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Policy Brief

Phase 1 CCUS cluster rollout - potential wider-economy impacts, responses and trade-offs

Introduction

In October 2021 the UK Government announced decisions on Phase 1 of the UK Cluster Sequencing for Carbon Capture, Usage and Storage (CCUS) Deployment, with supported activity initially focussed in the Hynet and East Coast industrial clusters in the north of England. This policy briefing revisits the findings of CEP's 2021 research on 'Moving Early on Carbon Capture and Storage', which used economy-wide scenario simulation analyses to understand the wider economy impacts of differing types of policy choices and economic conditions both for the delivery of industrial carbon capture and for introducing a new transport and storage sector to sequester captured emissions.[1] Here we focus on considering how the Phase 1 cluster sequencing decisions may impact the outcomes and insights of this earlier research. Our initial results suggest that the relatively substantial levels of investment spending required within the next 3 years to enable deployment of the Hynet and East Coast CCUS clusters by 2025 may ultimately enable 'green growth', but with disruptive near-term wider economy impacts in challenging labour supply conditions.

More generally, our research – which also includes our work on the 'Scotland's Net Zero Infrastructure (SNZI)' project - highlights a number of green growth opportunities and challenges. The opportunities lie in how supporting new CO_2 transport and storage (T&S) services in the economy may help transition existing oil and gas sector employment and supply chains. The challenges lie in how activity in a likely initially over-sized network will be funded and in terms of potential reductions in capital efficiency and competitiveness, both of which could introduce tensions with other policy priorities such as the regional levelling-up agenda. Here, our research also focusses on a number of important questions and implications for policymakers and industry around the timing and level of investment, the nature and impact of labour supply constraints, the scale of capital requirements, and the crucial role of efficiency gains in operating carbon capture in particular if CCUS is to contribute to continued competitiveness and sustained economic prosperity as well as emissions reduction in the UK's regional industry clusters. However, our research is ongoing and **one of the main aims of this briefing is to spark further engagement with policy makers, industry stakeholders and project developers to better inform the scenarios considered going forward, with initial focus on the announced Phase 1 projects.**

Key findings from our 2021 research and questions going forward

Context for considering the 2021 findings

The research reported in our 2021 report separately modelled and tracked year-by-year impacts on key macroeconomic and sectoral economic indicators from introducing (a) carbon capture within a sample industry (Chemicals manufacturing), (b) a new CO_2 transport and storage sector to service emissions across the four main UK clusters in the north of England and in Scotland. In the absence (at that time) of information on what the cluster sequence may be, we focussed on longer term (2040) outcomes under three broad 'who pays' (to guarantee demand for an initially over-sized sector) funding models - 1) Government pays with deficit 2) households pay 3) industry pays. We also had to estimate the total investment required and how this may be spread between 2021 and 2030.[2] Now that more information is emerging, we need to consult on resetting our assumptions on T&S investment, and which clusters it is targeted on, to better consider near and longer-term impacts, and to try to bring in fuller, and possibly ultimately integrated, consideration of linked carbon capture. Here, we provide an initial indicative set of results to inform this process.

