principles and conditions:

Costs and financing:
Economic sustainability was important for participants, which led to conditions around biomass not increasing prices for consumers.

Trust, transparency, and accountability:
Conditions around independent and enforceable regulation emerged from concerns expressed about the existing criteria. Engagement with the contradictory perspectives led to the development of a condition about communicating information transparently.

Feasibility and evidence base:
Conflicting information presented about carbon accounting led to the development of a condition about consistent carbon accounting across all stages of the supply chain.

Prioritising natural resources:
Concerns around the sustainability of importing biomass led to the development of a condition prioritising domestic sources.

Impact on the environment:
Discussion of the existing criteria led to the development of a condition to minimise the disruption to biodiversity and the depletion of natural resources.

7.1 The challenge of sustainability

7.1.1 Carbon neutrality

Participants arrived at the sustainability criteria discussion having already explored the sourcing and use of biomass in the previous session. As outlined in chapters four and five, during these prior discussions, participants expressed concerns about the environmental impact of sourcing biomass from forestry and crops, as well as the emissions involved in biomass production and importing. These concerns around the CO2 emissions produced in the sourcing and production of biomass emerged more prominently when discussing sustainability.

A number of specialists referenced the sourcing of biomass from forestry. The certification specialist outlined the certification system for woody biomass, the RSPB specialist highlighted concerns about deforestation, and the BEIS representative spoke about the sustainable forestry cycle. During the question-and-answer session, specialists fielded questions about the sustainability of importing wood pellets to address participants' concerns that this source appeared unsustainable.

After hearing this information most participants remained sceptical that biomass can be sustainable when sourced from forestry, which based on the information presented, they understood to be largely imported and produced through industrial processes that release CO2 emissions. Many participants found it challenging to accept the possibility of entering into the carbon debt that sourcing from forestry and importing sources could entail under certain circumstances. Some also picked up on challenges raised by the academic specialist that the re-absorption of emissions may not take place quickly enough to contribute to net zero.

"I don't see how it can be sustainable if we're cutting down trees. If we were to replant, it could take decades."

"That will take a lot of time, like [the academic specialist] has said [when replacing wood used for biomass], you have decades there with a vacuum."

Production processes involved in making bioenergy were mentioned by the academic specialist who outlined the bioenergy and BECCS supply chain, including CO2 uptake and emissions. The specialist from the RSPB also had the view that burning wood can emit more CO2 than coal. This information resonated with participants and served to confirm their scepticism that it is possible to neutralise the emissions released through production processes by absorption and capture.

"It's not really worth producing clean energy and having a [carbon] footprint in producing that clean energy."

These concerns about carbon neutrality were often expressed in comparison to the perceived sustainability of other renewables like wind and solar. As mentioned in chapter two, participants were not provided with information on the emissions involved in using wind and solar because the focus of this dialogue was on biomass. Therefore, participants' perception of wind and solar as more sustainable than biomass was based upon frames of reference outside of the dialogue. In contrast to biomass, participants perceived wind and solar to produce fewer emissions because they do not involve combustion processes or importation of sources. Some also appeared to believe that the infrastructure for wind and solar is already established (they referenced domestic solar panels and large-scale offshore wind farms), whereas many had understood from sessions one and two that the infrastructure to produce energy from biomass would need to be built in the

UK, which would involve costs and emissions.

Ultimately, to consider biomass to be sustainable, participants repeatedly stated that it should generate an overall reduction in emissions as part of a path to net zero. Some participants expressed concerns that biomass could enable individuals and industry to perpetuate high-carbon lifestyles because it was seen as a direct replacement for fossil fuels, which also involves generating emissions. Therefore, many wanted to see how the use of biomass worked alongside other initiatives to reduce emissions.

"This is not about finding new forms of fuel to carry on living the same way we always have: we need to change; we need to reduce our consumption."

7.1.2 Accounting and regulation

After hearing specialists explain how GHG emissions produced across the supply chain are accounted for, and regulated, many participants continued to express scepticism that it is possible to know if biomass is genuinely sustainable, considering the GHG emissions across the supply chain. This doubt was based on two pieces of information. The first was information shared by the specialist from RSPB who highlighted what they considered to be examples of non-compliance with the criteria (detailed in the land criteria section below). The second piece of information was examples of supply chains from other industries that they believed to be hard to regulate.

"I don't feel that there would be the infrastructure in place to make sure that everyone's doing what they should be doing. You're relying on a lot of different people to be completely honest about the emissions that are being created. Everybody's got to be on the same page."

Alongside the challenge of accounting and regulation, as detailed at the start of this chapter, participants also heard contradictory information from the BEIS and RSPB specialists regarding the extent of emissions counted within the GHG criteria. When the BEIS specialist outlined the criteria, she stated that emissions from the supply chain and processing are counted, where the specialist from the RSPB stated that emissions are not included in the criteria. Many participants referred to information presented by the RSPB specialist in their discussions when explaining their view on how transparent UK sustainability criteria were. They believed this evidence concluded that generating electricity in the UK from imported wood pellets releases more emissions than coal.

'Either it produces twice as much as coal, or it doesn't. If you change the way that you measure it to say it's better than it is, isn't that being dishonest?'

7.1.3 Additional aspects of sustainability

Throughout the discussion, participants referenced three additional aspects of sustainability that were not captured in land and GHG criteria: impact on energy prices, self-sufficiency, and small-scale community energy production. These aspects were informed by the three pillars of sustainability: economic, social, and environmental. These were presented to participants by the NatCen lead facilitator at the start of the session, based on information prepared by Eunomia.

For many, sustainable biomass would mean costs of energy not increasing for consumers. As mentioned in the introduction, rising energy costs were regularly referenced throughout the

dialogue, and participants emphasised that economic and social sustainability criteria should ensure energy prices do not increase for consumers because of biomass use.

"On the criteria, we're missing standards of living. Making sure that people aren't going to be worse off by these measures."

The concerns outlined earlier about whether it is possible to account for all emissions in the supply chain aligned with concerns that the UK accurately records all emissions, which led many to suggest that importing biomass should be scaled back in favour of greater self-sufficiency through domestic renewables.

"For me sustainable is living off your own land. We haven't got a guarantee that we'll always be able to get pellets from the USA or Canada."

Community and domestic-run energy were favoured by some as a more sustainable model of energy production compared to large profit-making energy companies. No information was provided about solar energy, but some participants brought their own knowledge of domestic solar as a reference point for how renewable energy can be delivered sustainably at small scale. Some of these participants felt this model could apply to biomass, potentially through domestic waste.

"A friend has solar energy on her house and it takes money off her electricity. If we had more power and our waste could feed into our electricity rather than trusting big companies… we [would] come up with the waste and take ownership for what we do."

7.2 Land use criteria

The BEIS specialist introduced an overview of the land use criteria, which applies to biomass used in the UK. In breakout rooms, facilitators re-shared the overview and asked participants to discuss whether it covered the right areas. A consensus emerged over the importance of all five criteria (figure 11), and some suggested adding public consultation and engagement.

Information on existing public consultation and engagement regarding land use for biomass was not provided to participants during the dialogue. As such, this suggestion was based on participants' belief that public consultation on any significant land use is important. Some referenced fracking as an example of the type of land use that they think the public should be consulted on. They did not provide specifics around how they think the public should be consulted, however.

Figure 10: UK land criteria presented to participants

7.2.1 Biodiversity and ecosystem protection prioritised

Protecting biodiversity and ecosystems emerged as a clear priority for participants within the land use criteria. Many participants referred to the importance of natural systems, wildlife, soil health and clean water. Protecting biodiversity and ecosystems was seen as a separate issue from net zero, and one which is equally fundamental to the health of the planet.

"The minute you start affecting biodiversity, that's the end of civilisation. We're not going to survive as a planet if we start destroying all the different ecosystems."

Within this priority, there was high public concern for protecting trees and forests. Using imported forestry biomass, however well regulated, was seen as running counter to this concern.

"As we've all said, it's been drummed into us not to cut our forests down, and try to get out of that psyche to say, 'Well, it's okay to cut forests down if they're regulated'. I find that hard to believe."

This perception held even after hearing that biomass comes from forestry residues. Participants expressed views that suggested they did not have confidence that regulation was strong enough to ensure only residues would be used, and even if only residues were used, some expressed concern that the primary use of the forestry may not be sustainable. These views reflect the scepticism participants had about our ability to regulate international supply chains outlined earlier. Participants focused on imported forestry residues because this was the larger focus of specialist presentations than domestic forestry residues.

'Pellets are made from the waste of production, but what are they're producing in Russia or Canada with the wood they cut?'

7.2.2 Carbon stocks is a less familiar term

The terms 'carbon stocks' and 'peatland' were unfamiliar to many, so participants in several groups did not express a view on criteria two and three (listed in figure 10 above). Those more familiar with the terms did see how using forestry residues for biomass whilst protecting both carbon stocks and biodiversity could work, and questions were raised about how carbon stocks could be feasibly measured and controlled. Any use of forestry biomass was seen as potentially damaging, and contradictory to natural net zero solutions for carbon sequestration such as tree planting.

"Ensuring carbon stocks of forest do not decrease… If you start cutting trees and using forest and then you burn that, isn't that a contradiction?"

7.2.3 Legal and sustainable harvesting seen as challenging to enforce

Although a requirement for legal and sustainable harvesting was seen as essential criteria, participants did not see how enforcement of this was possible, particularly when sourcing biomass internationally. As mentioned earlier, this scepticism was partly driven by participants' knowledge of commodities used in the UK from unsustainable sources – examples provided included deforestation for livestock in Brazil and for palm oil in South East Asia.

"The bit I don't agree with is the importing. I don't see how it can be fully sustainable, I think it would be difficult to enforce sustainable harvesting overseas."

This doubt was also based on how participants navigated the different perspectives provided in the dialogue. Specialists from BEIS and the certification scheme explained that each stage of the supply chain is audited and requires certification, which a small number of participants found reassuring. However, others referenced comments made by the RSPB specialist who suggested that wood pellet production in Eastern Europe and North America was, in some cases, not being done in line with UK sustainability criteria but still being imported by the UK.

Neither were participants convinced that domestic sourcing can be regulated. They offered examples from outside the dialogue of what they saw as failures in environmental regulations in the UK. For example, water companies releasing sewage pollution into rivers and landowners damaging wildlife or burning peatland for grouse shooting.

"We can't even keep on top of our land criteria in the UK at the moment. You still have farmers killing eagles and hawks and getting away with it, so if we can't enforce what we currently have, how the hell are we going to enforce all this, not just here but in the other countries that we're sourcing it from?"

7.2.4 Land use and labour rights also challenging to enforce

Similarly, many participants felt that protecting labour and indigenous land rights overseas was important, but again expressed doubts that this is possible to enforce. Participants cited examples of other industries that involve global supply chains, such as clothing, as reference points for how difficult it is to maintain labour rights in other countries.

"We've been buying clothes from factories where people have been getting well below the minimum wage, or made by children, how do we know this isn't just us profiteering off people's suffering in another country?"

Participants were divided over the enforcement of labour rights criteria within the UK, with some arguing they are already sufficiently protected, and others pointing to their erosion.

"Any job done in the UK should have labour rights protected, it's extremely important but I put it last because I'd take it as a given."

"The UK Government, they've taken labour rights away. We just left the EU where labour rights are protected."

7.2.5 Additional consultation and engagement

When asked what may be missing from the current criteria, some participants called for democratic public engagement to be part of the land use decisions in the UK. The high-level summary of land criteria did not involve details of how the UK Government currently consults the public on land use, so these comments were made potentially without a full understanding of government consultation processes.

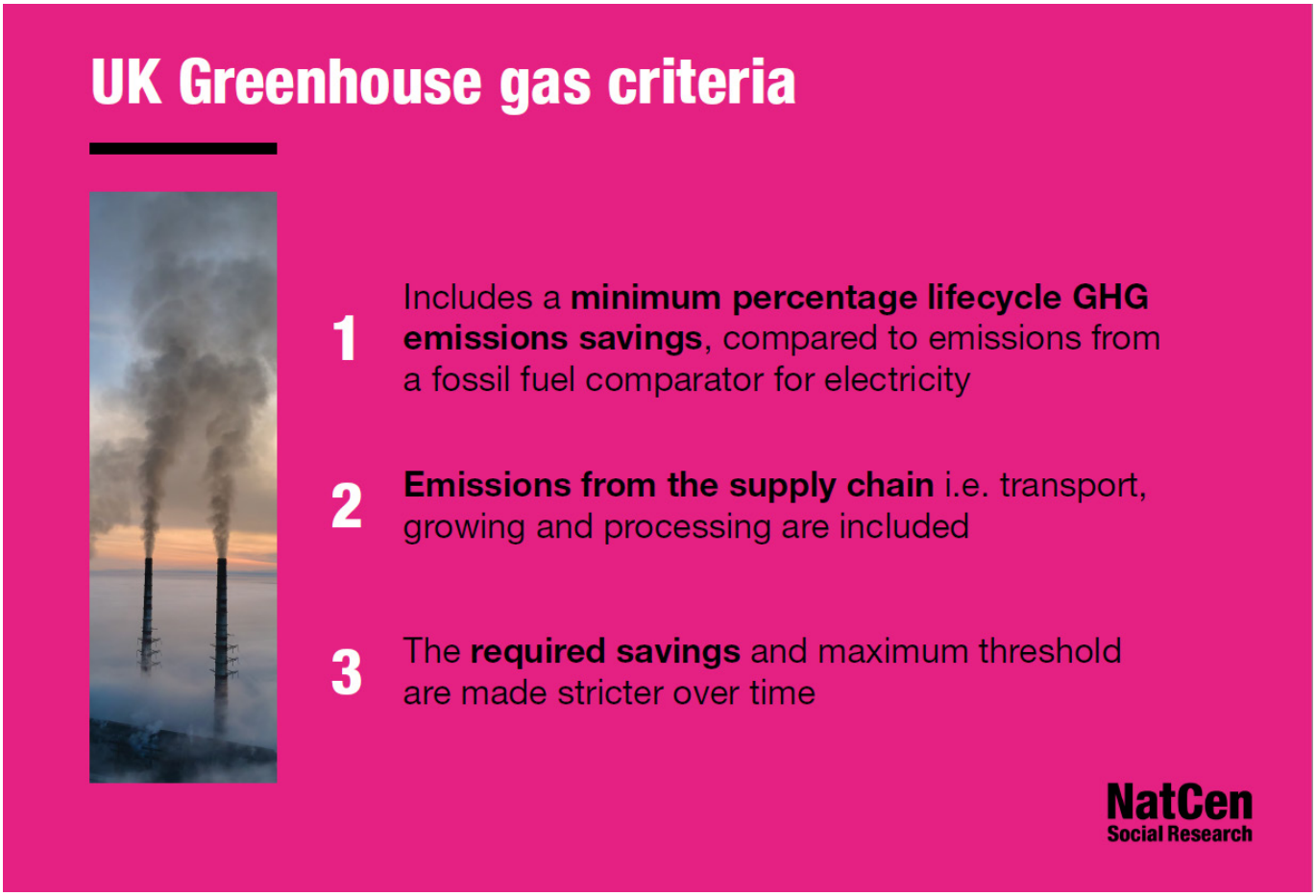
Suggestions included consultation and co-design with local people as well as protecting land for the common good rather than for wealthy landowners. Although participants did not provide explicit rationale for why consultation and engagement should be specifically added to land criteria, it is possible that the established practice of consulting on change in land use in the UK led some to ask for this addition.

