

Teesside Collective case study: Creating one of Europe's first clean industrial zones

Carbon capture and storage (CCS) is an important technology for the future of UK industry, as there are limited viable alternatives for industry to decarbonise.

With one of the highest concentrations of industry in the country, and located close to North Sea carbon storage sites, a Carbon Capture and Storage (CCS) network in Teesside has the potential to be as significant as offshore wind and new nuclear power in accelerating the UK's journey towards a competitive, low carbon economy.

The UK needs projects like Teesside Collective to generate new options to meet its carbon targets cost-effectively and industry needs the project to provide a solution for their carbon emissions while making these UK sites an attractive investment option.

CCS is no longer primarily a technical challenge; it is now a commercial challenge. Implementing a CCS network in Tees Valley – which Teesside Collective's work has shown is technically viable – would represent the UK's first commercial scale CCS project, and establish Tees Valley as a pioneer of industrial development. The project is now ready for the UK Government to work with the development team to bring to reality phase 1 of Teesside Collective to place Teesside at the forefront of a new, clean industrial future for the UK.

Author: Sarah Tennison, Technology and Innovation Manager, Tees Valley Combined Authority

Project name: Teesside Collective

Status: Pre-FEED

Start date: November 2014

Estimated to come online: mid-2020s

Website: www.teessidecollective.co.uk

What is Teesside Collective?

Teesside Collective is a ready-made, cost-effective opportunity for Britain to start removing carbon dioxide emissions from its vital process and chemical industries. A cluster of leading energy-intensive companies working together to build one of Europe's first CCS equipped industrial zones, Teesside Collective has the potential to help to retain the UK's industrial base, attract new investment and jobs, and meet the UK's climate change targets.

The group is made up of five large industrial companies in the region:

- BOC – UK's largest hydrogen plant
- CF Fertilisers – UK's largest ammonia plant producing fertiliser
- Lotte Chemical UK – produces PET for 15bn recyclable plastic bottles every year
- Sembcorp – provide industrial utilities for the UK's largest integrated industrial site and is current in planning for large scale CCGT
- SABIC – the UK's largest cracker which is upgrading to run on US shale gas

info@teessidecollective.co.uk



Teesside Collective is coordinated by Tees Valley Combined Authority and backed by the North East of England Process Industry Cluster. More industrial companies in the region are in the pipeline to join the project should the UK Government provide confidence around a long-term policy framework for CCS.

Many industrial plants produce CO₂ through their process, which is separate to emissions from sources of energy. CO₂ is produced from the chemical reactions needed to make the product, and the quantity is therefore unaffected by energy efficiency measures. In these situations, taking carbon dioxide from the flue gas before it is released into the atmosphere is the only option to decarbonise, as there are no viable alternative chemical reactions for these production processes.

Leading deployment of CCS with industrial clusters

Industry is facing growing pressure to reduce carbon emissions. Of opportunities to decarbonise industry, CCS is the only technology available to significantly reduce industrial carbon emissions, with no change needed to the production plant. CCS is technologically proven at a commercial scale on industrial plants and there are 22 CCS plants operating across the world, including industrial sites in the US, Canada and United Arab Emirates.

Why Teesside for CCS?

Home to nearly 60% of the UK's energy-intensive industry, Teesside in Tees Valley is the ideal location to develop the first CCS network in the UK. Being the most integrated industrial cluster in the UK creates economies of scale that will minimise the cost of CCS. In two instances in Tees Valley, chemical plants produce pure CO₂ as a by-product, some of this is already captured and transported for use in industries such as food and drink. The area is located on the coastline, with close proximity to storage sites in the North Sea. Supportive infrastructure and skills are already in place in Teesside, and Government-funded work has proved Teesside Collective is technically viable and cost effective. Last but not least, local industry is already on board.

Tees Valley's chemical industry – environmental drivers:

- Tees Valley produces 13.5 million tonnes of CO₂ – over 11 million tonnes from industrial sources (pre-SSI closure figures)
- Carbon emissions per person are 3x national average
- Industrial emissions of CO₂ have fallen by less than 19% over the past ten years

Tees Valley's chemical industry – economic drivers:

- High GVA – £2.5bn GVA per year
- High productivity – £116,000 GVA per head – over twice national average and 16% more productive than chemical industry elsewhere in UK
- High wages - £38,900 average – 30% higher than UK average
- £3.8bn exports
- Consistent trade surplus – £2bn surplus in 2016
- £3bn capital investment over the past five years

All industrial clusters across Europe face the same challenges, and all are assessing the possibilities of CCS within the context of other decarbonisation opportunities.



What has Teesside Collective done so far?

To date, Teesside Collective has developed:

- [Engineering costs](#) for three industrial plants as a starting point including transport and storage of the CO₂
- A [business case](#) for an initial CCS hub in Teesside
- A proposed [funding mechanism](#) for Industrial CCS across the UK
- An [economic impact assessment](#) of Industrial CCS in Teesside - it would create 1,200 jobs during the construction phase and help create and retain 5,900 jobs whilst in operation

It is envisaged that the Teesside Collective can act as the template for similar networks in other regions of the UK. There are also good expansion options within the region, as it is an ideal location for power plants and hydrogen production technologies. For example, Tees Valley already produces half of the UK's hydrogen, which can be used for heating and transport fuel; planning permission is in process for an 850MW gas-fired power plant in Teesside; and carbon can be captured from industry and sold to companies to use in commercial products.