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Central Finding #1

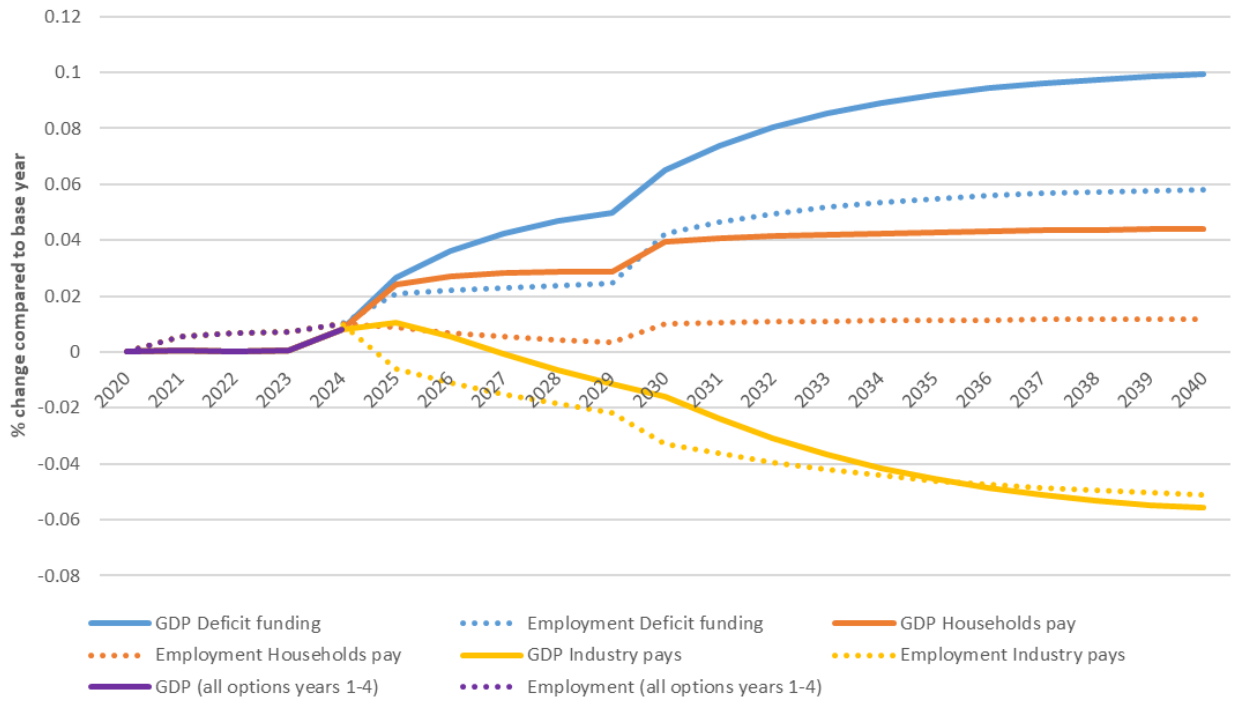
Deployment of CCS could lead to 'green growth' where it involves introduction of new CO_2 Transport and Storage (T&S) industry activity to the economy. However, net GDP, employment and public budget gains could be eroded or entirely offset, with distributional and 'just transition' challenges emerging, if taxpayers or industry must bear the costs of guaranteeing demand for new T&S services.

BROAD INSIGHT: Countries like the UK, Norway and the Netherlands, have significant offshore CO_2 storage capacity and linked onshore supply chain expertise, a legacy of oil and gas (O&G) industries that can be leveraged to provide new 'green growth' opportunities. The most obvious opportunity lies in new industry activity that supplies 'CO_2 transport and storage services' to domestic or overseas firms that need to capture CO_2. Repurposing existing supply chain capacity and providing continued or new job opportunities for workers currently employed in the O&G industry supply chains would also aid delivery of a 'just transition' for workers, households, and communities currently dependent on the O&G industry. Such more direct gross gains are sustained in all scenarios, but net impacts over time for the macro-economy and other sectors therein depend crucially on the 'who pays' funding model. Near term transitory impacts also depend crucially on the timing and level of upfront investment required to develop the required T&S capacity.

SPECIFIC FINDING AND ASSUMPTIONS: In the 2021 research we found that net positive impacts for UK GDP (up to 0.1% by 2040) and employment (up to a sustained gain of 17 thousand jobs) are possible in all time frames, but significantly limited when taxpayers bear the burden of guaranteeing demand for T&S output. See Figure 1, which also shows that when a pure 'industry pays' funding model is applied, the resulting competitiveness challenges for regional cluster firms triggers a sustained net contraction of the UK economy.

However, the magnitude and precise time path of adjustment of the economy in these results from our 2021 research depend on the central assumption of a T&S industry servicing all four North of England/Scottish clusters with a capital stock valued at £2.3billion, and that the required £2.8bilion upfront investment to create this capacity can be spread over 9 years to 2030.

Figure 1: Impacts (% change) over time on UK GDP, employment and productivity of introducing the CO2 T&S industry (Results from £2.3billion, 4 cluster case in CEP's 2021 report)



RESEARCH AND POLICY CHALLENGES ARISING: Our new scenario simulations focussing on the impacts of enabling the Phase 1 rollout involve studying the impacts of investment in these clusters alone. Our preliminary results (see Figure 2) indicate that the operation of the Phase 1 clusters could lead to UK GDP gains of up to 0.07% by 2040, along with over 11,600 jobs, if costs can be met without transferring the full burden to UK households or industry. Moreover, at this stage considering the announced Phase 1 clusters in isolation, we observe that sustained long-term outcomes earlier than in our previous research, where the overall investment considered was larger (including the Scottish cluster, which may still also deploy within the 2020s) and spread over a longer period of time for full deployment by 2030.

