CCS INFRASTRUCTURE FOR EUROPE

Carbon Capture and Storage (CCS) could be a critical step towards climate change mitigation. The Crown Estate is collaborating with partners and businesses to both de-risk and promote its development

Fossil fuels such as coal and gas are expected to play a key role in Europe's energy mix for decades yet. But, in order to meet our climate change targets and provide energy security, we will have to develop innovative technologies to reduce their greenhouse gas emissions.

To contribute to this effort, the Crown Estate is working with businesses and our partners to de-risk and promote the development of Carbon Capture and Storage (CCS).

CCS involves removing CO_2 from the exhausts of power plants and industrial processes, transporting it via pipelines or ships, and then pumping it more than a kilometre underground into stable geological formations where it is sequestered permanently ('stored') like the oil and natural gas accumulations of the North Sea. The formations used include rocks filled with saline water and former reservoirs of depleted oil and gas fields.

At the Crown Estate, we focus on the second and third stages of the process, providing leases for the transportation and storage of CO_2 in areas of the 12 nautical mile seabed and UK continental shelf that we manage.

"The deployment of Carbon Capture and Storage (CCS) is critical to global efforts to mitigate climate change and keep global warming below 2°C above pre-industrial levels."

INTERNATIONAL ENERGY AGENCY 2011

CCS in the UK

Two large-scale projects remain in the UK Government's CCS Commercialisation Competition – Shell and SSE's Peterhead project, and the White Rose project at the Drax Power site in Yorkshire, which also involves Alstom, BOC and National Grid.

The Crown Estate has signed agreements for lease with both of these projects, which provide exclusive time-limited options over offshore storage sites in the North Sea. Developers are now working under Front End Engineering and Design contracts from the UK Government to progress their plans through to Final Investment Decision (FID) over the next couple of years.

The Peterhead project plans to store CO_2 at the depleted Goldeneye gas field, located beneath the North Sea, 100km from St Fergus in Scotland, while the White Rose project expects to store CO_2 in a deep offshore saline aquifer, 110km from the east Yorkshire coast in England.

However, much work is still needed to progress CCS beyond these two projects if we are to deliver a cost effective solution for the disposal of CO_2 from industrial processes and the power sector during the next decade. We are working with a large number of stakeholders to identify ways of overcoming technical, financial and market barriers that could prevent CCS from achieving its full environmental and economic benefits.

In the year ahead, we intend to continue working with industry and government to determine the best ways of delivering a no-regrets, least-cost pathway for transport and storage infrastructure in the period up to 2030.