The challenge – commercialising CCS in the UK

CCS is technologically proven at a commercial scale on industrial plants around the world – its main challenge is financing.

Government support for CCS

Government needs decarbonisation from the UK's industrial base. In order to enable CCS to progress to a commercial scale, consideration needs to be given to the provision of appropriate financial support from Government. There is an established precedent for Government to support the technological progression and cost reduction of low carbon technologies through deployment, as the example of the UK offshore wind industry shows. There are many hurdles that would prevent industries in the region from financing industrial CCS entirely on their own at this stage. Commodity industries are lean companies with low margins; there is no financial driver for private investment in CCS and more significantly, there is an economic risk of increasing their UK cost base.

North Sea store for 50+ years of carbon

Transport and storage operation and liabilities are also outside the industrial remit, and Government's support is needed to ensure access to a suitable store is secured in the North Sea. The Energy Technologies Institute (ETI), a public-private partnership between government and major industry, completed an assessment of UK offshore CO₂ storage and concluded that there was enough CO₂ storage for over 50 years even from the limited stores that have been appraised.

Importance of CCS in hitting 2050 carbon target

Creating additional pressure is the timing of CCS – the UK needs to start deployment now to realise the full benefits of Industrial CCS. The Committee on Climate Change (CCC) believes Industrial CCS will be needed from the mid-2020s onward if the UK is to stay on track for its 2050 emission reduction goals, a message which was reiterated in its June 2017 report to Parliament on meeting carbon budgets. For this to be achieved, the CCC recommended that contracts be awarded by 2020. Further to this domestic pressure, there are international considerations, including the possibility that the UK will lose inward investment to other EU countries. Norway



is pushing ahead with CCS Front End Engineering and Design (FEED) studies on three industrial plants and its government is taking the CO₂ leakage liabilities. Rotterdam and Antwerp are also moving forward with CCS projects.

Teesside Collective's solution: demonstrate CCS cost effectiveness

To demonstrate that CCS can be a cost-effective low carbon technology that merits active Government support, Teesside Collective has taken action to demonstrate the cost-effectiveness of CCS.

Financial model for industrial CCS

Teesside Collective worked with Pöyry Management Consulting in 2016 to develop a finance model for Industrial CCS, intended to kick-start investment in shared infrastructure. Pöyry has deep commercial experience in CCS as well as regulation and policymaking, and as part of the UK CCS Cost Reduction Task Force has promoted the aim of reducing the cost of the technology and help the UK meet its climate targets.

The finance model is not a direct follow on from Lord Oxburgh's benchmark report on CCS; however, it does assume a separate state-backed transport and storage company which takes CO₂ liability.

This work found that the total cost of Industrial CCS in Teesside is £58/tCO₂ in total, including access to a transportation and storage network.

How can the Teesside project kick-start Industrial CCS in the UK?

- Teesside proposes to start CCS in the UK cost-effectively, with the first phase capturing and storing 11m tCO₂ over 15 years. Once the network is proven, this would expand to capture and store 10m tCO₂ per year as power stations and more industrial companies join the network.
- The first phase would cost £110m to construct and £29m per year to operate, including a transport and storage fee
- The pilot could repay up to £31 million per year to the Government in carbon saving income
- Allow even further cost reduction during FEED stage by choosing one of the two well-characterised UK competition stores, using best available technology and maximising sharing infrastructure
- The pilot could be capturing and storing CO₂ in six years

What does the Teesside project require from the Government?

- Allocate £15m in FEED funding for the pilot
- Support investment in a suitable store for Teesside

The benefits of Industrial CCS: decarbonisation and stimulating investment

If we can begin implementing Industrial CCS within the next couple of years, the benefits of this infrastructure to the UK would be enormous. All the modelled scenarios to achieve the UK's legally binding carbon targets require this technology. CCS has the unique ability to reduce carbon emissions by 90% at selected plants.

In addition to allowing the UK to meet its carbon targets at lowest cost, Industrial CCS would be a strategic asset for UK – stimulating inward investment in low carbon products, electricity, fuels and heat. Being able to offer clean industrial zones to manufacturers and investors, and low carbon products to their consumers, the UK would be seen as a leader in driving clean growth.

- *“CCS on industrial plants is going to be a critical part of the global effort to prevent serious climate change. Teesside is in the right place, at the right time, to get ahead of the curve.”* – Sir David King,

info@teessidecollective.co.uk



UK's Special Representative for Climate Change

- *"CCS in industry represents some of the cheapest available carbon abatement in the UK economy...CCS hubs [are] a national infrastructure priority."* – Lord Oxburgh's report on CCS
- *"The sustainability of the PET we buy is of paramount importance to us. Suppliers who account for their emissions in a credible way will present a fundamentally more attractive proposition in relation to their rivals."* – Alison Rothnie, Britvic Plc

Further information

- Parliamentary Advisory Group on Carbon Capture and Storage (CCS): Lowest Cost Decarbonisation for the UK: The Critical Role of CCS - <http://www.ccsassociation.org/news-and-events/reports-and-publications/parliamentary-advisory-group-on-ccs-report/>
- Tees Valley Combined Authority: Low carbon technologies in Tees Valley - <https://teesvalley-ca.gov.uk/business/key-sectors/renewable-energy/>
- Teesside Collective: What does Teesside, 2030 look like with the Teesside Collective industrial CCS project in place? - <http://www.teessidecollective.co.uk/project/teesside-in-2030/>



Tees Valley Integrated Complex