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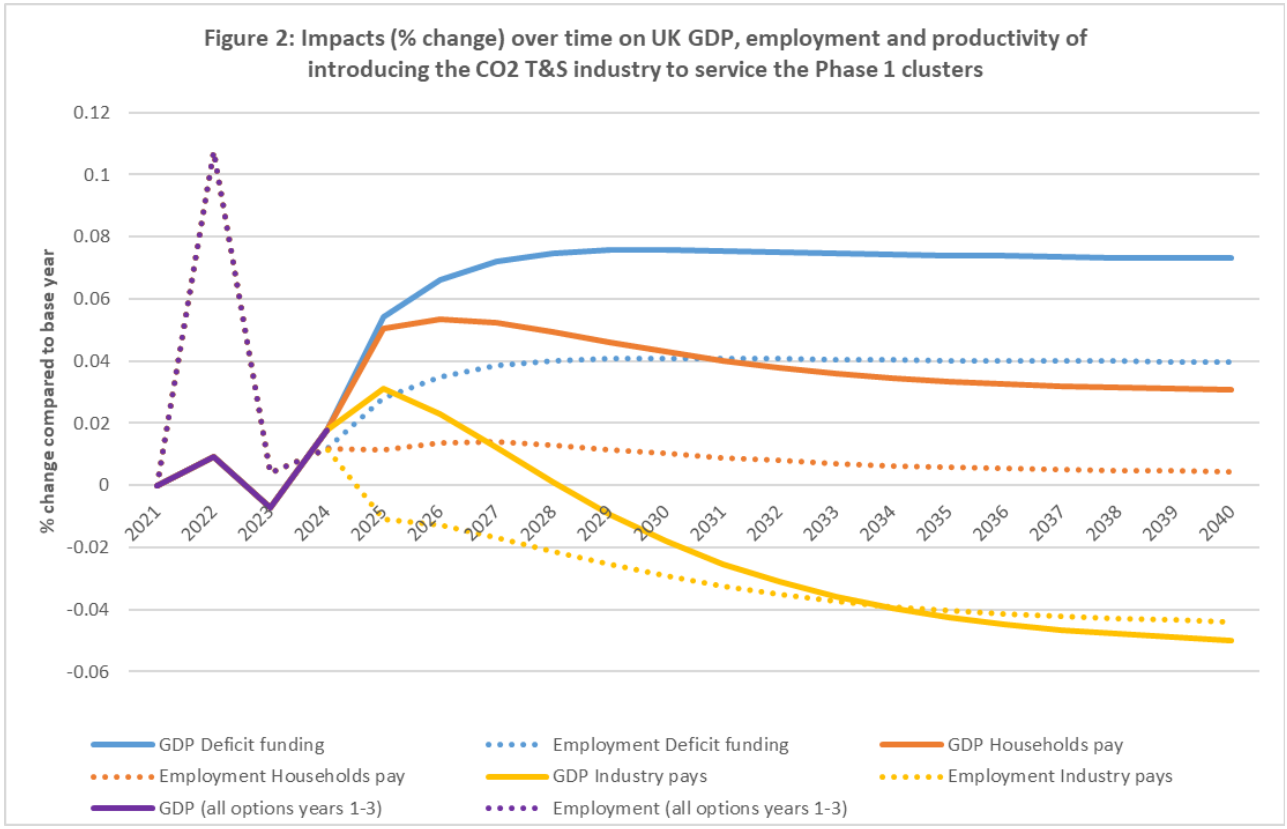


The smaller magnitude of the longer-term impacts in Figure 2 is linked to the focus on here on Phase 1 clusters only. However, the key qualitative difference between our two works lies in the results for the near term timeframe to 2025. In the 2021 research we considered how this (and estimated spending on the Scottish cluster) would be spread across 9 years. In practice, the Phase 1 plans imply spending being condensed within the three years between 2022 and 2024. In previous work[3] we have found that condensing the investment activity in a shorter timeframe can lead to disruptions across the wider economy, especially in the presence of economic constraints as is the case in the UK economy.

