Clean Air – Clean Industry – Clean Growth

How carbon capture will boost the UK economy

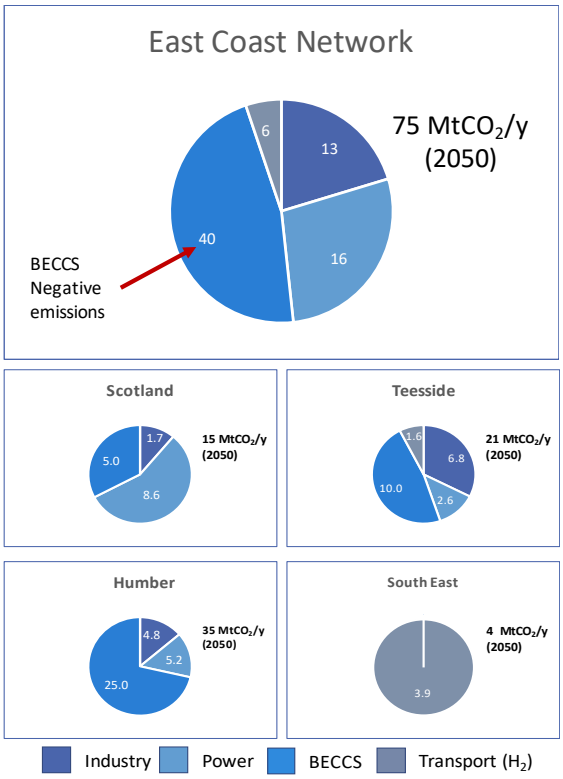
The development of Carbon Capture and Storage (CCS) infrastructure provides a carbon clean up solution for a large range of sectors: Industry, Power, Transport and Heating, with negative CO_2 emissions achievable through Bioenergy with CCS (BECCS). This report provides the first[1,2] quantified societal cost benefit analysis based on a viable evolution of a UK network of CCS investments that could result in a 5:1 payback to the UK economy. The pace of such investment has been aligned in this study to the potential for CCS to contribute to emissions reductions through to 2050 as identified by the Committee on Climate Change (CCC) Central Scenario[3].

Dedicated CO_2 infrastructure would link clusters of major industry and power generation in Scotland, Teesside, the Humber region, and the South East, to CO_2 transport and offshore storage (T&S) infrastructure in the UK Continental Shelf (UKCS).

Investment would be committed in the early 2020's based on current projects; including the Caledonia Clean Energy Project, the St Fergus Acorn project and the Teesside Collective Projects, with CCS infrastructure that can grow to a potential capacity of 75 $MtCO_2/y$ by 2050. This represents around 20% of the UK's carbon reduction targets from now until 2050.

The investments can proceed in discrete phases of around 5 years with each phase building on and using the infrastructure established in previous phases.

Recognising that neither technology nor policy stand still, each phase of investments would be optimised before proceeding.



East Coast CCS Capacity allocation

This approach negates the need for the UK and Scottish governments to commit to a whole series of investments upfront whilst creating options for the future as the UK's decarbonisation strategy evolves.

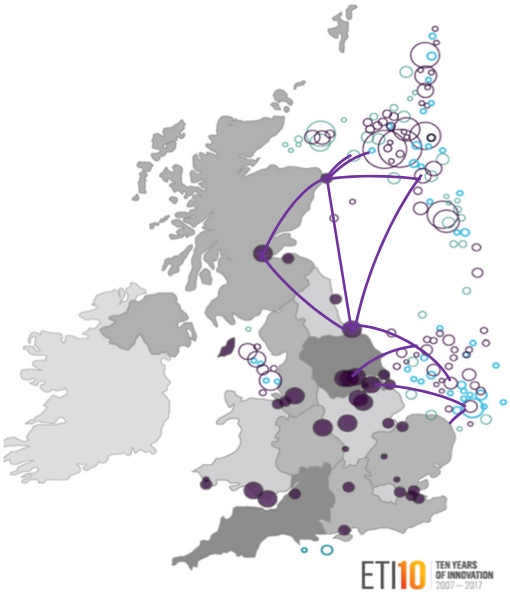
[1] https://publications.parliament.uk/pa/cm201617/cmselect/cmpubacc/1036/103605.htm#_idTextAnchor006

