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Capturing the (CO2) energy

Written by Elaine Maslin Tuesday, 01 November 2016 00:00

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Norway's government has agreed to a new round of funding into carbon capture and storage technologies. Elaine Maslin reports.

Last month, Norway took a step forward in its ambitions to advance carbon capture and storage (CCS) technologies.

The country's government, which has a US$50/tonne tax on CO2 emissions from industrial sources, agreed to $43.5 million (NOK 360 million) in funding for the continued planning of a full-scale CCS demonstration facility in Norway.

Continued support is also expected to be pledged for the country's Technology Centre Mongstad (TCM) – which has been a focus of CCS technology development, but on which a current support agreement ends in August 2017 – and CLIMIT, a body for CCS research and development.

Research and testing is set to continue at Technology Centre Mongstad. Photos from Gassnova/Helge Hansen.

Norway has been injecting and storing CO2 in offshore formations at the Sleipner field for 20 years, due to above market specification CO2 levels in the gas in one of the Sleipner project's reservoirs. At Sleipner, the CO2 from the produced natural gas is sequestered at the platform and then reinjected. One single chromium-steel well (which prevents CO2 corrosion) has been used for this task. Meanwhile, CO2 from the Snøhvit field, a subsea tieback in the Barents Sea, is also extracted and reinjected. On this project, onstream since 2007, CO2 is sequestered onshore, then piped back offshore for injection.

Norway now wants to extract CO2 from large onshore industrial plants, such as cement factories, energy from waste schemes, etc., which otherwise struggle to reduce their emissions, and then transport the CO2 offshore for storage.

So far, a number of concept studies for demonstrator projects have been drawn up, but, it is not likely that a full-scale project, which would aim to store 1 million tonne per year of CO2 over 25 years, will go into front-end engineering and design (FEED) until 2018, with an investment decision not before 2019, a statement from the government said in September.

While the work at Sleipner and Snohvit gives confidence that CO2 can be reinjected (high grade steel wells built to handle CO2 content are one enabler), taking gas from onshore industrial facilities and storing it offers challenges that the likes of semi-state-owned oil firm Statoil and the Norwegian state enterprise for CCS, Gassnova, are seeking to address.

However, a report from Gassnova earlier this year, summarizing feasibility studies for three projects, was positive about the chances of success. Projects were put forward by Norcem, a cement factory, Yara Norge, an ammonia plant, and the Waste-to-Energy Agency in Oslo. Gassnova has separately assessed the feasibility of ship transport of CO2 from locations for capture to storage sites (it's thought that at least initially this would be more cost-effective than building pipelines). Meanwhile, Statoil completed feasibility studies at three different sites on the Norwegian Continental Shelf. The best solution was the Smeaheia area, east of the Troll field, which could be fed CO2 via ca.50km-long pipeline from a nearby onshore site, Gassnova says.

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Other countries are also pursing industrial CCS projects. In the Netherlands, a project to extract CO2 from a biomass-based power plant at Rotterdam port to a site 6km offshore is being assessed. This project is in the define stage with a potential startup in 2019-2020, according to CCS Network, an EU body.

Stop start

Another project, one of two hoping for a share of government support in the UK, was Shell's Peterhead power station project, in northeast Scotland. This would have seen CO2 sequestered then piped offshore to Nexen's Goldeneye field. However, last year the funding was very suddenly pulled and the project left high and dry. A similar project in Yorkshire, England, called White Rose, suffered the same fate.

Another UK project, operated by Norwegian-owned Sargas Power, is seeking to extract CO2 from a newbuild natural gas power station, the Don Valley Project (previously "Hatfield Project"), and pipe it offshore for storage. This project has had more success in terms of funding. While it didn't succeed in a UK bid for funding, it received cash from the EU. However, by 2019, the UK will no longer be a member country. Sargas took over the project in 2014.

Despite the knock backs for Peterhead and Don Valley, another project was launched – as *OE* was going to press. The UK's Energy Technologies Institute (ETI) is to invest US$793,380 in a nine-month project to develop an outline gas powered power plant with CCS scheme, with a "template" gas power plant design, to identify potential sites and build a "credible" cost base. Construction group SNC-Lavalin, infrastructure services firm AECOM and the University of Sheffield are to work on the project.

Government support appears more forthcoming in Norway. "CCS is one of the government's five prioritized areas for enhanced national climate action," says Minister of Petroleum and Energy Tord Lien. "In order to reach the government's ambition to realize a full-scale demonstration project for the capture, transport and storage of CO2, we have to work systematically to establish a thorough decision basis."

There is some urgency, according to Tip Meckel, research scientist at the Bureau of Economic Geology, Jackson School of Geosciences, at the University of Texas-Austin. Speaking at a workshop on offshore CO2 storage in May this year*, he said that for CCS to make an impact, some 6 Gigatonne of storage is needed by 2050, which would be equivalent to 6000 Sleipner projects. Offshore shelves, he added, are the largest gigatonne-scale storage sites for CCS.

Norway says it will support concept studies on up to three CCS projects. The concept studies will go on until autumn 2017. Continuation of the project to a FEED phase will be considered in the budget for 2018, with a potential investment decision in summer 2019.

Net benefits

While storage is the main goal, CO2 injection could also play a bigger role in increasing oil recovery rates, says Pål Helge Nøkleby, business development manager, Aker Solutions. This way, it could also be a bridge to CCS solutions.

Speaking at ONS in Stavanger earlier this year, Nøkleby says a 5-9% increase in recovery could be gained from CO2 injection. Nøkleby says 10-11 million tonne of CO2 could help extract some 52 MMboe. But, it's not yet been exploited due to the space CO2 processing equipment would take up, he says, as well as the cost of shutting in facilities to integrate these facilities.

Aker Solutions has been looking at the potential for subsea CO2 separation and injection technologies. Recent breakthroughs such as the Asgard subsea gas compression project already offer some of the technology required, by adapting it for CO2 service. Aker Solutions has also developed a subsea membrane separator for subsea CO2 separation for enhanced oil recovery (EOR) backflow and sour gas fields. These would be in retrievable modules and would enable 97% of the CO2 content in a well stream to be separated.

For storage or injection of CO2 from onshore sites, CO2 could be supplied by ships via subsea buoy system or even European trunklines, he says.

"Small subsea processing units could serve small compartments in bigger reservoirs in parallel to conventional production," Nøkleby says. "They can be used for late-life injection or permanent storage. Retrievable modules can be moved. EOR [as such] can be considered a step towards CCS."

Norwegian firm Reinertsen has also developed a solution. Torkild Reinertsen, the firm's president, says it has bought the rights and the IP for a membrane palladium technology on which it has been working with research firm Sintef. The technology comprises some 100, 2m-long pipes covered in palladium and contained in a pressure vessel. They're used as a membrane through which hydrogen is extracted and CO2 captured.

The firm has had promising test results, Reinertsen told ONS. It has an agreement with Statoil to test the technology on a methanol plant outside Trondheim. A mobile test unit was taken to the test plant late August to start testing. Potentially, the technology could be used to produce large amounts of hydrogen from offshore gas, initially onshore, but

when the technology has become more compact, also offshore.

“It will be a real game-changer,” he says. The firm is setting up a subsidiary for these works and hopes to have factory building units next year.

**IEAGHG, International Workshop on Offshore Geologic CO2 Storage, 2016/TR2, May 2016.*

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