The Institute for Sustainable Resources responds to the government's Biomass Strategy

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In August 2023 the Department for Energy Security and Net Zero published their Biomass Strategy.

The UK government says biomass has a 'major role to play' in building a truly green economy. Biomass can be used as fuel for transport, heat and electricity generation, as well as being the starting material for decarbonising other important sectors, such as chemicals.

Bioenergy with Carbon Capture and Storage (BECCS) works by using sustainable biomass to create fuel, or directly burning it to create energy, with carbon capture to remove and store carbon dioxide. The intention is that the growing biomass fixes carbon dioxide from the atmosphere, which at the end of the process is securely and permanently stored.

The Biomass Strategy aims to 'set out the role biomass can play in reaching net-zero, what government is doing to enable that objective and where further action is needed'.

Researchers from the Institute for Sustainable Resources (ISR) have inputted to the development of the Biomass Strategy in various ways. In June 2021, we responded to a call for evidence on the role of biomass in achieving net zero, which was considered alongside other's submissions in the development of the Strategy. More recently in October 2022 we responded to a consultation on a business model for power bioenergy with carbon capture and storage (power-BECCS) and continue to engage with the policy team regularly.

Our modelling capability also informed the Biomass Strategy. ISR PhD candidate Chris Kim contributed modelling expertise and data to the UK TIMES modelling team, which allowed the Department for Energy Security and Net Zero to account for sustainable aviation fuels[1].

The ISR's key messages on the use of biomass in achieving net zero are:

(a) Land is the primary resource. Bioenergy should not be viewed in isolation from other uses of land. The focus should be on land-use options which offer significant co-benefits in terms of biodiversity, socioeconomic impacts and ecosystem services as well as carbon removal. A **coherent approach to land-use** which ensures long-term environmental, social and economic sustainability should be developed collaboratively across government.

(b) Biomass deployment should be limited to those sectors and specific applications which are harder to decarbonise using other routes such as electrification and hydrogen. Biomass should only be used in power generation, hydrogen production and fuel production if Carbon Capture and Storage is available.

(c) Sustainable biomass feedstocks are and will continue to be in limited supply with significant supply-chain risks and high levels of international competition. Strategies that reduce the size of the overall energy system by rationalising, shifting, and reducing demands – for energy, materials, and specific transport modes – should be pursued in order to reduce the carbon emissions from the energy system and thus the pressure on biomass supply options.

[1] This is reflected on page 114 of the Biomass Strategy 'The other major change to the model since the publication of the Net Zero Strategy is the addition of a number of technologies to produce SAF as well as the central-level SAF mandate from DfT's recent consultation.'

Another important angle when considering such a cross cutting topic is the social impact of a shift towards increased biomass use. This could include working with landowners and farmers when developing incentives structures to upscale biomass production. It is also important to respect the social priorities of communities that may be impacted by, or become involved in, biomass supply chains. Vulnerable communities have been negatively impacted by international supply chains in the past, and it is especially important that this does not happen again.

As we see it, the government's Biomass Strategy outlines three key areas, which we would like to reflect on:

(1) Biomass sustainability
(2) Biomass availability
(3) Priority use of biomass

On **biomass sustainability (1)**, we still don't have a definition of what sustainable biomass means. A failure to deliver truly sustainable (from carbon, environmental, and social perspectives) biomass will undermine its purpose as a 'green' option.

However, there is a recognition of differences across biomass using sectors. There are more developed, and more stringent, sustainability policies in the energy and transport sectors, and less in sectors such as chemicals, construction and manufacturing where biomass use is growing in importance.

The key differences between the current sectoral policies include indirect land use change, setting greenhouse gas thresholds, caps or bans on certain crops, and whether waste products are used as feedstocks.

We welcome the government's commitment to developing an overarching cross-sectoral common sustainability framework, to be consulted on in 2024. This would include:

- A common GHG emissions calculation methodology.
- Indirect land-use change (ILUC) criteria.
- Practicalities of accounting for soil carbon changes.
- A requirement for biomass users to ensure that 100% of woody biomass feedstocks are proven sustainable (where not already mandatory).

We recognise the inclusion of land use change, however, as recommended in our first key message **(a) we need to go beyond carbon or greenhouse gas accounting and consider the wider environmental and social impacts of biomass use.**

Recently there has been some media attention around existing biomass using power stations, and the difficulty in sourcing truly sustainable feedstock. The controversy suggests that there might be a need for more stringent sustainability factors in the sourcing areas, going beyond carbon. A good example to follow may be the JRC report, suggesting that very few biomass fractions should be removed from the harvested forests in order to preserve forest health and biodiversity.

This links to **biomass availability (2)** where the government has stated it is considering both domestic and imported biomass as necessary to ensure sufficient resource. The government has also committed to continued monitoring of this availability. The scenarios analysed in the Strategy show that the availability of domestic feedstocks remains relatively stable, with more significant variation (i.e. increase) in international sources. While biomass availability levels are assessed domestic supply will be tight and entail **difficult trade-off decisions on land-use (a)**.

It seems the increase in imported biomass is at odds with the public opinion, who see the emissions created in the sourcing and production of biomass as 'intuitively unsustainable'[2]. This combined with the complexity of international supply chains means that domestic biomass viewed as more sustainable. The Strategy also makes assumptions about international biomass availability which may introduce supply risk, as it is expected there will be significant competition internationally for limited supply.

This focus on increasing biomass supply seems to be in contention with our third recommendation **(c)**, **that in order to ensure consistent supply of sustainable biomass the most sensible first step would be to reduce the size of the energy system you are attempting to service.**

The Biomass Strategy also sets out the government's plan for **priority use of biomass (3)**, stating 'The use of sustainable biomass must be prioritised in sectors that offer the greatest opportunity to reduce emissions and where there are fewest options to decarbonise through alternative low carbon technologies'. Overall, this aligns well with our message around **biomass deployment being limited to sectors which are harder to decarbonise by other routes (b)**.

The plan is split over three time periods for priority deployment: in the short term across the economy including in alternative fuels for road transport; in the medium term the focus is on industry and aviation; and in the long term the focus is on BECCS, playing a core role in the decarbonisation of the electricity sector and potentially (to be determined) in providing hydrogen BECCS, biokerosene BECCS, and powering industrial processes. Within this prioritisation there is still some confusion as to power-BECCS's primary purpose – as a negative emissions technology, or as a power generating technology to decarbonise electricity generation.

It is notable that this medium term goal includes having carbon capture and storage up and running by 2035, and the report references a carbon removal efficiency between 65-85% after accounting for the supply chain and losses of non-captures biogenic carbon. Recent research from ISR authors looked at the role of bioenergy with carbon capture and storage for net zero, including modelling various efficiency levels for carbon capture and storage. From a review of existing literature, the authors found that over the BECCS supply chain stages there were expected CO_2 losses between 50 and 80%, translating into carbon removal efficiencies of 20 to 50%[3], much less optimistic than the Strategy figures.

Overall, the Biomass Strategy sets out a reasonable timeline and use cases for biomass. However, important questions still remain about the scaling up of carbon capture and storage, a cross government, cross sector approach to land use, and clarity around the definition and thresholds for sustainability.

[2] Role of biomass in achieving net zero: public dialogue - GOV.UK (www.gov.uk)

[3] These carbon losses unpack as 5% carbon loss during biomass cultivation/harvest, 16% due to biomass transport and storage, 16 to 19% due to biomass processing into chips or pellets, 11 to 38% due to bioenergy conversion and carbon capture efficiency, and 6% losses due to compression and transport of the CO_2