UKERC
UK Energy Research Centre

Biomass as a long-duration store of energy

A scoping study for UKERC and the UK's Supergen Bioenergy Hub

Funded by
UK Research and Innovation

Aims and outcomes

Exploring whether biomass could play a role in delivering flexibility into the energy system.

Collating and synthesizing the views of key stakeholders and domain experts – where are the commercial opportunities and what policy changes would be needed to unlock these?

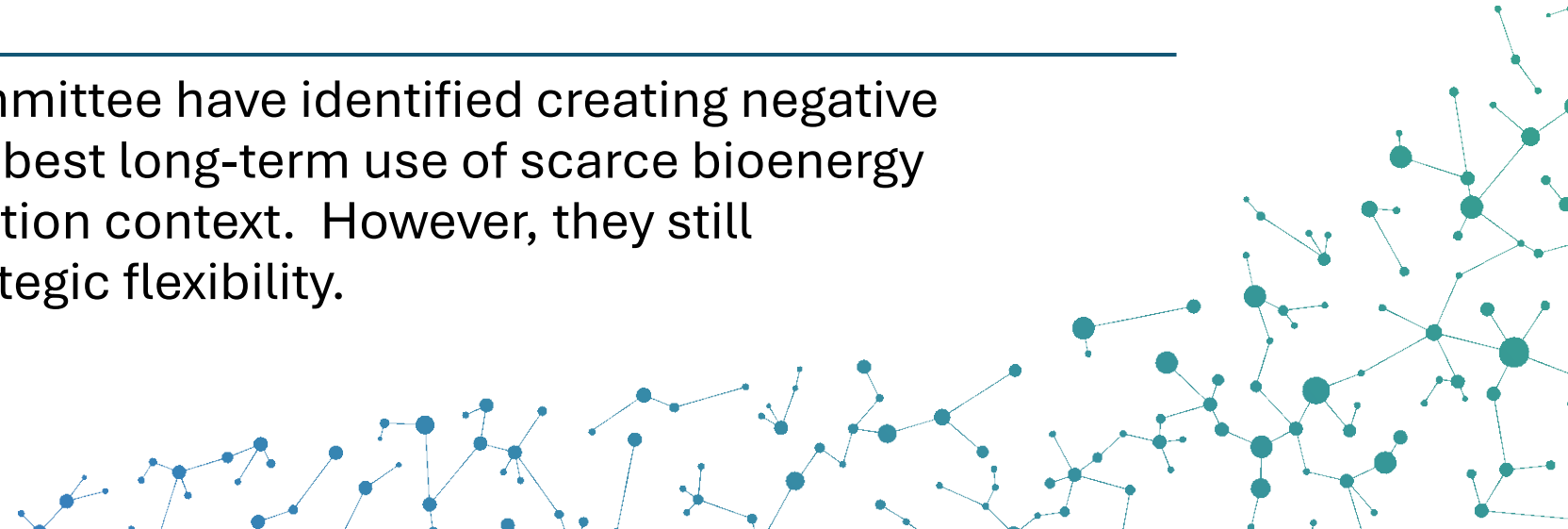
Developing coherent pathways from that synthesis to identify evidence gaps and point towards additional research needs.

Background

The UK Energy System Operator has identified that bioenergy ‘provides a renewable low carbon power source’ that can be used as dispatchable generation to ‘help meet demand during times of low wind and solar output’.

However, where CCS is installed on biomass plant they are suggesting that higher load factors would be desirable to ‘maximise carbon removal from the atmosphere’.

The UK’s Climate Change Committee have identified creating negative emissions with BECCS as the ‘best long-term use of scarce bioenergy resources’ in an energy generation context. However, they still acknowledge the need for strategic flexibility.