"Where this land criteria is going to have to be met, they should have to show they have had public engagement, public buy-in. The local council, the local people having a say before taking action, something that says we develop the laws together."

7.3 Greenhouse gas (GHG) criteria

Participants were introduced to a high-level summary of the GHG criteria (figure 11), which applies to biomass used in the UK, by the BEIS specialist in plenary. Then, in breakout rooms, facilitators shared the criteria and asked participants to discuss whether it covered the right areas. A consensus emerged that all three high-level criteria were important, but participants wanted the criteria to be more specific and comprehensive.

Figure 11: UK land criteria presented to participants



7.3.1 Emissions savings should be more specific and compared against other renewables

Participants were in favour of a tangible target for emissions savings, which could be compared against other renewable sources. Criteria one as presented to participants, was perceived as lacking specific data on savings and timescales, which created doubt about its usefulness. Several participants were interested in comparisons with other renewables rather than fossil fuels, to justify the role of biomass in the energy mix.

"It should really be compared alongside wind, solar and hydro power to let us know the full picture. Of course, it's going to be cleaner than fossil fuel."

7.3.2 Supply chain emissions need to be comprehensive

Participants agreed with criteria two and emphasised that all emissions in the supply chain must be counted. As mentioned earlier in the chapter, many participants saw a contradiction between the information shared by the BEIS and RSPB specialists regarding emissions accounting. The information shared by the latter resonated with participants' evolving concerns about the emissions created through production and use of biomass. This led participants to emphasise the need to include all sources of GHG emissions, as anything not counted, or counted in another country and thereby omitted from UK calculations, raises suspicion that UK biomass is not genuinely sustainable. When discussing the criteria in breakout rooms, a few participants recalled specific

emissions, which they had understood from specialist presentations, not to be counted in the UK GHG criteria.

"It's burnt here but that wouldn't go towards our emissions, that raised red flags."

"Back to those panel presentations and some information saying that emissions from the harvesting wasn't included in the UK emissions target. I think the harvesting of any crop has got to be included."

7.3.3 Making emissions stricter over time seen as lacking urgency

Participants expressed a sense of urgency and a need for decisive action on GHG emissions. This led to many questioning the idea in criteria three of savings and thresholds being made stricter over time. Participants were presented with the high-level criteria (figure 11), which did not include a rationale for making thresholds stricter. Participants saw this as too vague and flexible, allowing room for delay and potential watering down or lowering of standards.

"It should be made strict now instead of later and making the problem even bigger. I agree with everyone else, sounds like an excuse to push it back more."

7.4 Regulation and governance

7.4.1 Regulation to ensure focus on net zero and not profit

Participants wanted regulation and governance to ensure that the sourcing, production and use of biomass achieved net zero and enabled social and economic sustainability, referencing two of the pillars presented to participants early in the session. Many expressed concerns that large private companies may make decisions based on profit, and governments may make decisions based on vested interest. Some referenced the current energy sector as evidence that profit can drive decision-making rather than the needs of society.

"I fear the Government and the larger oil and gas companies will get their fingers in the mix and that's when it becomes a profit-making scheme for big business rather than a benefit to the community."

When discussing what regulating the profit incentive may look like in practice, many referenced minimising the financial impact on consumers as well as the environment. There was broad consensus that protections should exist at consumer level, to prevent energy costs from increasing further as a result of using biomass, thus making it financially sustainable. In addition, there was also a sense of agreement that growth of the biomass industry should not be incentivised in ways that contribute to unsustainable sourcing or production of biomass.

"There needs to be price caps on sources if we are going to use biomass, it needs to be sustainable for us as consumers. We need to be able to afford it."

7.4.2 Regulation by those focussed on net zero

Participants wanted sustainability of biomass to be regulated by an independent body that was focused on net zero. Within this context, independence was understood as having no potential profit-making or vested interest in the way biomass is sourced, produced, and used.

Governance by a diverse coalition of expert stakeholders was suggested several times to cover the breadth of issues and practicalities involved, ensure robust scrutiny, and keep the focus on net zero by limiting room for corporate abuse of the strategy to generate profit –" bio-washing", as one participant called it. Whilst participants thought sustainability criteria should be set by a coalition of independent bodies, they conceded that industry expertise might ensure the practicalities of regulation were included in decision-making. It was also the view that government involvement remains necessary for guidelines, democratic accountability, and enforcement.

"You need a diverse membership of the regulatory body, so those organisations can scrutinise it and have their say over what's going on."

Different types of independent organisations were suggested as part of this coalition. These included environmental non-governmental organisations such as Greenpeace or Friends of the Earth, whose aims and expertise were seen by participants to align with net zero and environmental protection, rather than profit or short-term political agendas. Scientific experts were also seen by participants as trustworthy and necessary for governance and regulation because they can ensure decisions are based on evidence. Some referenced the way that scientists from different backgrounds came together to advise on the development of the COVID-19 vaccination programme as a model for ensuring robust, evidence-based regulation.

"A national environmental organisation. Not somebody who's going to make money off the energy; not having any ties to the Government or those taking part."

"An independent body with qualified scientists. For example, the vaccine, there was a panel of scientists probably more than 100, and another body who was independent. There were no vaccine companies advising the Government."

Several participants suggested confidence in regulation could be increased by involving members of the public, as neutral parties, and laypersons, who could also help with explaining regulation to other members of the public. It was suggested that members of the public could be represented as stakeholders on regulatory panels or committees.

"I would recommend representation from the public to make it trustworthy and mutual. It's nice to have independent auditors and people in white coats, but they don't necessarily speak the same language as we all on this call."

7.4.3 Transparent standardised indicators of success

Participants would like to see data on the impact of biomass so that the public can be made aware of how biomass is contributing to achieving net zero. Some mentioned specific measures, such as carbon absorption rates. However, most emphasised clear and accessible indicators of success are necessary so that the public can track effectiveness. Participants also mentioned that these indicators would need to be consistent across different countries globally to ensure measurements are accurate. Several suggested that these global regulations should take into consideration circumstances of different countries, such as levels of development and varying reasons for high emissions.

"Clear comparisons on the economic, social and environmental, alongside solar power, wind power, the things that are going to be the genuine alternatives over the next 50 years."

"The public should be able to access this information live. We can't just get a report at the end of five or ten years."

7.4.4 Legal enforcement

Participants wanted legally binding sustainability criteria to be enforced through meaningful punitive deterrence ("jail time"). These punishments should be strong enough to disincentivise private companies from ignoring the criteria, and several participants suggested that personal rather than corporate sanctions would be more effective, as large corporations may have the potential to absorb fines or circumvent bans. Some saw a role for government here to create the right legislation that can be enforced by an independent body.

"I'd like to see a proper legal framework with named individuals being responsible. The head of biofuel UK or whatever is in charge and going to be fined or put in prison for not getting it right."

The certification schemes presented by the specialist speaker were not seen by most participants as stringent enough. A confusion may have arisen as these were understood to be voluntary even though the BEIS specialist outlined that complying with the sustainability criteria is mandatory. Information was provided by the BEIS and certification scheme specialists about auditing by regulatory bodies at different stages of the supply chain, which a small minority of participants found reassuring. However, most participants nonetheless interpreted the idea of voluntary certification as enabling private companies to opt-out of proper regulation. Participants' understanding was that even those companies who opted in, were understood to provide their own data and pay for the certificate without sufficient external checks, which was not seen as a strong model of regulation.

"Since when has voluntary compliance ever resulted in honesty? I don't believe in self-certification."

"The certification seems very woolly to me, you only had to conform on certain things, and the rest of it you just made up to suit yourself. It should be about standardisation, everybody working to the same rule book. It seemed to me like there was lots of loopholes that you could get round it with. You might have one company who's doing everything right to the T, and the other one who's just bending the rules."

A couple of participants also picked up on what they saw as incomplete or inconsistent elements to the certification. For example, the statistic that 70% of biomass has to be from sustainable sources was referenced as evidence that certification requirements are not strong enough.

"It all seems very ambiguous. Why we've only got to achieve 70 per cent, why things aren't included in our UK calculations, why things are being deliberately missed out..."

7.5 Conclusion

Participants agreed that both the current land and GHG criteria cover the right areas, but expressed doubts about how it can be applied in practice.

These doubts were based on scepticism towards the concept of sustainable biomass, because of the emissions associated with its sourcing and use. Even when participants accepted the concept that these emissions can be neutralised, many remained unconvinced about the feasibility of implementing sustainability criteria across international supply chains.

Throughout the discussion on sustainability, participants requested information that compared the sustainability of biomass with other renewables such as wind and solar. This information was not provided, so participants drew on perceptions to conclude that these energy sources were more sustainable because they involved fewer production processes and the technology for them is already established.

To ensure the sustainability of biomass, participants wanted a mix of organisations, including representatives from academia and environmental NGOs, regulating private companies to ensure the focus remains on net zero.

8 Bioenergy with Carbon Capture and Storage (BECCS)

About this chapter

This chapter outlines participants' views on Bioenergy with Carbon Capture and Storage (BECCS). At the start of the session on BECCS, participants were presented with a detailed explanation by Eunomia, which included a summary of key risks and opportunities. Then participants discussed their initial views, before hearing the following specialist perspectives:

- A specialist from academia talked about the possibilities for the role of BECCS in achieving net zero.
- A specialist from industry (Future Biogas) talked about the current industry deployment of BECCS (contribution via pre-recorded video).
- A specialist from an environmental NGO (Greenpeace) talked about the environmental impact of BECCS.

The presentations were delivered in plenary so all participants could explore the same information. Afterwards, the two specialists that attended in person (the academic and environmental NGO) participated in a twenty-minute question and answer session. Participants then discussed their views on the potential role of BECCS in breakout rooms.

Key themes

Participants agreed that BECCS has a role to play in achieving net zero, not least because they interpreted specialist speaker contributions as presenting few feasible alternatives for achieving net zero by 2050.

However, after hearing information provided by specialists that highlighted the lack of existing large scale BECCS operations, participants expressed considerable concerns that BECCS is as yet unproven at scale. Although this didn't change participants' conclusions, it did lead them to emphasise conditions such as a scaled implementation until the evidence becomes more certain.

Although indicative costs for BECCS were not provided, participants did hear from specialists that significant investment would be needed and that well-known multi-national energy companies would likely be involved in deployment. This level of investment added to concerns expressed by participants earlier in the dialogue about the potential for decisions about the role of biomass to be made in the interests of profit making, rather than net zero. As with sustainability, participants wanted regulation by a coalition of independent stakeholders to ensure that the focus of BECCS remained on net zero.

The discussion on BECCS contributed to the development of the following principles and conditions:

Costs and financing:
The importance of conditions around profit-making incentives were heightened when discussing BECCS, because the perceived scale of infrastructure required meant even more scope for detracting from net zero. Additional concerns were raised around controlling costs of large infrastructure projects, which led to conditions around the need for cost-benefit analysis.

Feasibility and evidence base:
Concerns were expressed about the extent to which BECCS is proven to reduce emissions at the scale required, which led to conditions that emphasised the importance of scientific consensus, feasibility studies and timelines.

Trust, transparency, and accountability:
As with sustainability, participants wanted conditions around strong regulation by a mix of organisations. For BECCS specifically, regulating safety was a particular concern.

Impact on society:
The impact on local communities was discussed more in relation to BECCS and the importance of jobs, and restricting air pollution emerged as conditions.

8.1 Benefits of BECCS

Participants accepted that BECCS has potential to play a role in the UK achieving net zero, but alongside other measures. This recognition was based on a perceived consensus amongst specialists that there are few viable alternatives to achieving the required reduction in emissions by 2050. Despite significant reservations, many participants reluctantly concluded that it is worth investing in BECCS because of the urgency of the situation, and the perceived absence of alternative approaches that can bring down carbon emissions quickly enough.

"I know we have to do something, but I think we need to have more thought into it, more planning first. The amount it's going to cost, the impact it's going to have on storage, leakage, marine life for instance. What impact is it going to have on people's lives that live nearby where it's stored?"

Despite these concerns, several benefits were picked up by participants from the information presented by Eunomia and the industry specialist. These benefits reflected those expressed in the Sciencewise public dialogue on Carbon Capture Use and Storage (CCUS).[30] The potential to use the UK's existing infrastructure and natural resources was considered an advantage. Participants picked up on the economic boost BECCS could provide to industrial areas, and the potential for job creation which could contribute to a fair transition away from oil and gas.

"It's good they can use the old powerplants, it does say it's going (to) increase the economy of the UK especially in the industrial areas."

30 Carbon Capture Usage and Storage | Sciencewise.

Some participants also noted information in the specialist materials showing the potential of BECCS to use waste as a feedstock. This aligned with participants' preferences for waste (defined as anything that would otherwise be thrown away) as a source of bioenergy more broadly, as discussed in chapter three. The use of imported wood pellets for BECCS was unpopular for reasons discussed in chapter three and six, so again this was seen as a benefit of waste.