Decarbonising Europe

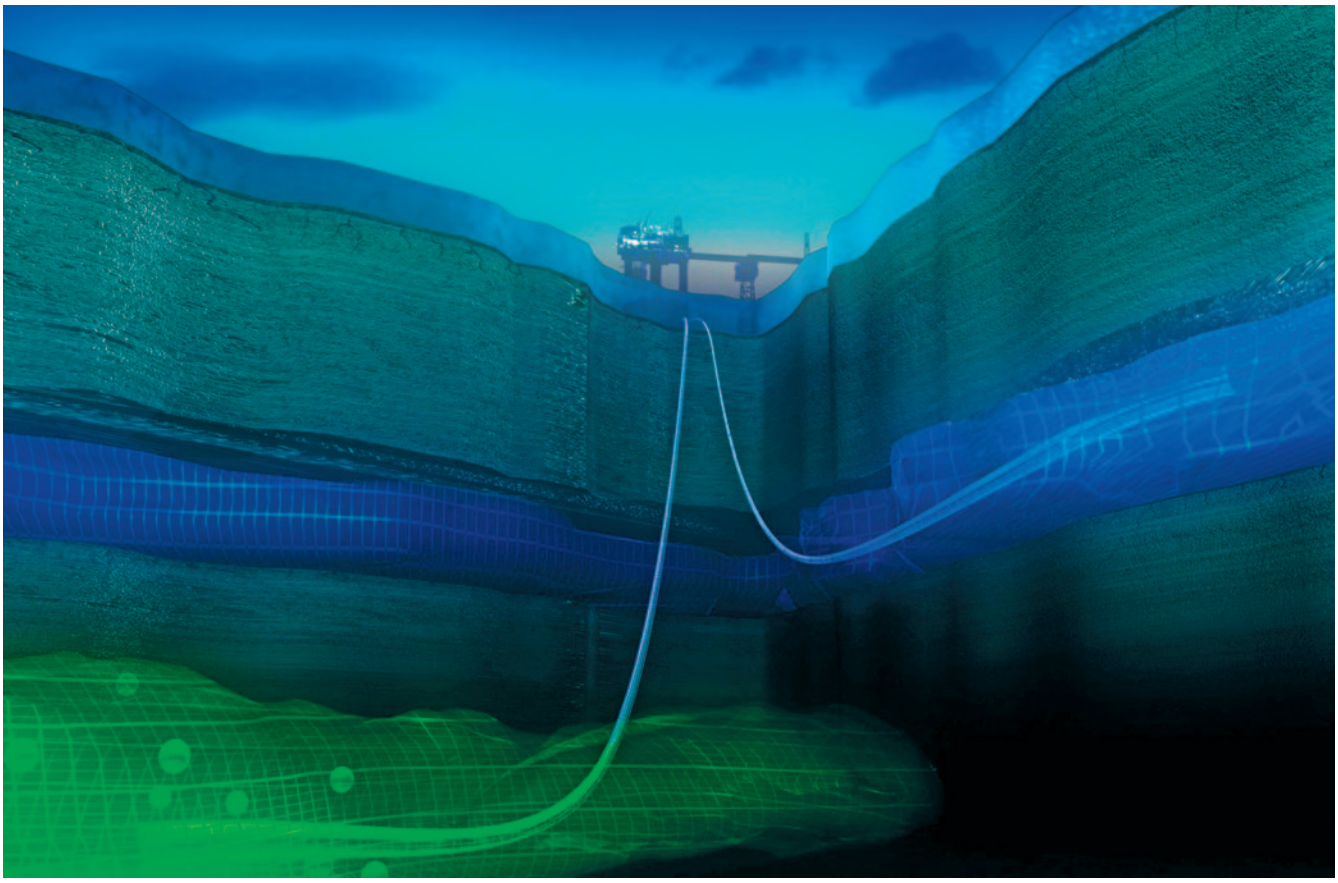
In order to achieve the IEA 2°C scenario for emissions abatement, 310 million tonnes of CO_2 will need to be sequestered each year in Europe by 2030. To put this into context, this is less than 10% of total EU annual CO_2 emissions in 2011. Is there enough storage? The UK Energy Technologies Institute has estimated that there is a 50% probability of 78,000 million tonnes of storage capacity beneath the UK continental shelf alone. Estimates of capacity beneath the Norwegian continental shelf are of a similar magnitude. This storage potential in the North Sea is no further away from northern Europe than the gas fields of Norway that supply natural gas through large export pipelines.

Because carbon (dioxide) pollution and the cost of the effects of climate change are not yet priced into all the activities and products of our economy, we have what economists call an 'externality', with the result that free markets do not drive us towards decarbonisation, including low carbon energy. The UK Government is taking a global lead with its policies to address this externality. In particular, its electricity market reform framework is designed to create the transitional conditions that will result in a properly functioning market for low carbon electricity in the future.

Similar thinking is urgently required to create the pathway for deployment of CO_2 transport and storage (CTS) infrastructure that

"Currently, a lack of targeted deployment policies to bridge demonstration efforts with longer term emissions reductions initiatives represents the most critical gap in government policy support for CCS globally. The United Kingdom is the only country to date to commence implementing such support."

INTERNATIONAL ENERGY AGENCY 2014



Carbon storage at Sleipner – image courtesy of Statoil

can be used in both the power generation and industrial sectors for the benefit of decarbonisation across northern Europe and the western Mediterranean.

Developers, investors and financial institutions all need a degree of certainty to take forward new projects to a final investment decision. To turn conceptual power or industrial capture projects into reality, offshore storage sites have to be 'characterised' and ready to be developed – in other words financeable or 'bankable'. If European and member state policies are left to focus solely on low carbon or renewable electricity generation, then the all-important development of CTS infrastructure at scale for use with abating industrial emissions may not be forthcoming.

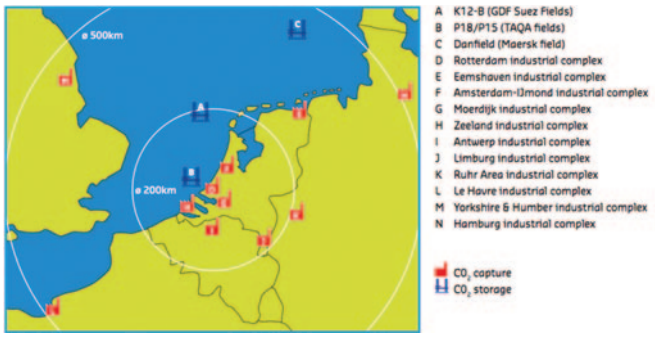
The process of characterisation of storage sites has been well defined by oil and gas industry experts. The length of time and cost to characterise a storage site depends on the type of site and whether data has already been collected from oil and gas exploration or production. The important thing to recognise is that storage characterisation and development is an entirely different activity to power generation or industrial processing, undertaken by different companies working with different investment options and criteria. Ensuring we characterise enough storage over the next ten years will be one of the most important foundations for decarbonisation of the whole energy system, including industrial installations, at the lowest cost in the future.