All of this highlights the importance of investigating the potential impacts of the Phase 1 plans, and thus introduces the need for some key information:

- We need to confirm our estimate that the initial up-front investment spending will be in the order of £2.2billion spread 29.4%/30.4%/36.2% over these 3 years to create £1.9billion in capital stock in the T&S sector. Moreover,
- Our initial Phase 1 scenario simulation results based on this assumption suggest that our earlier finding of potentially positive GDP and employment outcomes in all timeframes is heavily dependent not only on the level and timing of investment spending, but also on how wage rates faced by all sectors are impacted by the presence of UK labour supply constraints. It would be useful to set this in the context of actual intelligence on how labour market conditions may impact Phase 1 projects.
- This includes considering whether it may be necessary to extend the investment timeframes to resolve existing challenges, potentially, but not exclusively, linked to the availability of the necessary skilled labour force and wider supply chains. And linked to that, whether the agreements with the UK Government allow some extension to the proposed operational starting point.

Central Finding #2

Operational carbon capture can reduce the capital efficiency of industrial firms with implications for returns on capital at the current production location, where the need to pass on increased capital costs through output prices is likely to have implications for the relative competitiveness of UK cluster firms in international markets.

BROAD INSIGHT: Due to a lack of data and insight for the full range of industries that could potentially be involved in carbon capture activity in the UK regional clusters, our 2021 research focussed on the case of carbon capture in the UK chemicals industry. Industry discussions suggested that increased capital requirements could result in between 30% and 50% increases in the capital equipment required to produce a given level/unit of chemicals output, mapping to reductions in the capital efficiency of firms. However, the consequent negative implications for both capture firms and the wider economy could be offset by a combination of subsidies to avoid passing such costs through output prices and 'learning-by-doing'. Here these options could limit the overall capital efficiency implications of operating additional capture equipment, with potential to gain competitive advantage as international competitors follow in bearing carbon capture costs.

SPECIFIC FINDING AND ASSUMPTIONS: Assuming the lower (30%) figure at the UK-wide level, we found that for the chemical industry, as the sole adopter of carbon capture, competitiveness loss results in sustained contractions in GDP and employment (see Figure 3), and in the public budget (ultimately resulting in a £0.59billion per annum deficit), along with direct industry output and employment losses. Consequent negative impacts are also likely to be concentrated in the regional economies where cluster firms are located.

However, we also found that the magnitude of impacts of firms applying carbon capture depend on just how sensitive international trading conditions are to price changes associated with adopting carbon capture (with no other change in decarbonisation costs incurred). We did run sensitivity analysis considering more or less sensitive trade responses but note that sources such as European Commission[4] work regarding risks of carbon and/or investment leakage suggest that process industries such as many chemicals manufacturing activities (often serving highly complex and competitive global supply chains) may be highly exposed to challenging market conditions.

On the other hand, we found if UK firms can be supported in reducing the efficiency impacts of adopting carbon capture, effectively enabling a first mover advantage, there may be potential to deliver positive outcomes for industry and limit wider economy losses over time as the trade situation improves (see Figures 3a and 3b for total UK GDP, total UK and industry employment outcomes under 'sole adopter' and 'first mover advantage' scenarios in our 2021 report).