"There seems to be such a wide field of bioenergy. Even if we don't use wood pellets and import them from Canada and America, then we might have a fair amount of waste that we can use ourselves."

8.2 Risks and concerns around BECCS

8.2.1 Impact on net zero

The greatest concern participants expressed was similar to that expressed about biomass more broadly: that the production processes involved in BECCS could lead to increased emissions as opposed to helping achieve net zero. Despite being provided with more in-depth explanations of the carbon capture and storage element in this session from Eunomia, as well as academic and industry specialists, this did not appear to counter participants' concerns that the emissions in sourcing and production would be balanced out, and even tipped, toward carbon negativity.

"The risk is ensuring it stores more CO^2 than it emits. I just want them [unspecified] to be certain. There's no point in investing in it unless they know it stores more."

"There's no certainty to a lot of the risks. It's very different to renewables in terms of wind and solar, it reminds me of nuclear, there's this product created that needs disposing of."

Participants' concerns about whether BECCS would create negative emissions were based on an understanding that BECCS technology is unproven at scale. During the dialogue, Eunomia and other specialists provided information on the current deployment of BECCS, which was understood by participants to highlight that there is currently only one example of BECCS being deployed at sufficient scale. This was interpreted by participants as indicating that the technology is unproven at scale, and therefore the extent of carbon negativity possible is unproven.

"At the moment there's only one place doing long term CCS – I thought that was quite shocking actually."

An additional piece of information that contributed to participants' concerns about feasibility was the perceived length of time that the technology has been in development. Many participants repeated information they heard from the Greenpeace specialist that BECCS has been in development for twenty years, but sufficient progress had not been made in the technological development. There was little discussion amongst participants of the reasons why progress had not been made faster, but this timeframe contributed to a sense of uncertainty about the feasibility of the technology. Some referenced comparable energy technology, such as nuclear fusion, which was understood as an example of a promised solution that never materialised.

"The carbon capture tech, it's questionable. It's hoping for a solution which may not even come, the example (the Greenpeace representative) gave was nuclear fusion, we're still waiting on that."

8.2.2 Safety and environmental impact

Participants also had significant concerns about the storage element of BECCS and the potential impact on the environment. Here, participants interpreted information from specialists regarding the level of risk involved in storage differently. Some had taken away the idea that storage is finite, and leaks are a risk, whilst others had taken away the sense that risks are low. For many, the risk of currently unidentified problems arising for future generations undermined arguments that BECCS could be a long-term solution.

"These storage spaces that we're talking about, how long do they last? I don't think they're infinite. Are we actually solving the problem or are we just redistributing things for other generations to worry about later?"

"The key thing is the safety of it. You had one voice that was saying we can rely on these things for 10,000 years, they used to be oil fields. Then you had the other voice saying they leak. Basically, I'm not sure what to believe. I'm a bit confused and conflicted."

The key safety concern was the possibility of a continuous or sudden leakage of CO2.

As an odourless and invisible gas, participants had concerns that a leakage would not be detected, and what effect, as one participant terms a "catastrophic failure" of sudden release, could have on the climate or on people working or living nearby.

In line with findings from the public dialogue on CCUS, there were concerns about earthquakes and potential harm to marine and other wildlife.[31] Participants often referred to fracking as generating similar risks.

"We're building pressure inside our planet, isn't there an element of risk that it has an impact on seismic movements, earthquakes? Isn't that similar to some of the fracking debates that we're having?"

8.2.3 Costs

Participants were not presented with potential costs of implementing BECCS. However, information presented by Eunomia did highlight that costs would be high and possibly uncertain. Throughout the dialogue, participants referred to other infrastructure projects such as HS2, which was perceived to have cost more than anticipated. This supported the view from participants that the costs in BECCS, like many large infrastructure projects, are unknown and could spiral out of control. Some questioned whether spending large sums of money on BECCS was the right thing to do at a time when the UK economy is struggling. They conveyed the need for a cost-benefit analysis of BECCS technologies and implementation.

"My concern would be the costs, we are really looking into a void, and we really don't know, financially, if these actions are going to benefit us and be cost-effective."

"Times are lean post-covid and Brexit. Can we afford it?"

31 Carbon Capture Usage and Storage | Sciencewise.

As discussed in chapter six, there was a perception amongst participants that renewables, such as wind and solar, are more sustainable because they are understood not to involve the same GHG emissions as biomass. When discussing BECCS participants also expressed a view that further developing renewable technologies such as solar, wind and hydropower may be more cost-effective because the technology is understood to be more proven, and industries such as wind and solar are already established, whereas BECCS would involve more investment in infrastructure and the benefit is unproven.

"From what we're learning, the BECCS process isn't completely sorted. It still requires a lot of investment, and it still requires the technology to be developed. So, if we're having to fund expensive technology development anyway, why are we doing it into BECCS? Why are we not doing it into something which actually doesn't create these problems in the first place? As far as I'm aware, solar energy actually does work, and I don't think it creates carbon, does it?"

"My impression is that they're trying to build up a new system of saving and transporting CO2to make biomass one of the energy sources. This will be expensive, rather than focusing on solar that is already established."

8.2.4 Profit making vs net zero

As discussed in chapter three, the potential for profit-making and vested interest to detract from net zero objectives was a concern throughout the dialogue. This was pronounced when discussing BECCS because it involves significant investment in technology. The specialist from industry outlined how BECCS is currently being developed and funded, and this led some participants to raise concerns about the role of multi-national energy companies who may focus on profit rather than net zero.

"It's kind of the revival of the oil and gas industry. I think I saw the Shell logo on one of the slides (presented by the industry specialist), so I'm guessing they're going to be involved in this, which doesn't really fill me with much confidence."

As mentioned earlier, due to the complexity of BECCS deployment models, no information about levels of investment in BECCS compared to other renewables were provided to participants. Without this information, some participants made assumptions that the Government is investing in BECCS over other renewable options, which as outlined earlier were understood to be more established and potentially more cost-effective. This led participants across several groups to question the motivations behind why the Government appeared to be investing more in BECCS than in other renewable technologies. Some concluded that profit making and serving vested interests of the energy companies may be the motivator for both government and industry, rather than achieving net zero.

"They've (the energy companies) got a vested interest in making sure we maintain these shipping lines, these fuels, vehicles, all the rest of it."

"They (Government) seem to be going the wrong way when they should be trying to reduce the levels of CO^2 and having solar panels and storing energy in batteries overnight, then they wouldn't have to do all this stuff."

8.3 Regulation and governance

Participants were not provided with any specific information on regulation and governance models for BECCS. They were asked, based on the information shared in the session, what regulation and governance they would like to see in place. As with sustainability governance, participants wanted regulation to ensure that net zero, not profit, drives development. In addition, participants saw a particular role for regulation to ensure safety is not compromised by commercial companies.

Echoing findings from the CCUS public dialogue report, participants felt that oversight and regulation of all stages of BECCS development should be independent of both government and industry.[32] As in chapter six on sustainability criteria, participants called for a diverse coalition of environmental organisations, scientists, and supranational bodies, with legally binding regulations and stringent, enforceable sanctions in place to protect safety, ecosystems, workers, and affected communities. International collaboration should enable technological development, sharing of best practice, and maximising impact.

"Legislation has to be in place and there has to be an onus put on people to do the right thing and not necessarily do it the easiest quickest way. If people are threatened with legislation, and the people in charge of those companies are potentially going to be thrown in prison if they do something wrong, then they're going to make sure that all their employees are doing it right."

When asked how BECCS should be financed, participants felt that the most polluting industries should pay, with some saying government support could contribute. There was nevertheless a sense that although unfair, the consumer will inevitably end up paying, either through increased prices, or through taxation.

"I think industry should meet those costs. It shouldn't be the taxpayer; it should be those who will make massive profits. That would feel more just."

"I think it should be a mixture of those that would benefit from it really. Industry could really bear as much as possible, but you don't want to obviously bankrupt certain companies by doing it. Either way, the cost of it is going to get passed on to us."

Participants felt that a thoroughly documented strategy for how BECCS will be deployed should be made publicly available, including data and timelines for expected carbon savings. They considered that costings should be carefully planned, with caps and controls in place, and progress should be monitored constantly, with a firm exit strategy by a certain time if sufficient emissions reductions are not being achieved.

"Performance is regularly, annually at least, monitored to actually show it's achieving what it claims it will be."

"At what point will we start to see a recognisable, quantifiable benefit? If it's not meeting that, then obviously things need to be either discontinued or changed."

32 Carbon Capture Usage and Storage | Sciencewise.

8.4 Conclusion

From the information explored in the dialogue sessions, most participants concluded that BECCS should play a role in achieving net zero. Despite expressing concerns that BECCS appears an unproven technology, many were convinced by what appeared to be a consensus amongst specialists that there are few alternatives to reducing emissions in the time available.

As with biomass more broadly, participants continued to express concerns that the production and sourcing of biomass for BECCS is unsustainable. Concerns around cost and financing were particularly prevalent when discussing BECCS. After hearing information from different specialists about deployment, it was understood as a large infrastructure project, which for many increased the risk that profit-making will overtake net zero as a priority and lead to excessive public spending.

The principles of regulation and governance for BECCS were similar to biomass more generally, where participants wanted regulation of profit-making incentives by an independent body made up of a range of organisations.

9 Future engagement

About this chapter

This chapter provides an overview of participant reflections on their involvement in the dialogue, and suggestions for how the wider UK public could be engaged on the topic of biomass and net zero going forwards. In the final dialogue session participants were given space to reflect on the process and offer suggestions for future engagement. As with session one, affected communities' participants were put in separate breakout rooms to enable NatCen to analyse their concluding thoughts separately. No significant trends were observed amongst affected communities, as found in other chapters, the views of participants have not been disaggregated.

Key themes

To support the wider public to engage with the role of biomass and net zero, three core information needs were identified:

- Raising awareness of biomass as a sustainable technology and how that relates to the everyday lives of people in the UK.
- Clearly outlining the potential costs involved in using biomass, and how this might impact on UK consumers.
- The government to openly report the impact that biomass has on achieving net zero through regular monitoring against transparent performance indicators.

Across these, participants wanted information about biomass provided within the context of other renewable sources such as wind and solar. Participants also wanted this information provided by publicly known scientists who are independent of government.

In addition, and drawing on the final session of the dialogue, participants were keen to see how the conditions developed through the dialogue would impact the future Biomass Strategy; indicating the connection they wanted to see between consultation and implementation.

After taking part in the dialogue, participants felt it was important to continue involving the public. As a next step, NatCen recommends a citizen jury could be set up where members of the public are supported to deliberate specific biomass policy options. This style of public engagement would produce recommendations from a selection of the public and build upon the exploratory views reported in this dialogue report.

9.1 Key challenges

In the final session and in the post-workshop survey, participants reflected on their experiences of participating in the dialogue. Through analysis of responses, we identified challenges for future engagement, which related the three interpretative frames that were described in chapter two (figure 12), and which participants drew on to understand biomass as a concept. At the heart of all these challenges is the reflection from participants that the concept, implementation, and impact of biomass on net zero is complex and so does not lend itself to simple communication and engagement.

The complexity of the topic was reflected in the post-dialogue survey. A third of respondents still felt unsure of their opinion on biomass in achieving net zero by the end of the dialogue. Prior to participating in the dialogue, 23% of participants reported having heard of biomass but not knowing what it is, and 50% reported knowing a little, whilst 22% reported knowing a fair amount.[33] Most participants came to the dialogue knowing relatively little about biomass, and therefore the concept, implementation and impact involved a lot of unfamiliar information for participants.

"It's a difficult thing to try and get across succinctly to people."

"They are complex issues and they're not very easy to say, okay, in a [tweet] or in a three-word slogan, as the Government loves."

Figure 12: Three interpretative frames

Biomass as a renewable technology felt **counter-intuitive** to participants upon initial explanation in the first session. This was because of the GHG emissions associated with the sourcing and production of biomass. This sense grew as participants learnt more about production and supply chains throughout the dialogue. So, it appears that more information did not always move participants past this conceptual challenge, and in some cases (in particular, regarding production processes), it may have increased the sense that biomass does not feel very renewable or sustainable.

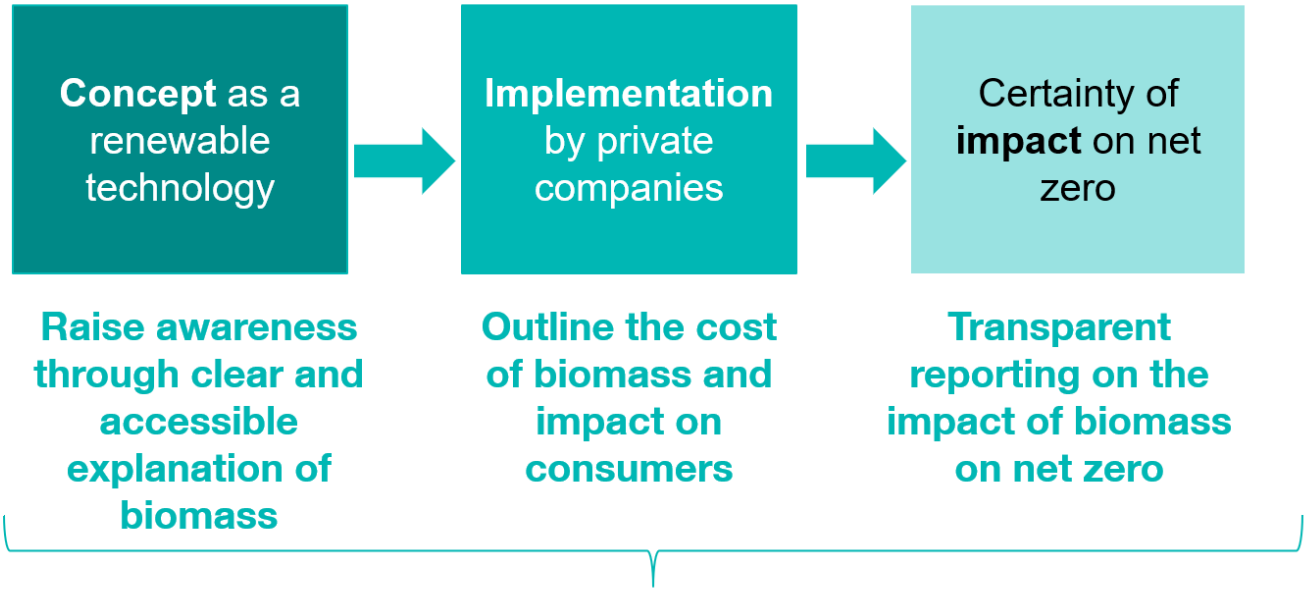
In terms of **implementation**, the challenge that participants returned to was mistrust of the energy sector and politicians. The role of biomass was often interpreted as a political decision that involves profit-making companies and political agendas. Participants regularly requested information on the costs of biomass, particularly in comparison to other renewables such as wind and solar, which as reported previously in chapter six, were perceived to be more cost-effective and sustainable. As mentioned earlier in the report, this information was not provided due to the challenges in reporting accurate data. This lack of information acted as a barrier to engagement since participants often needed assurances on how the dialogue process related to the final policy decisions that would be made.