Flexibility

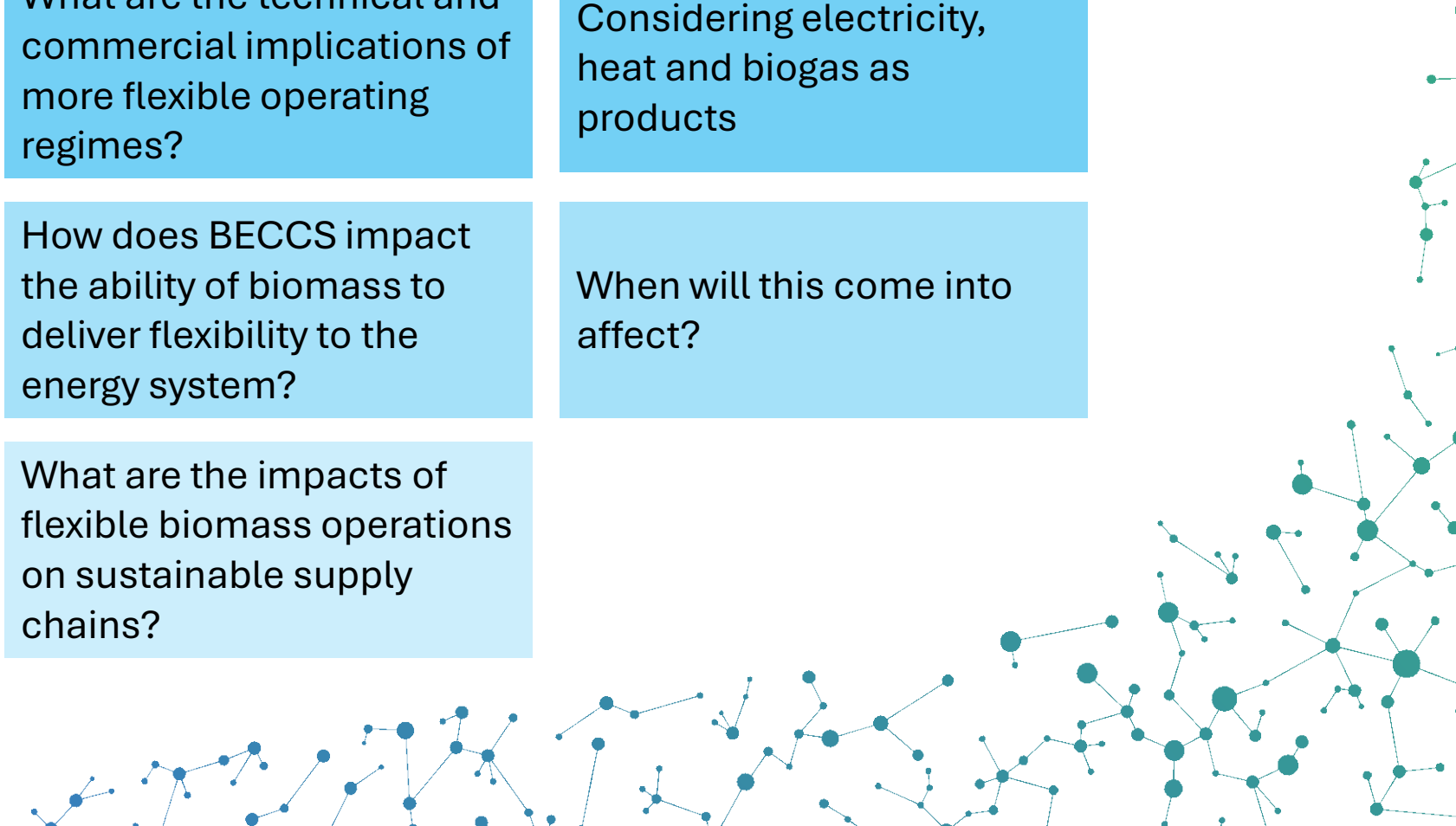
Energy system flexibility can mean many things. We have broken down our definition in terms of needs at different timescales:

Strategic reserves	**Poor renewables year**	**Seasonal imbalance**	**Wind drought**	**Supply/demand balancing**	Frequency regulation
	How do you make up the missing TWh?	How do you manage seasonal energy production surpluses and deficits?	How do you manage specific periods of extreme renewable generation deficit?	How do you manage day-to-day variability in supply and demand?	
	How many TWh?	How many TWh?	How many GW and for how long?	How many GW?	