[2] https://www.nao.org.uk/wp-content/uploads/2017/01/Carbon-Capture-and-Storage-the-second-competition-for-government-support.pdf

[3] https://www.theccc.org.uk/publication/fifth-carbon-budget-dataset/

Over 70% of the benefit of CCS is associated with industry and negative emissions

CCS infrastructure provides the key solution for Industry, Power, Transport and Heating (Hydrogen) and BECCS. CCS applied to fossil fuel power generation, for so long the focus of CCS commercialisation, contributes 22% of the envisaged emissions reductions in the scenarios developed. 71% of the capacity and benefit is associated with industrial and negative emissions applications for which CCS remains the lowest cost commercial solution. Importantly, with the remaining 7% of CO_2 emissions coming from a range of other sources.



East Coast CCS Network

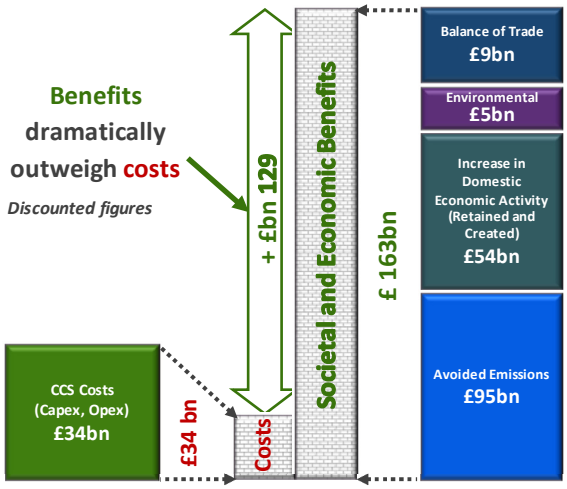
The benefits versus costs that such a network of CCS investments would generate for the UK were evaluated for several T&S infrastructure concepts. The base concept takes advantage of the re-use of existing on and off-shore gas pipelines, providing a T&S cost of less than £10/$tCO_{2(av)}$ over the lifetime of the investments.

Two alternative strategies were looked at; (i) a 10-year delay with deployment commencing only in the 2030's and (ii) a strategy of not deploying CCS in the UKCS but exporting UK CO_2 to other countries, such as Norway.

CCS Infrastructure can generate £163bn in benefits and 225,000 jobs at a cost of £34bn

The societal cost-benefit analysis considers the direct investments in CCS as well as their impact on the CCS-linked economies including power generation, energy intensive industrial sites (chemicals & pharmaceuticals, petrochemicals, iron & steel, cement and fertilisers), hydrogen production plants, fuel refineries and gas processing plants. The potential for reduced activity in the industrial sectors, due to rising carbon costs, is also taken into account.

Further, the related impact on the supply chain and the export potential related to the development of a CCS industry in the UK has also been included in the analysis, along with the potential for income from providing CO_2 storage to other countries (such as Germany) and the positive impact that re-use of North Sea assets could have on the associated decommissioning costs.



How the lifecycle value of CCS stacks-up

In economic terms the estimated cumulative benefit of the modelled CCS Investments to the UK economy outweigh the costs by an estimated £129bn, assuming operation of the network and CCS investments through to 2060.

Extending the asset lifetime will add to the benefits as carbon prices escalate.

The benefits include:

- avoided emissions costs
- increased domestic economic activity (GVA)
- environmental benefits (health & wellbeing)
- impact in the UK balance of trade (BoT)

which in total amount to £163bn. This is compared against costs of £34bn, a ratio of almost 5:1. In the same period, around 225,000 jobs could be created or retained and around 1.5 Gt of CO_2 captured and stored.