Finally, in terms of **impact**, participants found the perceived uncertainty of the scale of impact using biomass could have on achieving net zero challenging. This was reflected in requests for more data by participants throughout the process. Although, even if provided, the data may not have helped with this challenge, the requests reflect a desire from participants to have certainty over whether biomass works to reduce emissions, and perhaps more importantly what types of biomass have more impact. An example of this challenge is reported in chapter four, where participants discussed sourcing. Here they expressed preferences for waste sourced in the UK, but also requested information on efficiency of source. This reflects a willingness on behalf of some participants to question their initial preferences and consider less preferable options such as internationally sourced wood pellets, provided that data proves that this is a good option to support reaching net zero.

9.2 Information needs

Throughout the dialogue, participants made several suggestions of types of information that can help overcome the challenges of communicating and engaging on the role of biomass. We have aligned these suggestions to help address the challenges within the frames of concept, implementation, and impact (figure 13).

Figure 13: Information needs for each interpretative frame



Information needs related to the concept of biomass centred around raising awareness and making the topic more applicable and relevant to people's day-to-day lives. As reported in chapter five, uses of biomass were particularly challenging for participants to relate to net zero as these felt less familiar and intangible compared to sources of biomass. When discussing increasing public awareness, participants focussed on what might happen in their local area and how it might impact on their local environments.

Information needs related to implementation centred on transparency of funding, and potential impact that sourcing energy from biomass may have on costs to the consumer. Throughout the dialogue, participants requested information on the costs of biomass and whether these costs would be passed on to the consumer, as well as how the costs compared to other renewable sources.

Information needs regarding impact centred around reporting more 'data' and information that informed the public about the complexities of biomass. Participants expressed different levels of need here. Some felt that they had been overloaded with information in the dialogue and felt the public would be overwhelmed by similar levels of complexity. Others felt it was important that more data is made available. In both arguments, however, participants pointed to the need to deliver information at different scales and levels of complexity, to make this accessible for the public.

"I think it's better for us to have more information than less."

"All the information needs to be there, and it needs to be compressed and somewhere that people can access it."

A key information request that was regularly repeated throughout the dialogue in relation to concept, implementation and impact was how biomass compares to other renewable technologies. To form a view on the role of biomass in achieving net zero, participants wanted to compare the potential impact of biomass against other renewables, such as wind and solar, which they perceived as more environmentally friendly. In future engagement about biomass and net zero, it is important to consider that biomass is perceived as less environmentally friendly than other renewables. Explaining its role in relation to UK government strategies towards other renewables is important.

Participants also recognised that people may have different information needs, or communications preferences. Some emphasised that the Government would need to think about employing different methods to reach different communities and sections of the population who may not (be able to) access mainstream media or government communications networks for socio-economic or language reasons. They recognised that people need to understand 'biomass' in terms that make sense to them, and that this may mean the message needs to vary across communities.

"We need to be conscious of this as a social-cultural as well as environmental concern – it needs to be something that can be shared by social groups, families, across the political spectrum across the divides something that people can hold in common to a certain degree."

For all information needs, participants considered that independent and well-known scientists were the best people to communicate this information to the public. Others felt that the public engagement campaign itself should be managed by an independent body, this is to ensure trust in the messaging people received and that information campaigns should be subject to review and evaluation.

"It should be communicated by an independent body."

"I'll tell you one thing that I think's crucial; [getting] relevant people on board with it and getting them to tell the story of it. Not just politicians and not just people; experts…someone like David Attenborough."

9.3 Involvement

During the discussion of the principles and conditions, many participants requested specific information on implementation and impact.

This likely reflects a desire from participants to see the tangible connection between this dialogue and the forthcoming Biomass Strategy. Participants were advised at the end of the dialogue that findings will be published on the Sciencewise website, and that the results will be used in the

Biomass Strategy and future policy development. However, at this stage, it was not possible to outline specific ways the dialogue project will influence policy.

In final discussions, some participants expressed a desire to remain part of the decision-making process. They felt that the dialogue ethos should be carried forward via continued involvement of the public in decision making, via citizens juries or other consultation mechanisms, and these should be planned for the future strategy.

"No one likes being told what to do – they want to be made part of the overall strategy – people are important and that needs to have emphasis."

To build upon the exploratory nature of this dialogue, a citizens' jury could be set up as a next stage of public involvement to focus more specifically on policy recommendations. In a jury setting, members of the public can be supported to decide between future biomass policy options after being presented with the kind of information that policymakers use to develop recommendations.

This would build upon this public dialogue, which provided information and perspectives to support participants to form a view on the use of biomass, but did not seek to support the public to make difficult policy trade-off decisions.

9.4 Conclusion

By the end of the dialogue, participants reflected that biomass is a complicated subject and identified types of information that may help them or others navigate this complexity in future.

Communicating the concept of biomass as a renewable technology would benefit from information that provides a clear and accessible explanation of why biomass is renewable. To address concerns that implementation will be driven by profit-making, participants want information on funding and the impact biomass will have on energy bills. Finally, transparent reporting on the impact of biomass would help the public understand the level of certainty around how biomass can help achieve net zero. Participants would like this information about biomass contextualised against other renewable technologies, as this remained an important reference point for participants when exploring the role of biomass.

By the end of the dialogue, some identified that continued involvement with the public through extended engagements, like this public dialogue, would be one means to increase public confidence in implementation. A citizen's jury exploring specific policy recommendations could be a potential next step to build upon the exploratory views outlined in this report.

Appendix 1: Governance and oversight

This appendices outlines the members and terms of reference of the oversight group for this project.

1.1 Oversight group members

Alongside project delivery and management from NatCen and Eunomia, this project convened a group to support oversight of the dialogues. As of 21/02/2022, the members were as follows:

- From academia:
    - Dr Mirjam Roeder, Aston University and Supergen (chair)
    - Dr Naomi Vaughan, University of East Anglia
    - Dr Emily Cox, University of Cardiff
    - Professor Duncan McLaren, University of Lancaster

- From industry:
    - Mark Sommerfeld, REA
    - Jonathan Scurlock, NFU
    - Nick Primmer, ADBA

- From NGOs:
    - Mair Floyd-Bosley, RSPB
    - Jo Furtado, WWF

- From Government:
    - Jess Winnan, Defra

BEIS was responsible for providing the secretariat to support the oversight group.

1.2 Oversight group terms of reference

Department of Business, Energy and Industrial Strategy (BEIS), Sciencewise and UKRI public dialogue on the uses and implications of biomass and BECCS

Introduction

BEIS is conducting a public dialogue with both support and funding from Sciencewise. An Oversight Group (OG) has been established to oversee the project. The project managers are Laura Easterbrook and Dr Anna Mikis (BEIS).

The project will take place between March and September 2022. Due to the Covid-19 pandemic the dialogue events will be predominantly delivered online. Members will be asked to attend formal virtual meetings and give advice on their areas of expertise on an ad-hoc basis.

The contractor that will organise, facilitate and analyse the information obtained for the public dialogue is the dialogue contractor National Centre Social Research (supported by Eunomia), and the project will be independently evaluated by Ursus Consulting.

The first OG meeting with the dialogue contractor and the evaluation contractor will be convened on Monday 4th April 2022. The last meeting will centre on a presentation of the final report by the dialogue contractor and the evaluator's evaluation report of the dialogue process.

Every effort will be made to find dates when all OG members can dial-in to meetings. For key items of business where the group's opinion is sought then those not attending meetings will be invited to submit comments and views in advance and these will be presented to the rest of the group.

Project Aims and Objectives

1. To engage a diverse group of participants, broadly reflective of the UK public, in topic areas relating to the development of the Biomass Strategy.
2. To explore and understand participants' aspirations and concerns in relation to biomass sourcing (both domestic and imports), production and use across the economy.
3. To understand what values and perspectives inform participants' views in order to inform and help refine any future communications and engagement.
4. To define conditions of use in relation to sustainability frameworks (which could include areas like land, biodiversity, environmental impacts, ecosystem services, emissions and social criteria) to help shape policy development in this space.
5. To determine participants' views of using biomass, particularly through BECCS, as a negative emissions technology in achieving net zero, to inform policy development in this area.
6. To help shape other aspects of Government policy and guidance as part of the forthcoming Biomass Strategy, and inform future engagement.

Role of the Oversight Group

The role of the group is to oversee the dialogue process and materials, and to help ensure that:

- The dialogue material is comprehensive, balanced, while also representative of the diversity of the views and positions in the subject area and accessible to participants.
- The engagement process is far reaching, accessible, and targets all relevant stakeholder groups.

Members will be expected to:

- Bring diverse views and perspectives to the framing of the dialogue to help facilitate and support the dialogue.
- Bring intelligence from their own organisations and expertise to help shape the dialogue
- Disseminate and promote the project and its findings through their own networks during the project lifetime.
- Help select appropriate experts to inform the dialogue process, materials and speak at events, where necessary.

It is expected that the OG will comment on the following:

- Key questions to be addressed
- Background/stimulus materials (ensuring it is comprehensive, reflects the diversity of views, positions and understanding in the topic area, acknowledging differences in scientific understanding where relevant, and ensure that overall the materials are factual, neutral and accessible to participants)
- Communications strategy
- Language and framing
- Questions asked during the dialogue
- Outputs from the dialogue exercises including written reports.

Individual views expressed do not represent those of the whole group or of the organisations represented.

The OG will focus advice on:

1. **Impartiality**

- Ensuring that the dialogue process and materials are developed and delivered in a manner that enables diverse positions to be expressed and understood in order to support and facilitate participants of the dialogue. It will also ensure materials are factual, and the dialogue process is fair and balanced in its approach to the delivery of the dialogue.
- Supporting the overall process and ensuring that the right questions have been asked at the right time and that the right people are in the room.

2. **Support on the project process**

- Helping to develop the criteria on which the success of the project is going to be judged. OG members are often members of key organisations who will use the outputs of a dialogue, so help from them on what success "looks like" is useful.
- Acting as a sounding board for potential activities or decisions about the process or content.
- Giving advice when things get challenging for the project manager(s) – dealing with uncertainties, providing independence where needed, advise on finding and contacting the right people quickly.

3. **Dissemination and communication role**

- Providing informed input to and feedback from the dialogue throughout the dialogue from the set-up stage through to the dissemination of findings and impact of outcomes.
- Members are key parties or stakeholders, so when it comes to dissemination and communication of the project and of the results of a dialogue, they often own or can influence policy change in relevant institutions.
- Providing a credible independent voice for the process, if needed – quotations reflect on the integrity of the process, offering independent interpretation and critique in the case of controversy, media interviews could even be arranged.

The role of the OG is advisory. It is the responsibility of BEIS and the management group (comprised of members of BEIS, UKRI and Sciencewise) to make decisions on the dialogue process, materials and disseminate the outcomes within BEIS and its stakeholders.

Quorum

A minimum of 3 people are required for the meeting to be quorate.

Frequency of meetings

It is expected that the majority of meetings will be virtual. The OG will determine how many meetings are required but it is likely that at least two will be required before the dialogue events which are due to be held in June and July plus at least one meeting after the draft report has been completed. The OG may review and approve stimulus materials at a meeting or by email or other communications.

Members may be expected to comment on other project papers in between meetings.

Ad-hoc meetings may be held with the agreement of the Chair as and when required. Meetings may, exceptionally, be cancelled by the Chair.

Transparency

OG meetings will be minuted in terms of key decisions and action points; minutes will be sent to members after each meeting. Agreed minutes may be published or made available as part of final project reporting.

Appendix 2: Rapid Evidence Assessment

This appendix contains the rapid evidence assessment (REA) that was conducted by Eunomia.

Methodology – Information Materials Development

Rapid Evidence Assessment

A rapid evidence assessment (REA) was carried out to ensure the most up-to-date evidence, research and published range of public opinions on the sourcing and use of biomass and BECCS informed the information materials presented as part of the public dialogue sessions. The REA enabled quality information to be gathered through an efficient and controlled process. The following sections provide an overview of the REA methodology.

Approach

The REA was conducted in four main stages.

Stage 1 defined a functional and systematic approach to the search for evidence. This was characterised by four key features: transparency in how the evidence review was conducted; a rigorous method of identifying and reviewing the evidence; collaborative working to ensure the review was fit for purpose; and a focus on identifying sources that provided the information needed to support the development of information materials for public dialogue.

Stage 2 involved an initial pilot of the defined search approach and subsequent refinement before the full mainstage search.

Stages 3 and 4 assessed the information gathered and synthesised the evidence into dialogue information materials, which were used to present information about biomass and BECCS to the public.

Search Approach

Overall, the REA aimed to cover the following aspects:

Existing options and key areas of uncertainty or concern for the public relating to the sourcing and use of biomass and BECCS.

Published factual information and scientific evidence regarding these key areas of uncertainty or concern.