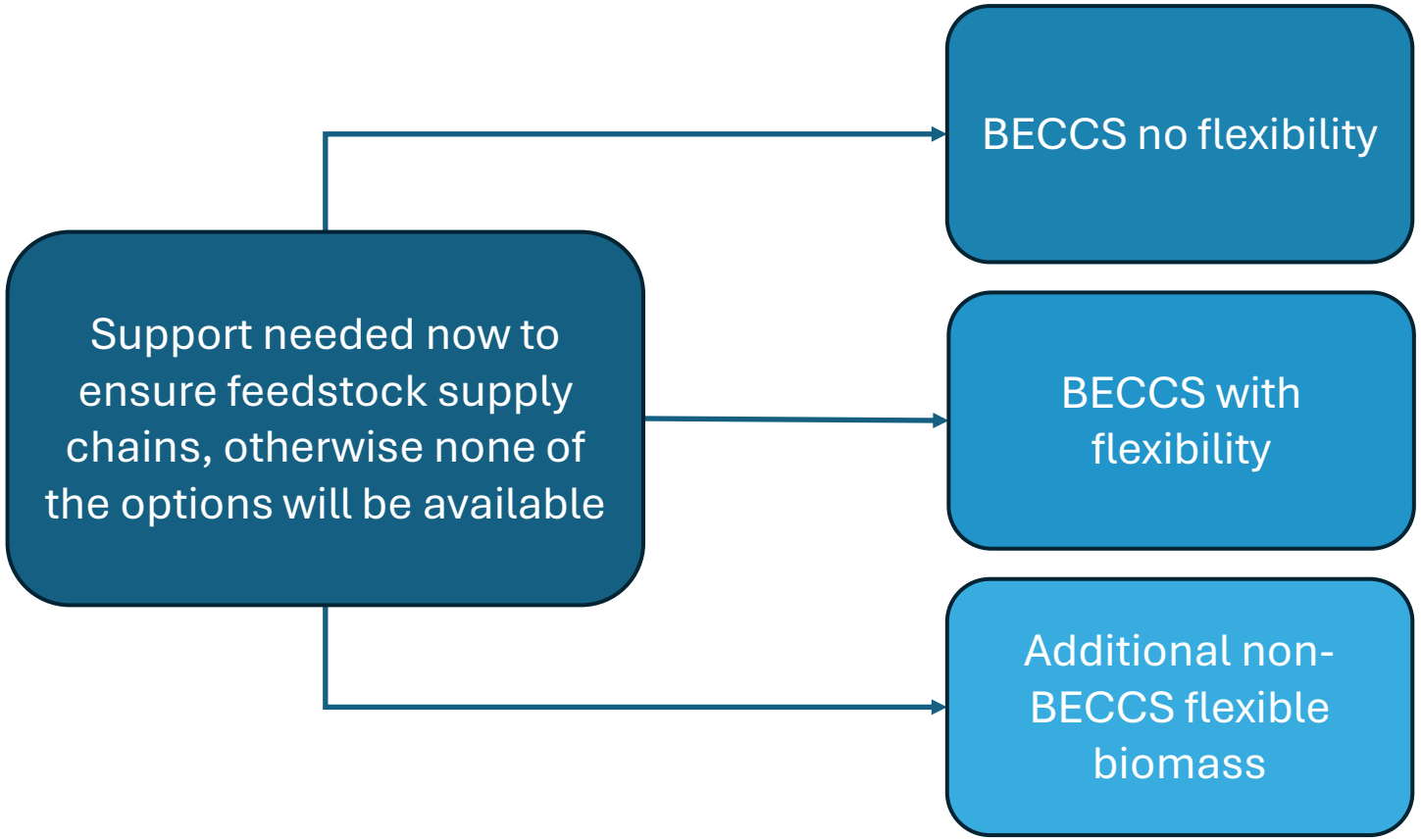
Bioenergy Themes

Stakeholder engagement explored three key themes:

Plant, infrastructure and products - current operation, future operation, best match to flexibility needs	What are the technical and commercial implications of more flexible operating regimes?	Considering electricity, heat and biogas as products
Dynamics of BECCS - timescales and feasibility of the transition	How does BECCS impact the ability of biomass to deliver flexibility to the energy system?	When will this come into affect?
Supply chains - UK and international	What are the impacts of flexible biomass operations on sustainable supply chains?	