Providing CO_2 storage services to other countries should be very attractive for the UK

A strategy of shipping UK CO_2 to another country was modelled, with a marked potential negative impact of £97bn on the UK Balance of Trade (BoT). This is based on future traded CO_2 prices in line with HMT Green Book supplementary guidance. This strategy would increase the total emissions reduction cost to the UK from £24 /$tCO_{2(av)}$ to £88 /$tCO_{2(av)}$.

On the contrary, every 5$MtCO_2$/y of additional CO_2 imported from another country and stored in the UKCS on a commercial basis, has an estimated cumulative positive impact on UK BoT of £8bn. This represents an attractive proposition for the UK to extract decades of further value from the UKCS.

Delaying deployment of CCS to the 2030's is a false economy

Delaying the deployment of CCS by 10 years is inconsistent with meeting UK carbon reduction targets, leaving a gap of 700 MtCO2 by 2050 in relation to the CCC central scenario. In addition, with no plan for large scale decarbonisation, industry closures are more likely to be planned and to occur. Delaying CCS deployment leads to 75,000 fewer jobs and reduces the cumulative GVA potential by £21bn and the health and wellbeing benefit by £2.7bn, even using conservative assumptions.

A standalone analysis considered the discrete implementation of only the early phases of the network between 2020 and 2025 assuming there were no further CCS developments. The resulting benefits still outweigh the costs by a factor of 2:1. This means that the first CCS investments can be delivered on a no regrets basis whilst also providing valuable options for the future. On this basis, a delay in deployment until the 2030's will only serve to limit future options and increase the challenge of meeting carbon reduction targets.

A new approach to Cost Benefit Analysis is required for CCS infrastructure and linked economic activity

CCS has to date been seen through the prism of electricity prices and the relative cost versus other low-carbon generation technologies that have benefitted from many years of subsidy. CCS costs will reduce with learning through deployment as well as efficient use of infrastructure at scale. The benefits of CCS are wide ranging, impacting broadly across different aspects of society and through linked economic activities. By comparing the overall economic, societal and environmental benefits, the value of CCS can be understood and quantified.

It is therefore recommended that transparent and quantified cost benefit analyses be undertaken when comparing alternative approaches to achieving emission reductions, Clean Growth and Industrial Strategies. Such analysis should provide the foundations of evidence based decision making that can, in turn, help to encourage future investment in the UK.

A Compelling Economic Case

CCS has the potential to form an important pillar of the UK's strategy to meet its greenhouse gas emissions reduction targets whilst delivering considerable economic, societal and environmental benefits. For CCS to deliver its full potential to the UK economy however, it is essential that commercial solutions are developed, involving the public and private sectors, that enable investment decisions to be taken. With a suitable approach to the development of T&S infrastructure, a T&S cost of less than £10/t$CO_{2(av)}$ can be achieved, representing an affordable proposition for the decarbonisation of industrial and other applications, especially when compared to the projected cost of CO_2 emissions.

Deployment of CCS in the UK can commence immediately to make use of the UK's huge potential for CO_2 storage in the UKCS, with the first projects able to come onstream in the mid 2020's. It is therefore important that there is consistent progress on critical enabling actions pre-2020. Sufficient funding should be made available to support the first critical phases of investment pre-2020 for the East Coast network, starting with the existing initiatives; the Caledonian Clean Energy Project at Grangemouth, the St Fergus Acorn project and the Teesside Collective Projects.

Finally, a commitment is required to create a dedicated national CCS Delivery Body with the explicit task of working with the private sector to deliver the required CO_2 T&S infrastructure. This will deliver great economic benefit, enabling a globally competitive UK CCS Industry and skills base.

A full copy of the study can be downloaded from 5th October 2017 at:

http://www.ccsassociation.org/news-and-events/reports-and-publications/clean-air-clean-industry-clean-growth/

This study has been led by Summit Power Caledonian UK Ltd (SPC) with funding from the UK and Scottish Government.

This study was prepared by SPC with support from Industria Mundum AG, Pale Blue Dot and the University of Strathclyde. During its preparation consultations were also held with the Tees Valley Combined Authority, the CCS Association and Scottish CCS.

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