To ensure the above aspects were encompassed within the REA, research headings and corresponding search terms (as set out in Table 1) were defined and reviewed by BEIS and the oversight group (OG). These search terms were entered into selected databases (Google and Google Scholar) and allowed both academic and grey literature to be explored. Literature provided by the OG was also reviewed.

To further refine our search and to accommodate the time constraints of the research, additional exclusion/inclusion criteria were utilised. These criteria are outlined below:

Volume – Focused on the most important and reputable resources.

Age – Focused on resources no older than five years' old. Two exceptions were made to the criterion:

Key resources older than 5 years but still have current applicability and are central to the scope (such as the 2012 UK Bioenergy Strategy).

Resources that provide important historical context that may contribute to the public's present-day views.

Geography – Geographic prioritisation of sources:

Those with a UK focus;

Those covering international sources of biomass which are exported to the UK;

Global sources which have relevance to the UK.

Language – Published in English.

Overall, 100 sources were reviewed as part of the REA with sources encompassing policy documents, reports, consultation, academic literature and web articles. Information from each source was entered into an excel matrix according to relevant search heading before being colour coded to indicate positive, negative or neutral viewpoints, or conclusions on basis of evidence.

Table 1: Rapid Evidence Assessment Headings and Search Terms

Search Heading	Sub Heading	Search Terms
Existing research on public opinion on biomass		
Existing opinion	Values, perspectives and concerns	"biomass public opinion" "biomass view" "biomass perspective" "biomass review" "biomass citizen" "biomass communit*"
Published factual information and scientific evidence		
Biomass sources	Feedstock, sources and sourcing	"biomass sourc*" "biomass uk import" "biomass uk domestic" "biomass feedstock"
	Land Use	"biomass land-use" "biomass deforestation" "biomass biodiversity" "biomass monoculture" "biomass land quality"
	Agriculture	"biomass agriculture" "biomass food vs fuel" "biomass crop" "biomass food security" "biomass food production"
Biomass production		"biomass produc*" "biomass tech*" "biomass process*"
Biomass uses	Transport	"biomass transport" "biomass fuel" "biofuel" "biodiesel"
	Heat	"biomass heat*"

Search Heading	Sub Heading	Search Terms
	Energy	“biomass energy” “bioenergy” “biomass energy infrastructure” “biomass energy mix” “biomass energy security”
	Bio-based products	“bio-based products” “biobased products” “biomass bio-based products”
	BECCS	“BECCS” “bioenergy carbon capture” “biomass greenhouse gas removal” “biomass GRR” “biomass carbon offset” “biomass emissions” “BECCS finance” “BECCS payment” “BECCS funding” "GGR"
Biomass net zero		“biomass emissions” “biomass net zero” “biomass carbon neutral” “biomass negative emissions” “biomass carbon bonus”
Biomass sustainability		“biomass sustainability” “biomass pollution” “biomass air quality” “biomass water quality” “biomass land quality” “biomass scalab*” “biomass resources” “biomass resource pressure” “biomass criteri*”
Biomass governance and regulation		“biomass uk governance” “biomass uk regulation” “biomass uk rule” “biomass uk law” “biomass uk legislat*”
Impact on local communities		“biomass communit*” “biomass power plant” “biomass local impact” “biomass community impact” “biomass community benefit” “biomass community job” “biomass pollution” “biomass community investment” “biomass safety” “biomass security” “biomass air quality” “biomass water quality” “biomass income”

Stakeholder Interviews and Workshop

In addition to the REA, stakeholder interviews were conducted to inform the development of the information materials, and a workshop was held to test the quality, thoroughness and neutrality of the developed materials.

Research was conducted to identify a longlist of potential stakeholder organisations within the

following categories:

Industry;

Investment;

NGO;

Policy; and

Academia.

To ensure each category was covered, in consultation with BEIS, Sciencewise and the OG, the ten organisations in Table 2 were interviewed from the longlist and the 14 organisations in Table 3 attended the workshop. The intention was to select a variety of representative stakeholder groups that would provide a mix of knowledge and opinions. The interview guide was developed in partnership with BEIS and aimed to cover key research questions. Each interview was approximately 30 minutes long, with some including multiple attendees from the same organisation to provide as much information as possible and facilitate more of a discussion.

Table 2: Interview organisations

Organisation	Description
Cut Carbon Not Forest Coalition	A coalition of environmental advocacy groups who banded together to campaign against subsidies for biomass power plants that use trees and to put pressure on policy makers to support reform.
Sustainable Biomass Programme	A certification system designed for woody biomass used in industrial large-scale energy production to provide assurance that it is sourced from legal and sustainable sources.
Energy & Bioproducts Research Institute (Aston University)	Institute at Aston University dedicated to researching new and innovative ways of converting biomass into sources of sustainable energy, using thermochemical, biological and catalytic processes.
Lynemouth Power Station	A large-scale biomass power plant, located in Lynemouth, UK, that uses woody biomass primarily sourced from the US and Canada.
Department for International Trade	A UK government department responsible for striking ang extending trade agreements between the UK and foreign countries.
Friends of the Earth	An environmental campaigning community dedicated to protecting the natural world and the wellbeing of people and animals in it.
Progressive Energy	Focused on developing low-carbon technologies from concept to commercial deployment.
Institute for Sustainable Resources (University College London)	Focus on developing knowledge in the globally sustainable use of natural resources.

Organisation	Description
The Lifescape Project	Group dedicated to the protection and restoration of global ecosystems in response to the recent significant degradation of the world's ecosystems.
Future Biogas	Developer and operator of AD plants across the UK that provide the full service of development, construction, operations, and ongoing compliance.

Table 3: Workshop organisations

Organisation	Description
Anaerobic Digestion & Bioresources Association (ADBA)	A UK based trade association for the anaerobic digestion and associated industries.
Bioenergy Infrastructure Group	Owner and operators of biomass and waste energy solutions.
Carbon Capture and Storage Association (CCSA)	Trade association promoting the commercial deployment of Carbon Capture, Utilisation and Storage (CCUS).
Climate Change Committee (CCC)	An independent statutory body that was established under the Climate Change Acy 2008 to advise the UK and devolved governments on emissions targets and progress made against reducing greenhouse gas emissions.
Department for Business, Energy and Industrial Strategy (BEIS)	A UK government department responsible for business, industrial strategy, science, innovation, energy and climate change.
Economy, Land and Climate Insight	A central information hub dedicated to collating the best existing academic and policy research on the interactions between land, economy and climate change.
Energy & Bioproducts Research Institute (EBRI), Aston University	Institute at Aston University dedicated to researching new and innovative ways of converting biomass into sources of sustainable energy, using thermochemical, biological and catalytic processes.
European Academies' Science Advisory Council (EASAC)	A council formed by the national science academies of the EU Member States, Norway, and Switzerland to enable them to collaborate with each other in providing independent science advice to European policy-makers.
Greencoat Capital	One of Europe's largest renewables investment managers, focussing on large-scale institutional capital deployment that is aligned to clear, beneficial impact for the world.

Organisation	Description
Sustainable Biomass Programme (SBP)	A certification system designed for woody biomass used in industrial large-scale energy production to provide assurance that it is sourced from legal and sustainable sources.
Wildlife and Countryside Link (WCL)	The largest environment and wildlife coalition in England dedicated to protecting and enhancing wildlife, landscape and the marine environment to further the quiet enjoyment and appreciation of the countryside.
Energy Crops Consultancy	A UK-based, independent advisory service specialising in perennial energy crops.
Ofgem	The government regulator for the electricity and downstream natural gas markets in Great Britain, working to deliver a greener, fairer energy system. Their objectives include supporting decarbonisation and improving the energy system.
Drax Power Station	The UK's largest large scale biomass electricity power plant, located in Yorkshire, UK, that uses woody biomass primarily sourced from the US and Canada.

Information Materials

The scope of each of the public dialogue sessions was determined with NatCen, BEIS and Sciencewise. A draft document with slide headings and a summary of the proposed content was developed and approved prior to the development of each session's slide deck. Slide decks were developed to present information to aid discussion in a visual and engaging style utilising images, flowcharts and other visual aids.

Selected slides from various sessions were discussed with stakeholders in the workshop. Key points within the content were critically analysed and refined by the stakeholders, with their comments and knowledge being transferred into the content of the slides. Attendees from Eunomia and NatCen were conscious to remain neutral and balanced throughout, and took care to ensure that the information materials were also appropriately balanced. The workshop was also attended by an independent evaluator for observational purposes.

The slides went through a minimum of two rounds of comments and amends with BEIS and Sciencewise before they were presented to the public in the dialogue sessions.

Appendix 3: Sampling and recruitment

This appendices provides detail of the achieved sample – outlining the demographics of who participated in the dialogue as well as the sample plan that was shared with the oversight group.

Full breakdown of achieved sample

The proposed sample sought to engage 110 participants across two groups of 55 (see table 2 in section 1.1.2.2 below for the full sample plan). Across the groups, 75 participants would reflect the UK population in terms of demographics and levels of support for use of Biomass as a renewable energy source. The remaining 35 would be from 'affected communities'; citizens whose views are likely to be affected by living in close proximity to biomass sourcing areas or bioenergy production plants.

In the achieved sample, NatCen engaged 109 participants. Of these, 91 (83%) attended all five sessions, five (5%) attended four, and 13 (12%) attended three or fewer. NatCen did not recontact those who did not attend the first session, and overall, 95 participants (87%) attended the final session. As such, those who did not attend all five sessions are more likely to have missed an intervening session.

In terms of demographics, against the target of 35 participants (32%) from affected communities, 31 people were engaged (28% of the total engaged). More broadly, the achieved sample was reflective of the UK population, including in the cohorts overrecruited to anticipate greater attrition, namely young people and ethnic minorities. Though a reflective, not representative, sample was sought, it is worth noting that in one dimension, social grade, the achieved sample fell considerably short on two occasions: social grades A (0% achieved rather than 4% target) and E (2%/10%).

The table below breaks down the achieved sample used in the research.

Demographic	Category	Sample (n)	% of Sample
Age	0-16	0	0%
	16-29	24	22%
	30-44	37	33%
	45-64	39	35%
	65+	11	10%
Gender	Female	56	51.38%
	Male	53	48.62%
Ethnicity	White	70	64%
	Black, African, Caribbean or Black British	16	15%
	Asian or Asian British	16	15%
	Mixed or Multiple Ethnic Groups	7	6%
	Other Ethnic Group	0	0%
SES	A	0	0%
	B	37	34%

Demographic	Category	Sample (n)	% of Sample
	C1	48	44%
	C2	15	14%
	D	7	6%
	E	2	2%
Disabled Status	No	91	83%
	Yes, a little	12	11%
	Yes	6	6%
Urban/Rural	Urban	74	68%
	Rural	16	15%
	Missing Data	19	17%
Political Affiliation	Green Party	13	12%
	Labour	29	27%
	Liberal Democrat	4	4%
	Conservative	30	28%
	Brexit Party	2	2%
	Other	2	2%
	None	28	26%
	Missing Data	1	1%
Awareness Level	Know a lot about it	1	1%
	Know a fair amount	24	22%
	Know a little about it	55	50%
	Heard of it but don't really know what it is	25	23%
	Never heard of it	3	3%
	Missing Data	1	1%
Affected by Biomass	No, I am not affected by or aware of biomass being sourced, or bio-based products/ bioenergy being produced in my local	78	72%
	Yes, I consider that I am affected by bio-based products and/or bioenergy being produced from biomass in my local area	14	13%
	Yes, I consider that I am affected by land in my local area being used to source biomass	7	6%
	Yes, affected by biomass	10	9%

Demographic	Category	Sample (n)	% of Sample
Support for Biomass	Strongly Support	32	29%
	Tend to Support	30	28%
	Neither Support nor Oppose	36	33%
	Tend to Oppose	11	10%
	Strongly Oppose	0	0%
Conscious of Cost of Heating and Electricity	Yes	74	68%
	No	9	8%
	N/A	5	5%
	Missing Data	21	19%
Prevented from Heating Home Sufficiently in Winter	Yes	27	25%
	No	36	33%
	N/A	24	22%
	Missing Data	22	20%
Financial Stability	Living Comfortably	6	6%
	Doing Alright	60	55%
	Just About Getting By	34	31%
	Finding it Quite Difficult	7	6%
	Finding it Very Difficult	1	1%
	Missing Data	1	1%
Attendance	Attended at least one Session	109	100%
	Attended Three or Fewer Sessions	13	12%
	Attended Final Session	95	87%
	Attended all Five Sessions	91	83%

Sample plan approved by BEIS and Sciencewise and commented by oversight group

Biomass public dialogue sampling plan

Overview

This document sets out the sampling criteria that will be used to engage a diverse group of participants, broadly reflective of the UK public, in topic areas relating to the development of the Biomass Strategy.

A total of 110 participants will be engaged across two groups of 55. These groups will be sampled to enable the dialogue to explore the concerns and aspirations of the general public as well as members of the public who are more affected by Biomass policy.

Across the two groups 75 participants will reflect the UK population in terms of demographics,

and support for use of Biomass as a renewable energy source. The rapid evidence assessment and conversations with the Oversight Group revealed that there is no recent reliable data on awareness of Biomass , therefore the BEIS tracking data on support for Biomass as a renewable source is the closest proxy attitude on the subject to ensure a mix of perspectives that reflects the UK population.

The remaining 35 participants will be from 'affected communities'; citizens whose views are likely to be affected by living in close proximity to biomass sourcing areas or bioenergy production plants. These respondents will live within 15 miles of one of the sourcing or production locations identified by BEIS. They will be aware of the sourcing, production or use of Biomass in their local area, and therefore are likely to have greater awareness of issues related to Biomass compared to the rest of the UK population. Therefore, we will not set quotas on levels of support for Biomass as a renewable source as affected communities views are likely to differ (either more or less support than the general public).

We will use a trusted and experienced recruitment company, Propeller, to recruit all participants. We will agree a screening questionnaire with BEIS and Sciencewise that Propeller will use to confirm people are eligible to participate as well as fulfil demographic quotas. Propeller will manage a team of fieldwork interviewers across the country who will use a combination of approaches to contact potential participants. They will contact people who have consented to have their data held on a database to be contacted about research opportunities. They will also free-find people through open adverts and street intercept interviews. Once people express any interest the interviews will complete the screening questionnaire with all members of the pubic who express an interest.