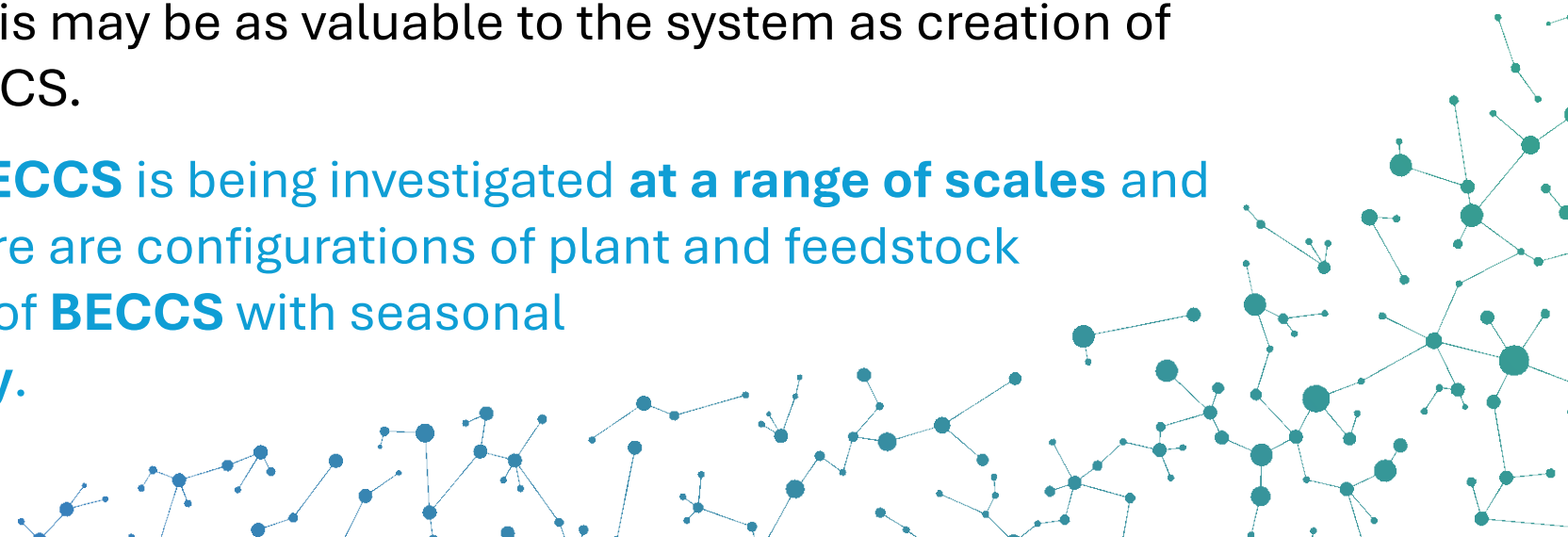


Key Narratives



Key Messages (1/2)

- **Bioenergy infrastructure and supply chains** currently store energy at scale over relatively long periods. This characteristic could be used to **facilitate greater flexibility** in the operation of **heat, gas and electricity** systems and markets.
- The **capital and operational costs** of bioenergy are **well understood** and are already delivering **commercially**. This knowledge could deliver a complementary, lower-cost solution to the **long-duration energy storage challenge**.
- The **flexibility potential** of biomass operations is **diverse** and geographically as well as temporally distributed. This may be as valuable to the system as creation of negative emissions from BECCS.
- The potential for delivering **BECCS** is being investigated **at a range of scales** and with diverse feedstocks. There are configurations of plant and feedstock that could **combine** delivery of **BECCS** with seasonal energy **storage and flexibility**.



Key Messages (2/2)

- Current supply and use of biomass in the UK is shaped by **government policy**, incentives and regulation, which focuses on negative emissions and does not currently promote flexible operation on smaller capacity sites.
- **Incentivising** flexibility without increases in plant capacity could have a detrimental effect on hard-won feedstock supply chains – in many cases this is material that would otherwise go to landfill.
- There is significant **pressure** being placed on government in the UK to **reduce** the **use** of biomass on the basis of concerns about emissions and sustainability of supply chains.
- There are a number of **uncertainties** about the timing of **BECCS** becoming a 'commercially available' option to all bioenergy producers.

Project partners

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