

Seizing sustainable growth opportunities from carbon capture, usage and storage in the UK

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1. Key messages

- Carbon capture usage and storage (CCUS) needs to be deployed urgently to bring greenhouse gas emissions to net-zero.
- The potential contribution of CCUS to sustainable growth in the UK is high, through jobs and supply chains.
- CCUS could present a levelling-up opportunity if support is directed strategically to address the unequal distribution of innovative performance across the country.

2. Background

Coordinated investments in infrastructure, innovation and skills must reorient the UK economy *in this decade* towards a growth path aligned with its target to achieve net-zero greenhouse gas emissions by 2050. The use of carbon capture, usage and storage (CCUS) is key for enabling this growth path, given its role in decarbonising hard-to-abate industries such as steel and cement, producing low-carbon hydrogen and delivering negative emissions.

An inconsistent policy environment, including two failed major demonstration competitions, has been the primary setback against CCUS development in the UK to date. Now is the time to make up for years of stalled progress in deploying this essential technology. Fast, strategic action can enable the UK to deliver significant emissions abatement through CCUS while generating export opportunities and wider economic benefits from the sector.

To evaluate the role of CCUS for sustainable growth, we have:

- Reviewed 15 ex-ante studies assessing economic impacts (including gross value added and jobs) of CCUS investments in the UK
- Analysed global trade data to identify the UK's productive strengths across the CCUS value chain
- Analysed patents data to identify the UK's innovative strengths across the CCUS value chain

3. Our findings

Economic opportunities and jobs

Job creation opportunities lie along the highly complex and fragmented value chain for CCUS. Overall, the studies we reviewed suggest that CCUS investments can generate significant gross value added (GVA) benefits and a substantial number of jobs in the short, medium and long terms. Multiple estimates for the number of jobs created from CCUS by 2030 cluster between 22,000 and 31,000. This is unsurprising given these studies consider unambiguous deployment scenarios designed to be consistent with the UK's climate targets. As well as creating new jobs, CCUS is crucial for helping retain existing jobs in energy-intensive industries.

The UK's productive strengths in CCUS

The UK's export share in CCUS-related product categories tends to be low (around or below 5%) and declined over the period 1995–2019. The US and Germany historically have been dominant in CCUS related exports but increasingly are being overtaken by China. This partly reflects China's dominance in global manufacturing exports more generally.

Nevertheless, the UK has revealed comparative advantage (RCA) in some key CCUS-related products, and a mix of strengths and opportunities, especially in mechanical machinery and measuring, monitoring and verification (MMV) instruments. RCA is defined as a given product's share in a country's exports, divided by the product's share in global trade volume.

The UK's innovative strengths in CCUS

A more forward-looking indicator of the UK's comparative advantage in CCUS is its innovative capability. Our analysis of CCUS-related patenting shows global CCUS innovation has been growing rapidly over the last 20 years but experienced a decline following the financial crisis. Just 4% of global CCUS patent applicants over the period 2000–2015 were made in the UK but the country demonstrates a comparative advantage in this area – which also exceeds other broad categories of 'clean' innovation. It is worth noting that previous analyses have shown that the UK exhibits strong comparative advantage in specific technologies within these *broad* categories of 'clean' innovation, including wind and ocean energy.

Looking at patenting at a regional level (Figure 1), we find a relatively high share of CCUS-related innovation activity in the South East of England. Industrial areas in the North East and North West also appear to have a relatively high share of CCUS-related patents compared with other regions. Regional dimensions and transferability of R&D capability require further attention to ensure CCUS-driven growth is regionally balanced. In the context of uneven economic performance across the country, it is important to understand where technological strengths are located, and the extent to which different parts of the UK could be well positioned to act as R&D hubs for CCUS in the coming years.

While CCUS has the potential to contribute to future growth and employment in the UK's industrial heartlands, the extent to which this is the case will depend on where new knowledge is generated, patterns of knowledge spillovers, the structure of supply chains and the skills base.

A positive correlation between CCUS innovation and areas that have traditionally patented more intensively in oil and gas extraction technologies is also shown by our analysis. This suggests that places that have specialised in these technologies might be well-placed to benefit from the transition to CCUS.

Regions such as North Eastern and Eastern Scotland have a large share of innovation in oil and gas extraction but quite a low share in CCUS-related technology, whereas inner London and parts of South East England, including Surrey, East and West Sussex, display a large share of patenting in oil and gas extraction as well as CCUS-related technologies.

4. Conclusions and policy recommendations

Recent policy frameworks and funding committed to CCUS, including through the Net Zero Strategy and the Cluster Sequencing process, have set a clear deployment pathway for initial CCUS projects in the UK but more needs to be done to stimulate investment at the required scale and pace. The UK cannot afford any further policy failure or delays deterring investment in CCUS, given the urgency of net-zero, and investor confidence that is already fragile due to past experience.

In light of our analyses of the data on economic impacts, trade and innovation relating to CCUS, and the current barriers to CCUS development that we identify, we present policy recommendations that span national and local levels, and relate to the investments across infrastructure, innovation, human, natural and social capital that are required for sustainable and inclusive growth. Maximising sustainable growth opportunities from CCUS for the UK requires holistic thinking across these types of capital within a consistent, long-term policy, institutional and regulatory framework to improve coordination across stakeholders at the national and local levels on the entire portfolio of net-zero solutions.

Table 1. Summary of policy recommendations across five types of capital investment*

Infrastructure / physical	Knowledge / innovation	Human	Natural	Social
<ul style="list-style-type: none"> • Business models underpinned by long-term funding • Coordination across interrelated energy systems • Robust, net-zero-aligned carbon price • Role of the UK Infrastructure Bank • Wider infrastructure programme for net-zero-aligned regional growth 	<ul style="list-style-type: none"> • CCUS supply chains aligned with evidence on competitiveness • Early and enhanced coordination of stakeholders • Innovation support addressing regional disparities • Explicit link between domestic CCUS policy and climate leadership 	<ul style="list-style-type: none"> • Special emphasis on CCUS skills as part of proactive net-zero skills programme • Collaboration across departments • Place-based approach to understand skills availability and gaps 	<ul style="list-style-type: none"> • Agile regulation and legislation without compromise on environmental scrutiny • Holistic view of all energy systems, respecting local ecosystems and resource constraints 	<ul style="list-style-type: none"> • Awareness and information programme • Rebuilding pride and sense of community around a shared purpose for clean growth • Participatory decision-making processes at local level

*Types of capital investment defined by Stern et al. (2020)

This poster summarises a policy report (107 pages) published in September 2021, 'Seizing sustainable growth opportunities from carbon capture, usage and storage in the UK', available from www.lse.ac.uk/GranthamInstitute/publications.

Figure 1. Share of CCUS innovation out of total innovation in the UK, 2000–2015 (share of patents at NUTS2 regional level)