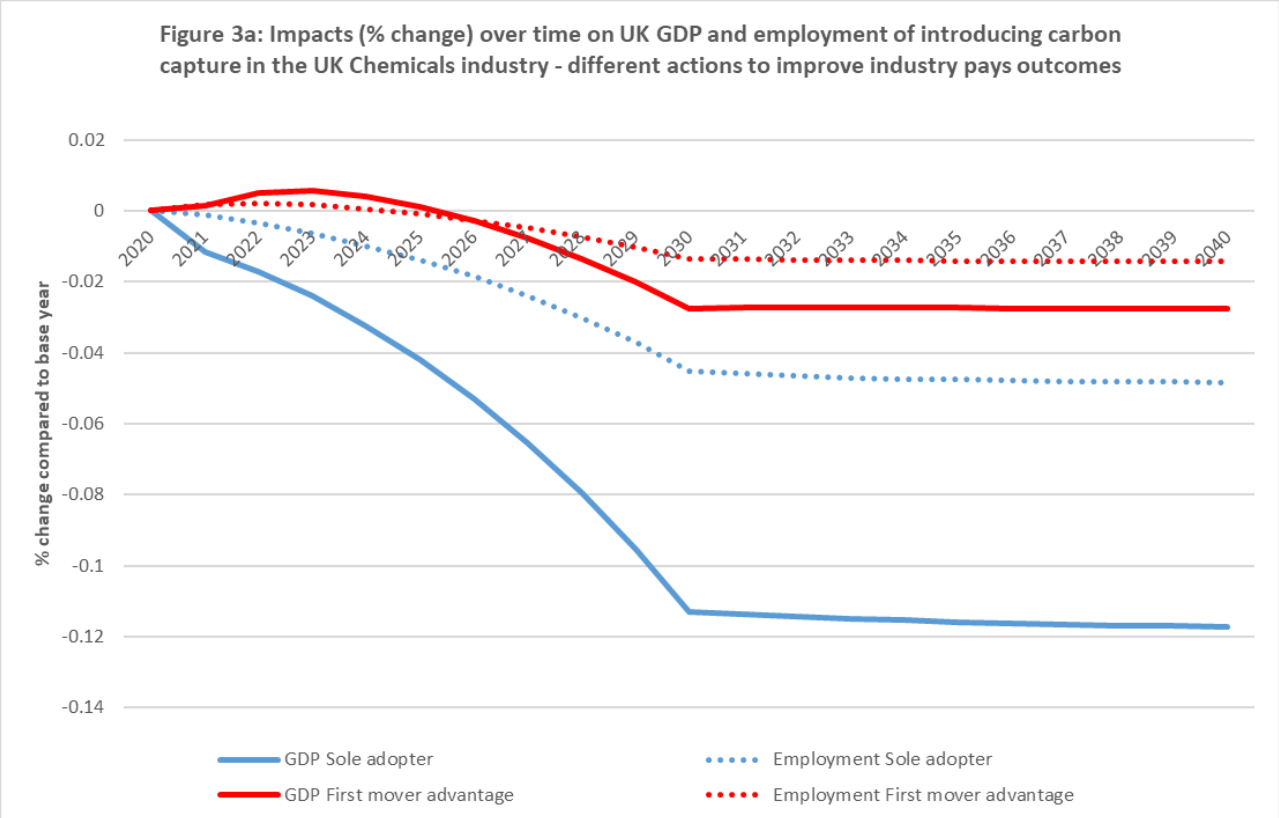
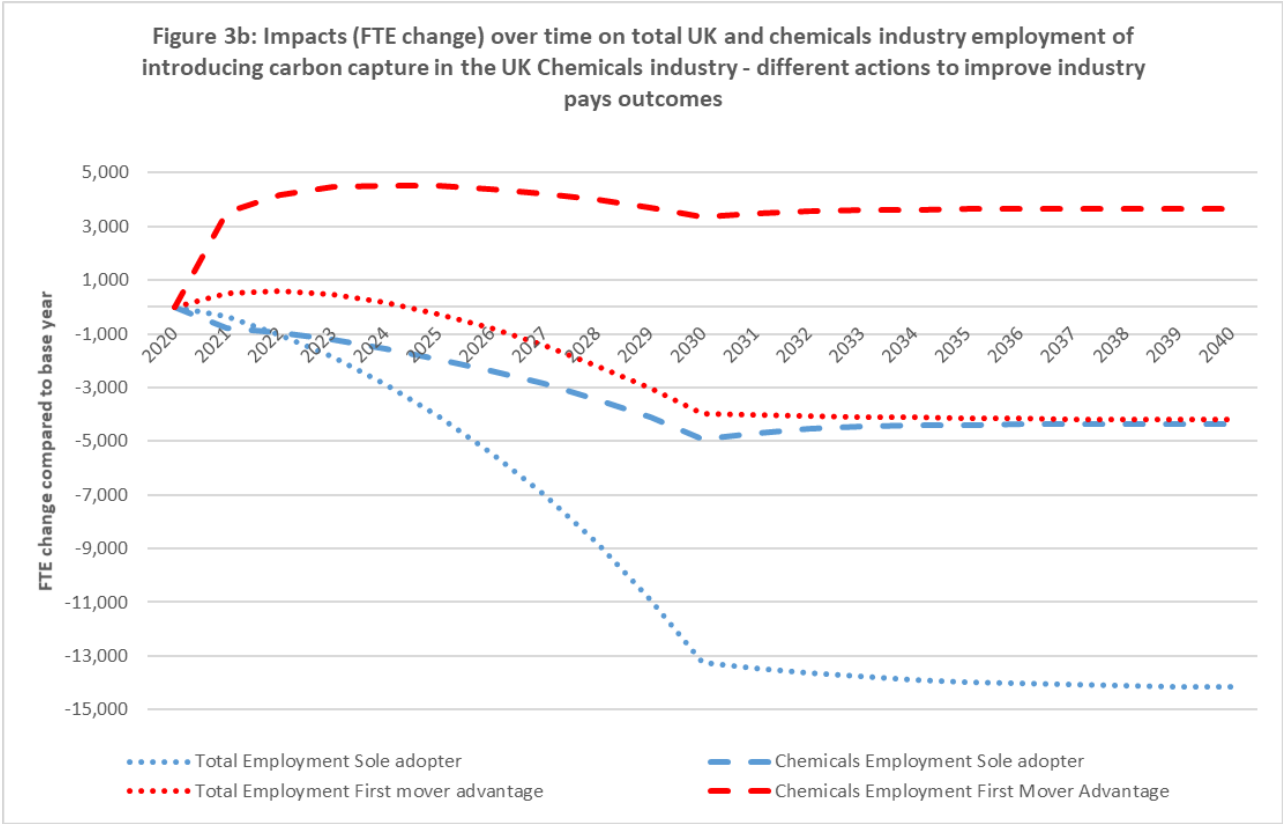


