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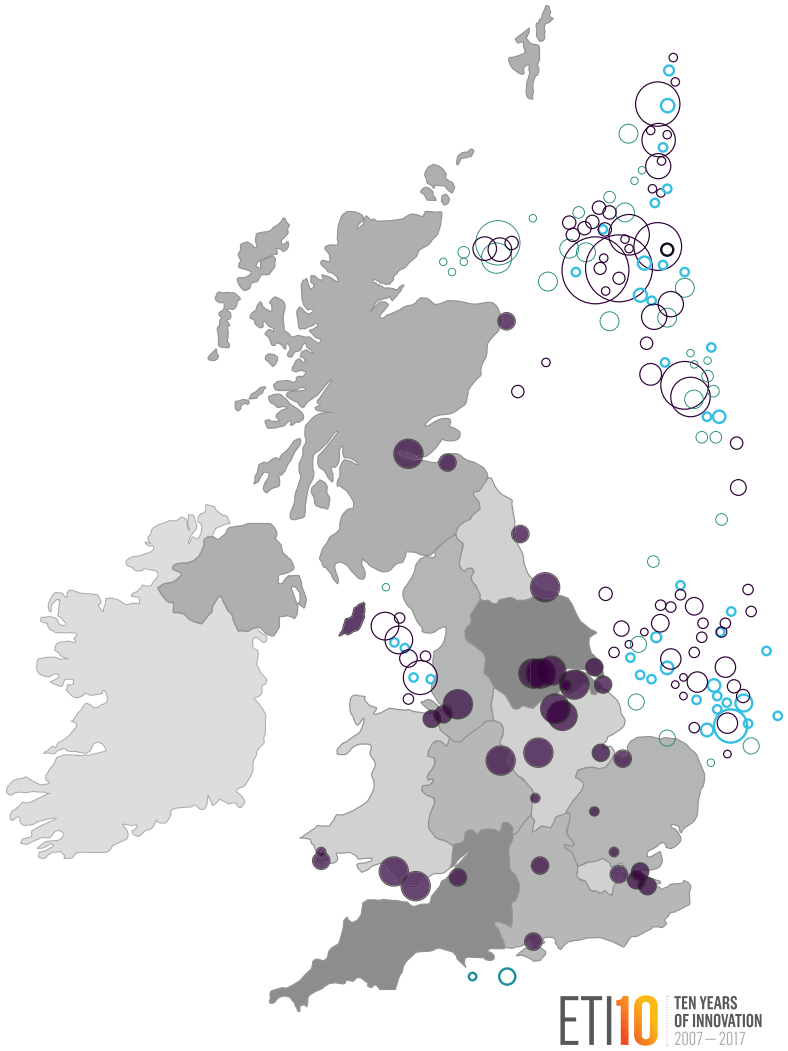
An ETI Perspective

Storage, storage, storage – key observations from our Strategic UK CO_2 Storage Appraisal project



THE CHALLENGE

To meet the UK's legally binding climate change targets and to meet the Paris Agreement objective to limit the increase in global temperatures to "well below" 2 degrees above pre-industrial times, the introduction of carbon capture and storage (CCS) becomes critical.

WHY?

CCS is one of the few technologies that can support the decarbonisation of heat, heavy industry and power generation. It is also the only technology that can enable the continued use of almost 80% of the world's proven fossil fuel reserves in a manner compliant with the 2 degree limit.

So if we can capture carbon, how well placed is the UK to store it?

The ETI has spent the last decade painting a detailed storage picture for the UK – identifying what there is, where it is and how much capacity is available. This is available for public consumption through the website www.CO2Stored.co.uk.

In 2015 we commissioned Pale Blue Dot Energy, Axis Well Technology and Costain to identify a select inventory of 20 CO_2 storage sites with detailed analysis of five sites to assess their potential contribution to mobilising commercial scale CCS projects in the UK. The project was supported by £2.5m in funding from the Department for Business, Energy and Industrial Strategy (BEIS) formerly the Department of Energy and Climate Change (DECC).

The project has verified the potential of almost 1000 million tonnes of storage in UK waters. When added to the work carried out on the three stores, which were developed as part of previous UK CCS projects, this provides the UK with a range of storage options with sufficient capacity for the next 30 years at least. It is hoped that this demonstrated level of capacity will help to provide confidence to investors in UK projects that the capacity exists to meet their needs.

By carrying out storage appraisal work early to provide assurance of the quality and security of stores this should greatly reduce the complexity and financial risk for associated onshore investment in CO_2 capture and transport systems, by clearly demonstrating the storage element of the value chain. The results of the project have been published by Pale Blue Dot Energy and are available on the ETI website www.eti.co.uk. Alongside CO2Stored and key knowledge documents published following previous CCS competitions, this means that the UK now has in the public domain one of the most comprehensive and mature propositions for CO_2 storage.