We will recruit 60 participants to each workshop, from which we anticipate around 50-55 will complete the process considering possible retention rates. Across an online deliberative project, we anticipate around a 10-15% attrition rate, which in NatCen's recent experience falls predominately amongst younger and ethnic minority participants, and therefore we have over-recruited these demographics. We will develop a participant information sheet and privacy notice to communicate the aims and purpose of the dialogue to ensure informed consent.

Table 1: Sampling criteria for each workshop

	Number of respondents per group (minimum)	Sampling criteria
Workshop 1	35	Demographics: Mix of age, gender, ethnicity, social class, education level and location. Inclusion of those in fuel poverty as well as demographics more likely to drop out in the process. Attitudes towards Biomass, climate and energy: A mix of levels of concern for climate change, awareness of and support for Biomass use that reflects national trend data. World views and outlook: A mix of voting behaviours or other agreed values-based attitudes.
Workshop 2	35	

	Number of respondents per group (minimum)	Sampling criteria
Workshop 3 (affected communities)	35	As above for demographics, inclusion and world views. All to be aware of the sourcing or production of Biomass in their local economy. A mix of levels of concern for climate change and support for the use of Biomass that reflects national trend data.
Total	**105**	

Reflecting the UK public

To develop the sample plan, we have drawn upon the concept of the 'mini public' to ensure that across the whole sample of 105 people, and as much as possible, within each workshop of 35 people, the participants reflect the UK public in terms of:

- **Demographics** so that people with different backgrounds and experiences are heard.
- **Attitudes towards the issue being deliberated (Biomass)** so that the dialogue is not dominated by citizens with a strong interest in or knowledge of the subject. The 'affected communities' will be citizens who are more aware than the rest of the population.
- **Political views** to ensure that the dialogue reflects a range of perspectives that reflect the UK public.

To ensure the sample reflects the demographics of the UK we will set quotas for key criteria of gender, age, urban/rural location, education level and social class .

To ensure the sample reflects the range of attitudes towards the policy being deliberated we will ask about concern about climate change and support for Biomass as a renewable source. We will use the BEIS public attitudes tracker to set quotas to ensure the sample reflects national trends. The evaluation of the UK Climate Assembly suggests that concern for climate change acts as a proxy to ensure that the sample reflects views of and engagement with climate change issues and energy policy . Support for use of Biomass as a renewable energy development (currently 67% support) can be used to ensure the inclusion of those in favour and against its use.

To ensure the sample reflects range of political views we recommend recruiting a mix of people with different political affiliations. We will not set quotas because of the limitations of using different recent election results and also the objective is to ensure a mix of views in line with the deliberative principle of the 'mini public', rather than attempt to reflect what the UK public thinks politically. This approach is in line with the UK Climate Assembly evaluation report that emphasised the importance of ensuring deliberation takes place with a mix of political affiliation .

NatCen explored other political attitudes that we could consider setting quotas on based on the NatCen social attitudes survey – for example attitudes towards redistribution, inequality or the role of government. After discussion with the Oversight Group it was agreed not to use these attitudes in this way because they are not clearly related to the deliberation topic - conditions for use of Biomass. There is no simple worldview question that we could identify to ensure a mix of perspectives. Instead the balance of demographics and affected communities should ensure a natural fallout of different worldviews in the room.

Inclusion

We know from previous dialogues and public opinion research that certain demographics are more likely to drop out at different points in the process, so we have increased the quotas for participants aged under 30 years old and ethnic minority groups.

We have also included a quota for people defined to be in fuel poverty because the topic involves the discussion of energy policy and people in fuel poverty will be particularly affected by the Biomass Strategy. BEIS estimates that 13% of the UK public are in fuel poverty so we have used this to set quotas. We understand this may have increased following the increase in fuel prices in 2022 but BEIS do not have more up to date reliable data to change the quota. We will use a self-reporting screening question to define fuel poverty as there is not enough space in the screening questionnaire to ask all the questions to determine income and energy usage.

To support digital inclusion NatCen has included a question in the screening questionnaire to understand digital access issues. We have budget to support people with connection problems through providing a MI-FI device and we also offer support to access and use zoom. We have not included budget to provide computer equipment.

Defining “affected communities”

To identify people for the “affected communities” group we will use an awareness question to determine if they are aware of Biomass being sourced or produced in their local area, e.g. crops being grown, or of biomass being used e.g. at an anaerobic digestion plant. The following wording was agreed with the Oversight Group:

Biomass is any material of biological origin. Different types of biomass can be sourced from the UK and/or overseas.

Biomass has many uses. It can produce bioenergy through being burned in a power plant or from being processed into a gas through anaerobic digestion and can be used to produce heat. It can also be used to create low-carbon fuels like biofuels and hydrogen for transport, or in other bio-based products like bio-plastics and in timber for construction.

Do you consider yourself to be affected by biomass sourcing, or bio-based products/bioenergy production in your local area?

- Yes, I consider that I am affected by land in my local area being used to source biomass.
- Yes, I consider that I am affected by bio-based products and/or bioenergy being produced from biomass in my local area.
- No, I am not affected by or aware of biomass being sourced, or bio-based products/bioenergy being produced in my local area.

[Those answering yes either to statement one or two AND living near one of the sites below qualify as “affected communities”]

To support Propeller to target recruitment and ensure a mix of affected community participants with experience of different sourcing and production sites the following list of locations were provided to Propeller.

Demographic	Category
Electricity	• Drax • Lynemouth
Heat	• Grissan (or other large Anaerobic Digestion site e.g. KIRK UK Anaerobic Digester in Staffordshire) • A large CHP plant • An Energy from Waste plant
Transport	• Teesside – where both Ensus, a bioethanol producer, and Greenergy, a biodiesel producer and fuel supplier, are located • Immingham/Hull – South of the Humber you would have P66 (who are a traditional oil company who is also doing a few things with biomass) and Greenergy, North of the Humber Vivergo (a bioethanol producer that is supposed to reopen in the next months) • Ellesmere Port – where both Argent and an Essar refinery are located (for the type of stakeholder engagement that you are planning could be an advantage that this is a slightly smaller place and businesses more concentrated)
Bio-based materials	• An area of land/forest used for timber in construction? (e.g. in Scotland/Wales) • Ensus bio-ethanol plant in Teesside • A large recycling centre - This website https://www.enfrecycling.com/directory/paper-plant/United-Kingdom has a directory of paper recycling facilities. Unfortunately, they don't have the size of them apart from one. We'd suggest going with the bioethanol plant in Teeside and one of the paper mills for this category. • A large papermill - There are two mills in the country which have integrated pulp production: Iggesund Workington board mill (Cumbria) and the UPM Caledonian LWC mill (Scotland, south of Glasgow).
GGRs/BECCS	• Drax • Merseyside cluster • Site/s used for CCUS public dialogue
Sourcing	• A Terravesta site • The supplier for Brigg power plant

Existing public opinion research shows both more support and more opposition to bioenergy amongst more knowledgeable members of the public but there is little evidence on how living near a site impacts views on Biomass. Therefore we will not set quotas on support for Biomass amongst affected community participants.

Recommended quotas

Table two shows the quotas we will set to achieve a reflective sample of 105-110 participants. We will recruit 120 people overall (60 per workshop) to allow for 5-10 people per workshop to drop out at some point in the process. ONS mid-year estimates have been used to set all demographic quotas except social class where we used the national readership survey and disability/Long term illness where we used NatCen British social attitudes alongside ONS.

Propeller, our recruitment partner, will use a screening questionnaire to obtain demographic and attitude information and allocate participants to the relevant dialogues. All participants will confirm they are eligible to participate in all 5 dialogue sessions prior to completing the recruitment questionnaire.

Table 4: Sampling criteria and targets

Criteria	Categories	Target (%)	Target overall (across 2 workshops 105)	Target per workshop (60 per workshop to account for over recruitment)
Demographics				
Gender	Male	50.1	5	60
	Female	49.9	55	60
Age	16-29	23.7	25 (plus 5-10 over-recruits)	16
	30-44	31.9	33	18
	45-64	30.1	32	17
	65+	14.4	15	9
Area	Urban	82	60	A mix in each workshop. These quotas are just general population participants as affected communities are targeted geographically and will not reflect national trends.
	Rural	18	15	
Ethnicity	White	84.8	86	Include 15 over-recruits (7 per workshop) from non-white ethnicities.
	Other	2	2	
	Asian	8	9	
	Black	3.5	5	
	Mixed	1.8	3	

Criteria	Categories	Target (%)	Target overall (across 2 workshops 105)	Target per workshop (60 per workshop to account for over recruitment)
Disability/LTI	Yes	6.8	7	15 across both
	Yes, limited a little	7.4	8	
	No	86	90	
Social Grade	A	4	4	Allow groups to fall out so that there are at least 2 or 3 people from same social grade present to prevent individuals feeling socially excluded.
	B	23	24	
	C1	28	29	
	C2	20	21	
	D	15	16	
	E	10	11	
Nation	England	84.3	85	Mix in each workshop. NI excluded due to recruitment complexity and cost
	Scotland	8.2	11	
	Wales	4.7	9	
Fuel poverty: agreement with both statements	I am very conscious of the energy I am using at the moment	13		Spread across the two workshops
	During winter, the price of energy prevents me from keeping my home as warm as I need			
How well would you say you are managing financially these days?	Living comfortably	20.6		Spread of financial situation across the two workshops. No quotas set as data is pre-cost of living crisis.
	Doing alright	40.3		
	Just about getting by	27.3		
	Finding it quite difficult	7.3		
	Finding it very difficult	4.2		
Attitudes				

Criteria	Categories	Target (%)	Target overall (across 2 workshops 105)	Target per workshop (60 per workshop to account for over recruitment)
Climate Concern	Very concerned	33	34	Mix within each workshop
	Fairly concerned	47	48	
	Not very concerned	15	16	
	Not at all concerned	4	6	
	Other	1	1	
Political affiliation Option 1: Which of following parties do you feel closest to	Conservative	29.3	30	Soft quotas – aim for a mix of political affiliation within each group – figures are just a guide
	Labour	21.7	22	
	Liberal Democrats	7.7	8	
	SNP	2.6	3	
	Greens	1.8	3	
	Brexit Party	1.3	3	
	Other	2.6	3	
	None/did not vote	32.7	33	
Awareness of Biomass	Know a lot about it	Record no quotas		
	Know a fair amount			
	Know a little about it			
	Heard of it but don't really know what it is			
	Never heard of it			

Support for Biomass	Strongly support	25	69	Mix of attitudes within each workshop
	Tend to support	42		
	Neither support nor oppose	23	41	
	Tend to oppose	3		
	Strongly oppose	1		

Appendix 4: Dialogue Session Materials Sample

This appendix offers an example session plan and information materials used for one of the dialogue sessions.

4.1 Biomass Dialogue – Sample Session Plan (Session 3, Sustainability Criteria) – 2.5 hours.

Sustainability Criteria

This public dialogue on biomass will involve a diverse group of 110-120 participants, split into two cohorts of 55-60 people. The dialogue will take place online using Zoom, over the course of five sessions. The same information will be explored with all participants in plenary sessions led by NatCen. Members of the NatCen team will then facilitate participant's deliberations in pre-assigned breakout rooms of 6/7. The groups and facilitators will remain the same within each session to build rapport. To expose participants to different perspectives we will change the breakout room groups for each session, always maintaining a mix of demographics within each breakout room. In this session participants from affected communities and the general public will be mixed in breakout rooms. Eunomia will attend these sessions as 'energy specialists' to give an overview of what Biomass is, and answer clarification questions to ensure the evidence is clearly explained.

At this stage in the dialogue all participants will have explored the sourcing, production and use of Biomass across the economy. Key things we will have explored:

- **Emerging principles/values for sourcing, production and use:** Captured on a Mural board from session two
- **Aspirations and concerns for biomass:** captured through survey, online platform and Mural board from session one
- **Deliberating the role of biomass in achieving net zero:** In session one participants will have had the question of the role of biomass in achieving net zero introduced to them, including the debates of potential risks, benefits and trade-offs in using Biomass to achieve net zero and what assurances the public want in place to manage these risks and trade-offs. In session two participants will have applied this question to source, production and use across the economy.

Prior to attending session three, participants will have been set a task to think of something they think is sustainable.

The central question to be explored in session three is:

1. **Explore participants views on the sustainability of biomass, including views on land and GHG criteria.**
2. **What governance, regulation and criteria do participants want in place to ensure that any sourcing (both domestic and imported) and use of biomass in the UK is sustainable?**
    - Who do they trust to oversee the governance and regulation of biomass use?

Timings	Objectives	Structure and materials

10 mins	Welcome and orient participants, thank them for their continued participation.
	Recap previous session on sources and uses of biomass.
	Introduce and link to session 3 on sustainability criteria and regulation.
		Introduction and recap presented in plenary by lead facilitator
		• Welcome and thank participants, emphasising the importance of the dialogue and of their continued participation.
		• Quick recap of the process
		• Introduce and link to topic for session 3: Biomass sustainability criteria and regulation;
		  • Show agenda for the evening.
		  • Reminder of where session 2 lies within the structure of the 5 sessions.
		  • Reminder of key question: 'What role should biomass play on the path to net zero?'
		• Quick recap of housekeeping and ground rules.

20	Breakout room introductions and warm-up. Round-up of sustainability factors surrounding biomass. Provide opportunity to formulate questions for Q & A.	**Breakout 1:** In breakout rooms of 6-7 people (which remain the same throughout session 3), a NatCen facilitator leads introduction and discussion: • Participants introduce themselves, and talk about the thing they think is sustainable. • Round the table, participants describe the many aspects of sustainability which have come up so far in relation to biomass, and discuss the sustainability of current biomass uses and sources. • Explanation of the panel Q & A. Participants formulate and decide on one or two questions to be posed to the panel. NatCen facilitator logs questions googlesheet question log and group nominates one participant to ask a question.