Current policies at member state and pan-European levels are not enabling a virtuous cycle of storage appraisal, CTS infrastructure development, lowering of CCS cost, and construction of capture plants on power and industry that will deliver a sufficient scale of emissions abatement in the required timeframe. This outcome also runs the risk that industrial decarbonisation in the future will be more expensive and the projected savings to the economy of including CCS in the energy system will not be achieved.

De-risking CCS as a viable low carbon option in the energy market and industry of the future, therefore, requires additional government support that addresses the structural problem of CO_2 transport and storage infrastructure needing a development pathway in parallel to policies that support low carbon power generation or industrial processes. Furthermore, a distinction needs to be made between renewable power generation projects when formulating policy because, unlike power transmission infrastructure, there is no existing CO_2 pipeline network for carbon capture projects to connect to.

Building on early projects

The graphic overleaf, prepared by the Rotterdam Climate Initiative, shows major emissions sources across northern Europe and their proximity to the southern North Sea Basin. The offshore field marked 'B' is associated with the ROAD project and Rotterdam industrial complex ('D') in the Netherlands. The UK White Rose project is located in the Yorkshire and Humber complex marked 'M', and the offshore storage site is about 100km east of the coastline. Both these commercial-scale projects are technically feasible and with the right funding support could become operational before 2020. The importance of these two projects



Rotterdam Climate Initiative 2011

goes far beyond being the first of a kind integrated CCS projects with offshore storage sites. If the perspective is moved from the national to European level, these projects in combination present an opportunity to create the beginnings of the CTS infrastructure required for abating emissions from all the industrial complexes shown in the map.

A key question, therefore, is how to progress CTS after the initial projects have been built out to ensure maximum deployment scale and cost efficiencies? The UK Cost Reduction Taskforce (May 2013) found it will be essential to develop a co-ordinated approach in the future that delivers CCS 'clusters' which leverage and share existing transport and storage infrastructure. This will contribute to achieving economies of scale, reducing cost, and establishing lower cost options for future use of CCS in industrial applications. This conclusion is equally applicable elsewhere in Europe.

Collaboration is the key

Building on the findings of the Cost Reduction Taskforce, The Crown Estate is chairing a new UK CO_2 Transport and Storage Development Group which will recommend ways of unlocking cost reductions, maximising the benefits of scale and reducing financial and technical barriers in transport and storage.

The oil and gas exploration and production industry has the expertise to undertake CO_2 transport and storage; however, at the moment, operators find it difficult to make a business case to invest in these activities. To help maintain the momentum of CCS development in the North Sea Basin over the next decade, oil and gas operators could start to examine whether geological formations in and around their productive fields or those approaching decommissioning could be used for CO_2 storage. The Crown Estate is also working with industry and government through the UK CCS Commercial Development Group to identify those additional policies and support mechanisms beyond the domestic electricity market reform that may be needed to help incentivise early storage appraisal.

In the UK, we are finding that collaboration between industry and government is essential to move beyond public funding competitions and enable smart no-regrets early deployment of appropriately sized CTS infrastructure for use with power stations that can then be expanded to industrial CCS in the future. The UK is well placed to pursue such a strategy, but this model needs to

Goldeneye

be transferred to common CTS projects between multiple member states, including those in and around the west Mediterranean area.

Time is of the essence if Europe is going to achieve deep emissions cuts during the 2030s and 2040s. Member states need to start thinking about the future CTS infrastructure today because long lead times are required to achieve the scale of deployment consistent with emissions reduction targets. Member states who can in principle undertake offshore CO_2 storage should begin collaborating with neighbouring countries to access, as a priority during 2015, the European Commission's Connecting Europe Facility for CO_2 Transport Projects of Common Interest and the Horizon 2020 programme funding for storage characterisation and demonstration. New collaboration forums need to be established and existing ones, such as the North Sea Basin Taskforce, need to be refreshed with mandates to vigorously investigate and pursue the design and development of CTS infrastructure projects of common interest.

THE CROWN ESTATE

Dr Ward Goldthorpe
CCS Program Manager
The Crown Estate

tel: +44 (0)207 7581 5379

ward.goldthorpe@thecrownestate.co.uk
www.thecrownestate.co.uk