Figure 3b: Impacts (FTE change) over time on total UK and chemicals industry employment of introducing carbon capture in the UK Chemicals industry - different actions to improve industry pays outcomes



RESEARCH AND POLICY CHALLENGES ARISING: The initial focus of our new scenario simulations is the impacts of the T&S investment and operation of the new sector. However, where information is forthcoming on what the additional capital requirements may be for firms in those potential capture industries located at the Phase 1 clusters, it may be possible to run carbon capture scenario simulations alongside and potentially integrating a first consideration of full chain CCS.

Moreover, if intelligence and/or informed estimates regarding the potential efficiency gains in using carbon capture equipment over time can be acquired, it would be possible to consider a wider set of scenario simulations around potential 'early mover' advantages as a return to time-limited public support of capture activity. This would be particularly important to better understand the opportunities and challenges around securing comparative advantage that may act to mitigate potential sustained losses.

CONCLUSION

Understanding the nearer as well as the longer-term economy-wide and societal impacts of CCS deployment will be critical to decarbonising the UK economy and ultimately meeting mid-century net zero emission targets. Our research on the cluster sequencing process more broadly, and ongoing work specifically focused on the Phase 1 rollout, raises the following key questions and implications for policymakers and industry to consider:

- **Level and timing of investment:** What level of upfront investment will be committed and how will it be spread over the timeframe between now and 2025 to create the necessary capital stock in the T&S sector? What level and timing of investment to support Phase 2 of the CCUS cluster sequencing will interact in these and subsequent timeframes?
- **The impact of UK labour supply constraints:** Emerging research findings suggest that potentially positive GDP and employment outcomes in all timeframes is heavily dependent on the level and timing of investment spending and on labour market conditions, both in terms of current and lasting labour supply constraints, and wage responses. How are current labour market conditions likely to impact both in terms of short-term or transitory disruptions to the economy and in delivery of the CCUS projects themselves. Is there any consideration of how these challenges could these be mitigated by extension of investment timeframes, and how would this trade-off against any impact on required timescales for enabled emissions reductions?
- **Capital requirements:** What will the additional capital requirements be for firms potentially involved in the uptake and operation of linked carbon capture in the Phase 1 clusters. Specifically, what might the impacts be on capital efficiency and returns in different kinds of industry, and what may be the consequences in terms of the international competitiveness of these businesses?
- **Efficiency gains over time:** Could time-limited public support enable capture firms to develop potential efficiency gains in using carbon capture equipment over time, and could this translate to potential 'early mover' competitive advantages for the UK in industry decarbonisation through CCUS?

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Endnotes

1 See various papers by Turner, Calvillo and colleagues listed in our references for more details on the underlying research.
2 See the Calvillo et al. paper in the references list.
3 See the Alabi et al. paper in the references list.
4 See European Commission (2018).

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