Timings	Objectives	Structure and materials

45	A range of specialists, advocates and/or stakeholders introduce their position and answer questions from participants.	**Return to plenary for Q & A with a panel of specialists and advocates**
		• Lead facilitator sets out key questions and concepts of sustainability; pillars and indicators
		• Lead facilitator explains how the Q&A will work, and encourages participants to ask or questions in the chat, during specialists presentations.
		• Lead facilitator chooses first 3 participants flagged by breakout room facilitators via whatsapp or raised hands
		• Each specialist introduces themselves and presents their position (3/4 minutes each).
		  • **Dr Anna Mikis from BEIS** will talk about the biomass sustainability criteria
		  • **Dr Mirjam Roeder from Aston University** will talk about the sustainability of biomass more broadly
		  • **Mair FloydBosley from the Royal Society for protection of birds** (RSPB) will talk about the environmental impact of using biomass
		  • **Laszlo Mathe, from Sustainable biomass production**, will talk about certification schemes for sustainable biomass
		• Lead facilitator invites responses from participants who asked questions and opens up to other participants (20mins)
		• Lead facilitator asks popular question(s) from the chat

15	Break	

Timings	Objectives	Structure and materials
50	Opportunity to discuss themes and issues raised in the Q & A Prioritisation exercise to understand views on land and GHG criteria Understand high-level views on governance and regulation.	**Breakout 2:** • For 10 minutes participants share reflections on the Q & A – what they found interesting and whether it has changed their initial view on sustainability and biomass from the start of the session. • Participants will spend 10 minutes discussing high level reactions to the land criteria and 10 minutes on GHG criteria. They will rank the 5 land criteria bullet points and the 3 GHG criteria bullet points and discuss if some elements feel more important than others in ensuring biomass is sustainable and if so , why. • After prioritisation, participants will explore transparency, governance, regulation and trust. This will include the assurances participants need, questions of enforcement and who they trust to ensure biomass meets sustainability criteria, and why. • To end the session the NatCen facilitator asks participants to identify emerging values/principles that drive the sustainability of biomass. These are logged on a google sheet • If specialists remain for the whole session they can move between breakout rooms and observe/respond to specific questions.
10	Thank participants and encourage continued participation. Explain expectations between sessions. Introduce next session and close.	**Return to plenary** • Lead facilitator to thank participants and emphasise importance of their contribution. • If time permits, lead facilitator pulls out themes from the Mural board or specialists are invited to reflect on what they've heard from the participants and what it has made them think about/ question. • Brief overview of what to expect in next session Thank participants and close

4.2 Biomass Dialogue – Sample Slides (Session 3)

NatCen
Social Research that works for society

Biomass sustainability criteria

Public Dialogue Session 3

June 2022

Welcome back

- Welcome back to this public dialogue on the role of biomass in achieving net zero. It has been commissioned by Department for Business, Energy & Industrial Strategy (BEIS)
- Over five sessions we will explore the question: **What role should biomass play in achieving net zero?**
- This evening we will focus **on the criteria used to ensure that biomass is sustainable**

1

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Who is in the room this evening

Department for Business, Energy & Industrial Strategy

BEIS and Sciencewise who have commissioned this dialogue are here to observe

An independent evaluator is here to observe

sciencewise

NatCen Social Research

NatCen is an independent social research organisation running the dialogue

4 speakers

Providing specialist input

Participants

You are a diverse group of people from across the country

NatCen Social Research

2

Dialogue questions remain the same

- To help us explore **What role should biomass play in achieving net zero?** We'll explore…

Benefits and concerns around the use of biomass in achieving net zero

Values and principles that can inform the potential use of biomass in achieving net zero

Additional information you feel you need to explore the role of biomass in net zero

NatCen Social Research

3

We are at session 3 out of 5

Session 1	Session 2	Session 3	Session 4	Session 5
Understanding biomass	Biomass production and use in different sectors	Biomass and sustainability criteria	Biomass and net zero (BECCS)	Agreeing principles and prioritizing concerns
Monday 20th June 6.00 – 8.30pm	Monday 27th June 6.00 – 8.30pm	Wednesday 29th June 6.00 – 8.30pm	Monday 4th July 6.00 – 8.30pm	Monday 11th July 6.00-8.30pm

4

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Before now

Session 1	Session 2
Understanding biomass	Biomass production and use in different sectors
Monday 20th June 6.00 – 8.30pm	Monday 27th June 6.00 – 8.30pm

We've focussed on achieving shared information

We haven't yet heard many opinions

5

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Now

Session 3	Session 4
Biomass and sustainability criteria	Bioenergy with carbon capture and storage (BECCS)
Wednesday 29th June 6.00 – 8.30pm	Monday 4th July 6.00 – 8.30pm

We will look at different perspectives on two of the more challenging and controversial aspects of biomass use in relation to net zero:

- Sustainability criteria
- BECCS and Negative emissions

6

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At the end

Session 5
Agreeing principles and prioritizing concerns
Monday 11th July 6.00-8.30pm

We will report back to you what we think we've heard over the 4 sessions and you'll tell us if we heard you correctly.

7

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Ground rules – NatCen role

- We're not experts in the topic
- We'll make sure everyone is involved
- We'll keep you on topic and to time
- Let us know if you need a break or something isn't clear

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Using zoom

- Please mute yourself when not speaking in case of background noise
- Please display only your first name on Zoom
- Use the chat functions when invited by facilitators
- Please have your camera on if you are comfortable with that and your internet connection allows
- Recording

10

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The session this evening

Section	Timing	What happens
Welcome	6pm – 6:10 pm	Hear introductory presentation as one group
Share initial views and questions	6.10 – 6.30 pm	Meet each other and discuss initial views on sustainability and biomass
Specialist Q & A	6.30 – 7.15 pm	Hear from specialists
Break	7.15 – 7.30 pm	
Discuss sustainability criteria	7.30 – 8.20pm	Discuss reactions to presentation in breakout rooms
Conclusion and round up	8:20 – 8:30 pm	Hear from each other together and outline next steps

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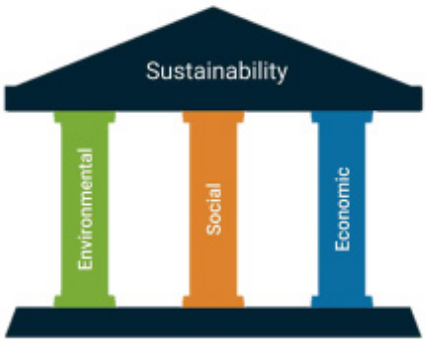
Introduction to Sustainability



Sustainability requires an integrated approach across three pillars:

- Social sustainability
- Environmental sustainability
- Economic sustainability

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How can we use biomass to help achieve net zero?

- Biomass is an **alternative to fossil fuels** as a fuel and in products.
- Unlike fossil fuels, sustainably sourced biomass can be **renewable**.
- Unlike fossil fuels, because biomass absorbs carbon dioxide as it grows, accounting for supply chain emissions, it is a **low carbon** energy source.
- Biomass materials and products can act as a **carbon store**.

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Biomass Indicators for Sustainability (non-exhaustive)

Environmental	Social	Economic
GHG emissions	National energy security	Resource availability and use
Air quality	National food security	Energy security
Biodiversity	Access to land, water and other resources	Economic development
Soil health	Human health and safety	Competitiveness of bioenergy

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Note: some of these are already covered by the Government's existing sustainability requirements and some are covered by other means.

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Who will we hear from this evening?

- **Dr Anna Mikis from BEIS** will talk about the UK biomass sustainability criteria
- **Dr Mirjam Roeder from Aston University** will talk about the sustainability of biomass more broadly
- **Mair FloydBosley from the Royal Society for protection of birds** (RSPB) will talk about the environmental impact of using biomass
- **Laszlo Mathe, from Sustainable biomass program**, will talk about certification schemes for sustainable biomass

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Quick introduction

In breakout rooms:

- Get to know each other
- Share thoughts on sustainability

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Specialist presentations and Q&A

6.30 – 7.15pm

2.

The UK's sustainabilit framework

Dr Anna Mikis

Biomass Sustainability and Availability Lead

BEIS

29th June 2022

Public Dialogue on Biomass

Department for Business, Energy & Industrial Strategy

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NatCen Social Research

The UK's sustainability criteria

The UK uses **sustainability criteria** to **ensure biomass use delivers low-carbon, renewable energy** and that **it does not lead to environmental degradation**.

Sustainability criteria are in place for specific government support schemes.

The criteria apply irrespective of the sourcing location.

Criteria apply to liquid biofuels, woody biomass and other fuels, such as energy crops. Some exemptions apply.

Not meeting the criteria = no support

https://www.alternative-energy-tutorials.com/biomass/biomass-resources.html

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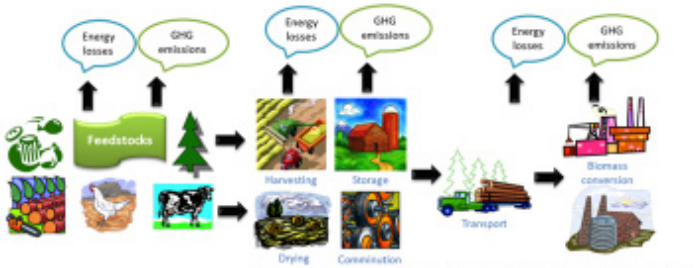
Requirements on 'Land' and 'GHG' criteria

The land criteria covers social, economic, and environmental issues:

- Legal and sustainable harvesting
- Carbon stock of forests do not decrease
- Protection of high carbon stocks such as peatland
- Protection of biodiversity and ecosystem services
- Protection of land and labour rights



https://www.supergen-bioenergy.net/project/streamlining-the-supply-chai

https://www.forestsandfish.com/sustainable/

Credit: USFS

The Greenhouse Gas (GHG) criteria require that biomass does not exceed a set GHG threshold:

- **Include requirement for minimum percentage GHG emission savings**
- **Emissions from the supply chain, i.e. transport, growing, and processing are included**
- The required **savings and maximum threshold are made stricter over time**

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Governance framework

Sustainability criteria

Sustainability Criteria of government support scheme

Certification/ Evidence collection

How is compliance demonstrated?

Can use of voluntary certification schemes to demonstrate compliance.
If not using voluntary schemes, can use other methods:
1) By sourcing feedstock from an approved suppliers list for the subsidy scheme (e.g. RHI has a Biomass Suppliers List)
2) By collecting bespoke evidence that demonstrates compliance

Regulator

The evidence must be independently audited and compliance demonstrated to the regulator

sbp · FSC · RSB CERTIFIED · PEFC · ofgem · LOW CARBON CONTRACTS COMPANY POWERING NET ZERO

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Supergen Bioenergy

Sustainability of Bioenergy and Bioenergy with Carbon Capture and Storage (BECCS)

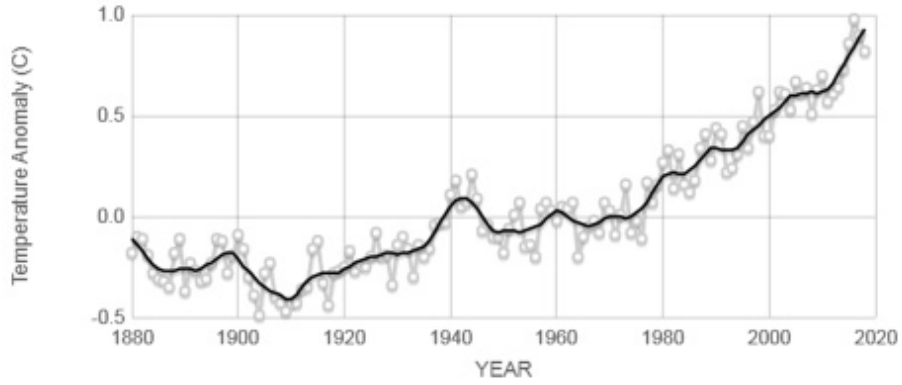
Mirjam Röder & Dan Taylor

We work with academia, industry, government and societal stakeholders to develop sustainable bioenergy systems that support the UK's transition to an affordable, resilient, low-carbon energy future.

Supergen Bioenergy Hub

Supergen Bioenergy

Global temperature is increasing…



Source: climate.nasa.gov

Supergen Bioenergy Hub

Supergen Bioenergy

What is biomass?

- Biomass is our only **renewable source of carbon**.
- Biomass is renewable organic material that **comes from plants and animals**.
- Plants produce biomass by **absorbing CO_2** via photosynthesis.
- Biomass comes in **many forms**, with different properties.

Supergen Bioenergy Hub

Supergen Bioenergy

What can biomass be used for?