CO_2 Stored

THE PROJECT

At its simplest, successful CO_2 storage is characterised by three main components:

1. Capacity – connection to underground pore space of storage reservoirs within which to hold the CO_2

2. Injectivity – the ease with which CO_2 can be pushed into the storage reservoir adjacent to injection wells. The process depends upon permeability, thickness and the ability to dissipate pressure

3. Containment – an impermeable cap rock which assures that the injected CO_2 will be contained safely for the long-term within the storage reservoir and other trapping mechanisms which work together to retain the injected CO_2

Moving forward the deployment of CCS in the UK requires the rapid assembly of plans for offshore CO_2 storage sites around the UK Continental Shelf (UKCS). The identification of the capacity of such stores will help to support investor confidence around the deployment of large energy and industrial CCS systems by assuring the presence, location and cost base of high quality storage site development options.

This project identified a select inventory of 20 specific CO_2 sites. This represents only a small part of a very large strategic national CO_2 storage resource, which is estimated to be around 78,000 million tonnes. Five of these 20 sites alongside the sites known as Hewett, Goldeneye and Endurance studied in previous front end engineering design studies now presents a mature and well qualified UK storage proposition in excess of 1,500 million tonnes, which could be operational by 2030. This would be enough to service a significant roll out of commercial projects, including up to 10GW of power generation and see major industrial sources fitted with CCS. In total this would meet UK needs for the next 50 years, yet represents only 2% of the UK's natural storage resource potential.

The project has significantly de-risked five substantial stores – two depleted gas fields, two open aquifer systems and an aquifer with a structural closure - all of which are well-placed in relation to the UK's major emission sources. This means that any prospective capture projects that are to be developed now have access to detailed knowledge on a range of storage options for the next 30 years at least.

The five sites studied in detail provide much needed confidence regarding the ability to inject CO_2 at commercially significant rates, the capacity to store CO_2 in commercially significant volumes and the capability to retain the injected CO_2 within the defined storage reservoir on a permanent basis. It also shows that a UK storage proposition could be available for injection from the early 2020's with three of the five considered sites not requiring any further appraisal drilling.

SO WHAT CONCLUSIONS CAN WE DRAW?

The UKCS is endowed with a rich and diverse offshore CO_2 storage resource. The key components can be brought into service readiness without further extensive appraisal programmes having to be undertaken because of decades of petroleum exploitation and development activity.

Most of the offshore oil and gas infrastructure available in the UKCS is likely to be unsuitable for use for CO_2 storage infrastructure. But there are important exceptions which can serve to reduce capital expenditure requirements. The re-use of infrastructure should really focus upon pipelines which retain high pressures ratings.

Individual storage site types – saline aquifers and depleted oil & gas fields - present operational development opportunities but have their own specific challenges and characteristics. The Southern North Sea in particular contains a large portfolio of gas fields which have the ability to contribute significantly. Saline aquifers in Bunter "domes" also in the Southern North Sea represent an important strategic national resource given their proximity to major UK emission sources. All of the evidence gathered in this project show there to be substantial secure capacity in the domes with high injection rates.

Many saline aquifers within the UKCS can be considered as "brown field". This means they have been drilled during the search for oil and gas and therefore could be brought into service relatively quickly because of the data that has been acquired during years of oil and gas exploration.

Further key cost reduction opportunities lie in the use of shared infrastructure. Previous ETI analysis has shown that in our view no more than six shoreline hubs and 20 offshore stores are needed to deploy CCS effectively in the UK. But whilst installing oversized transportation systems can be helpful, this is only as long as the additional capacity does not remain unused for an extended period of time.

SUMMARY

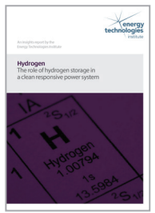
In summary, the project and its results (all publically available) have confirmed that there are no major technical barriers to overcome to move industrial scale CO_2 storage forward in the UK. The UK is endowed with well-characterised offshore geology that presents a strong national CO_2 storage proposition. Given the sheer size of storage potential the UK could also service the needs of many parts of Europe in addition to its own. Careful site selection will allow storage developments to proceed quickly and in a cost effective manner with a limited impact upon electricity costs.

It is our hope that the data generated in this project will provide confidence to investors and policy makers to push forward with the early mobilisation and delivery of CCS and offshore CO_2 storage in the UK, because we believe CCS remains a critical lever in delivering on UK climate targets cost-effectively.

FURTHER READING

Reducing the cost of CCS - developments in capture plant technology

http://www.eti.co.uk/insights/reducing-the-cost-of-ccs-developments-in-capture-plant-technology



The role of hydrogen storage in a clean responsive power system

http://www.eti.co.uk/insights/carbon-capture-and-storage-the-role-of-hydrogen-storage-in-a-clean-responsive-power-system

Building UK carbon capture and storage by 2030

http://www.eti.co.uk/insights/carbon-capture-and-storage-building-the-uk-carbon-capture-and-storage-sector-by-2030

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