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- Heat
- Electricity
- Chemicals
- For cooking
- Car fuel
- Truck fuel
- Plane fuel
- In factories

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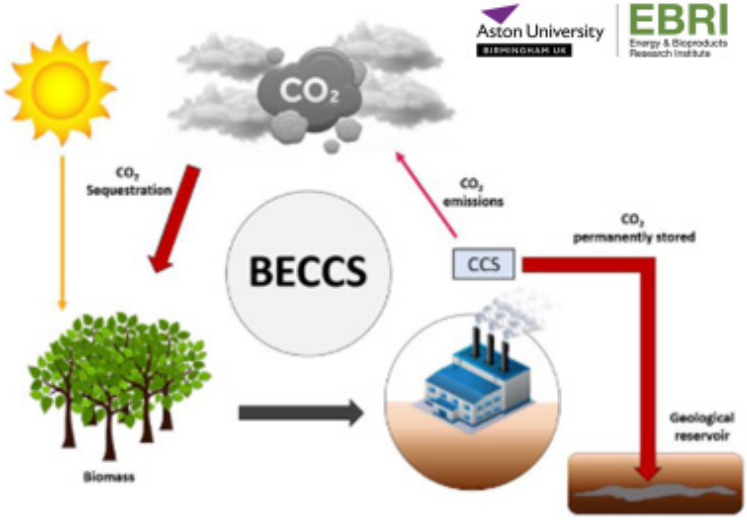
Supergen Bioenergy

The role of bioenergy with carbon capture and storage (BECCS) in emission reduction

Aston University BIRMINGHAM UK | EBRI Energy & Bioproducts Research Institute



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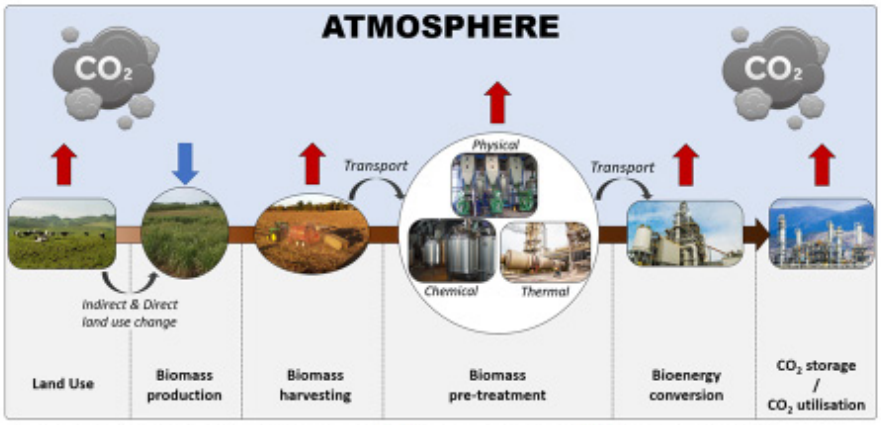
Supergen Bioenergy

Bioenergy and BECCS sustainability

Aston University BIRMINGHAM UK | EBRI Energy & Bioproducts Research Institute



BECCS supply chain. The CO_2 uptake (➡) and emissions (➡) are represented

Supergen Bioenergy Hub

Supergen Bioenergy

Bioenergy and BECCS sustainability

Aston University BIRMINGHAM UK | EBRI Energy & Bioproducts Research Institute

Society Environment Econom y

Supergen Bioenergy Hub

Supergen Bioenergy

Supergen Bioenergy Hub

Aston University BIRMINGHAM UK | EBRI Energy & Bioproducts Research Institute

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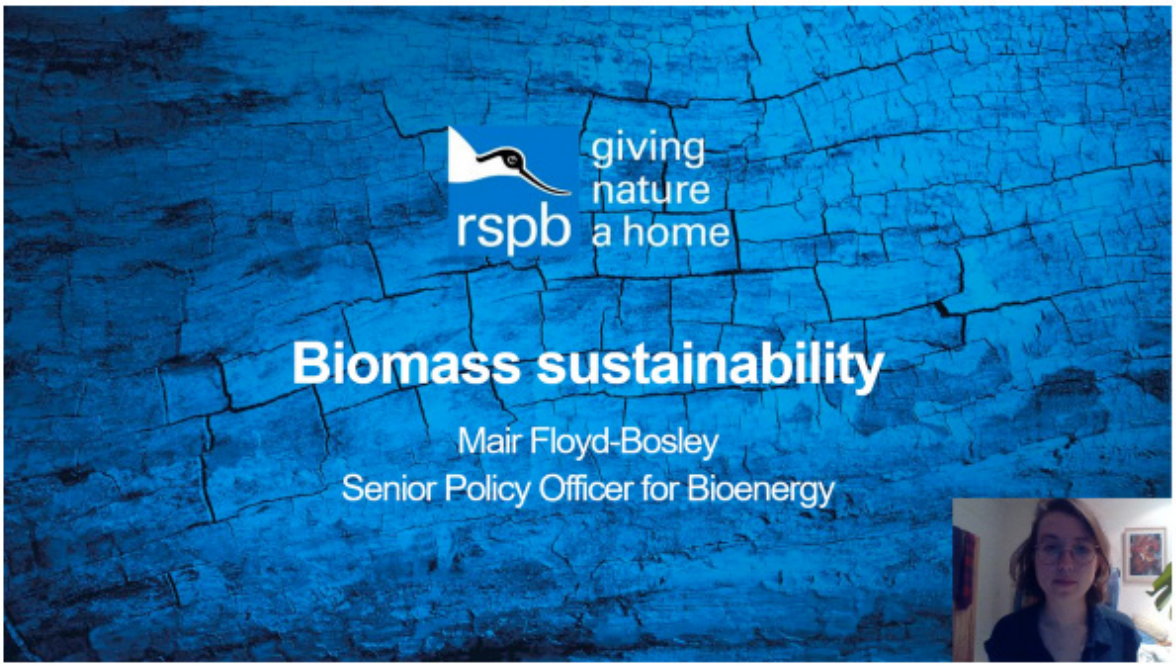
@SupergenBioHub



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Sustainable Biomass Program

Introduction to SBP

László Máthé - June 2022

Sustainable Biomass Program

About SBP

- SBP is a non-profit, independent certification scheme
- Specifically developed for woody biomass used in large-scale industrial heat and power production
- The SBP system can be used to ensure that feedstock is sourced from legal and sustainable sources
- Heat and power producers (End-users) use SBP certification to demonstrate compliance with national legality and sustainability requirements for woody biomass
- Biomass Producers and Traders use SBP certification to comply with purchasing policies of End-users
- Independent auditing :

CONTROLUNION SCSglobal DNV·GL NEPCon FOREST CERTIFICATION

Independent Accreditation Body

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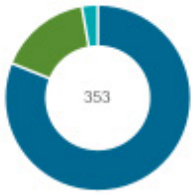
Facts & Figures

Certificate Holders by type*



Biomass Producers	281
Traders	62
End-users	10

353 Certificate Holders across 34 countries
25 Applicants

SBP Facts & Figures: https://sbp-cert.org/about-us/facts-figures

SBP-certified biomass accounts for:
- approaching 77% of the EU industrial pellet market
- Ca. 30% of the worldwide pellet production in 2020

* As at Jan 2022

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Leading in biomass certification

SBP is the world's leading independent multi-stakeholder certification system for woody biomass

Benefits

- One size fits all
- Meta-standard to include different regulatory requirements
- Replaces multiple supplier audits
- Enables international trade
- Collects and transfers energy data enabling calculation of GHG emissions

FSC and PEFC do not fully meet the existing regulatory requirements in European Countries

FSC PEFC

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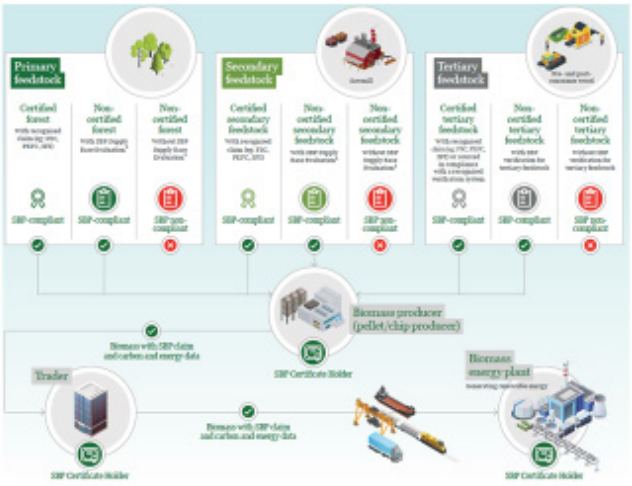
Certification system

- There are three types of Certificate Holder
  - Biomass Producer (BP)
  - Trader
  - End-user
- Each step of the supply chain must be certified if the biomass produced and sold is to carry an SBP claim
- BPs undertake a Supply Base Evaluation (SBE) of feedstock sources
- BPs determine and mitigate risks of using unsustainable feedstock
- Certified volumes and energy data transferred through the SBP Data Transfer System (DTS)



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Sources

- SBP Video: https://www.youtube.com/watch?v=V6YxUToXjmk&t=3s
- SBP Annual Review 2020: https://sbp-cert.org/documents/annual-reviews/
- SBP Facts & Figures: https://sbp-cert.org/about-us/facts-figures
- SBP Standards: https://sbp-cert.org/documents/standards-documents/
- White Paper: Better certification and regulation for biomass: a certification scheme's perspective

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Contact SBP:
info@sbp-cert.org
www.sbp-cert.org
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Q+A

Break

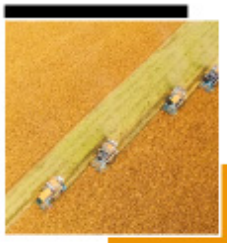
7.15 – 7.30pm

Breakout room discussions

7.30 – 8.20pm

2.

UK Land criteria



Land Criteria

1. Requirement for **legal and sustainable** harvesting
2. Ensuring **carbon stock** of forests do not decrease
3. **Protecting high carbon stocks** such as peatland
4. Protecting **biodiversity and ecosystem services**
5. Protecting **land use and labour rights**

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UK Greenhouse gas criteria

Greenhouse Gas Criteria

1. Includes a **minimum percentage lifecycle GHG emissions savings**, compared to emissions from a fossil fuel comparator for electricity
2. **Emissions from the supply chain** i.e. transport, growing and processing are included
3. The **required savings and maximum threshold** are made stricter over time

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en
earch

Wrap up

8.20 – 8.30pm

3.

Thank you and next steps

- The **next session is on Monday 4th July at 6pm** You'll also receive a new link for the next session from **NatCen** (biomass@natcen.ac.uk)
- We will talk about **bioenergy with carbon capture and storage (BECCS).**
- All the material we've shared so far will be available on our website. We'll share a link via email for you to access.

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Appendix 5: Biomass Pre and Post-workshop Questionnaire

Biomass pre and post-workshop questionnaire

Landing page:

Thank you for taking part in the workshop. Please complete this questionnaire to help us understand how you found the workshop, as well as what you think about the role of Biomass in achieving net zero.

It will take no longer than 5 minutes and we need you to complete it to get the full incentive after all workshops have been completed.

1. **After taking part in the workshop, how sure or unsure do you feel in your current opinion on the role of biomass in achieving net zero**

   (Select only one)

   - Very sure in what I think
   - Quite sure in what I think
   - Not sure in what I think
   - Not at all sure in what I think

2. **After taking part in the workshop, how well informed do you feel about the role of biomass in achieving net zero**

   (Select only one)

   - Very well informed
   - Quite informed
   - Not very well informed
   - Not at all informed
   - Don't know

What additional information would you like to have to help you develop your views on the role of biomass in achieving net zero. (Please type your answer in the box below)

3. To what extent do you agree or disagree that Biomass should have a role in achieving the UK's net zero target?

(Select only one)

- Agree strongly
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- Don't know

4. After taking part in the workshop, how much or little of a role do you think biomass should play in achieving the UK Government's net zero target?

(Select only one)

- I think biomass should play a large role
- I think biomass should play some role
- I think biomass should play a very small role
- I don't think biomass should play any role
- Don't know

Please explain why you have selected the option above. (Please type your answer in the box below)

5. To what extent, if at all, are you concerned about the use of Biomass in achieving net zero?

(Select one only)

- Very concerned
- Fairly concerned
- Not very concerned
- Not at all concerned
- Don't know

Please explain why you have selected the option above. (Please type your answer in the box below)

6. Please add any other comments about the role of biomass in achieving net zero.

7. Overall, how much did you enjoy taking part in the workshop?

(Select only one)

- A great deal
- Quite a lot
- To some extent
- Not very much
- Not at all

8. I understand the objectives for this public dialogue and how BEIS will use the findings.

- strongly agree
- tend to agree
- neither
- tend to disagree
- strongly disagree
- don't know

9. The information shared today was clear and easy to understand

- strongly agree
- tend to agree
- neither
- tend to disagree
- strongly disagree
- don't know

10. I felt comfortable and heard in my small group.

- strongly agree
- tend to agree
- neither
- tend to disagree
- strongly disagree
- don't know

11. Was there anything that made you feel that couldn't take part fully in today's session? If so please tell us so that we can help sort this out before next time.

Appendix 6: Biomass dialogue example elicitation materials

6.1 MURAL board exercise (screenshot)

6.2 Section of spreadsheet for logged responses to the elicitation exercises for Session 2 (partial screenshot)

	A	B	C	D	E	F	G	H
1	Theme	Session	Group	Room	Source	Use	Good idea when	Bad idea when
2	Cost	2	2	1	waste		it's not too expensive to do it'/acquire it	
3	Cost	2	2	1	overall		that it's worth it financially – overall – to use biomass	
4	Cost	2	2	1		transport	on road transport if sustainable and cheaper	
5	Cost	2	2	1		heating	Provided overall cost is worth it	
6	Cost	2	2	1		heating		If it's more expensive than gas or electricity
7	Cost	2	2	1		electricity	Total cost of ownership comes into play	
8	Cost	2	2	1		electricity		Concern: we have to pay more due to environmental concerns but people don't have enough already
9	Cost	2	2	1		transport	Same conditions apply – provided it's better for the environment balanced with cost	
10	Cost	2	2	2	overall		it is more cost effective than other renewable energy sources (solar/ wind).	
11	Cost	2	2	2	forestry		it can be imported in a cost effective way (e.g. exchange rate of South African Rand making imports from South Africa relatively cheap).	
12	Cost	2	2	2	forestry		it supports the profitabilty of forrestry.	
13	Cost	2	2	2	marine		when 'free stuff' is used, e.g. sea weed that is washed up on beaches.	
14	Cost	2	2	2		overall	all biomass is prioritised for the most valuable uses.	
15	Cost	2	2	2		electricity	consumer.	
16	Cost	2	2	2		transport	it reduces the cost of travelling for consumers, i.e. makes it more socially inclusive while being more sustainable.	
17	Cost	2	2	2		industry		consumer.
18	Cost	2	2	2		hydrogen	the use of biomass offsets the currently high cost of hydrogen	
19	Cost	2	2	3	waste			it
20	Cost	2	2	3		electricity	it's scaleable and cost effective	
21	Cost	2	2	3		electricity	it reduces the cost of electricity and reliance on gas which is finite	
22	Cost	2	2	4	marine			If the benefits are uncertain – concern that investment wont yeild value
23	Cost	2	2	4		overall		If big businesses that invest demand high returns leading to rich/poor divide in those able to access the benefits
24	Cost	2	2	5		heating		It's expensive to install, maintain and store the fuel
25	Cost	2	2	5		heating		Need expensive specialists to service it
26	Cost	2	2	6		electricity		It's dirty and expensive