



# US - NORWAY COLLABORATION ON CCS/CCUS

**United States Department of Energy**

**&**

**Ministry of Petroleum and Energy, Norway**

**Virtual Bilateral Meeting**

**June 10, 2021**

**Meeting Notes**

**Present:**

United States:

Jarad Daniels, Mark Ackiewicz, Richard Lynch, Lynn Brickett, Stephanie Hutson, Darin Damiani, Sarah Leung

Norway:

William Christensen, Åse Slagtern, Kari-Lise Rørvik, Philip Ringrose, Svein Ingar Semb, Jørild Svalestuen, Espen Bernhard Kjærgård, Lars Ingolf Eide

Agenda for the meeting:

Updates capture activities (Svein Ingar & Lynn TCM, Jørild/Åse R&D) 10 min

Updates storage (Kari-Lise, Philip, Darin) 10 min

Status ACT (Mark) 5 min

New calls USA (Lynn/Darin) 5 min

New calls Norway (Åse) 5 min

Status Longship (William) 5 min

Future activities and plan forward 25 min(all)

Delegates from the United States of America (USA) and Norway met virtually June 10, 2021, to follow-up on the bilateral between United States of America and Norway on CO<sub>2</sub> Capture, Utilization and Storage (CCUS). The last physical meeting was held in Pittsburgh, USA, in August 2019 and the last virtual meeting in June 2020.

There were two new faces: Sarah Leung, who recently joined the US Department of Energy (DoE) to work on CO<sub>2</sub> storage with Darin Damiani, and Svein Ingar Semb, Gassnova, TCM asset manager at Gassnova and chair of the TCM board. Svein Ingar has replaced Bjørn-Erik Haugan, who has retired.

During the introduction of participants, **Jarad Daniels** took the opportunity to state that the Biden

administration looks favorably on CCUS, and that applications in industry is important, In power generation, CCUS applied to natural gas will have priority over coal. Carbon dioxide removal (CDR), such as biomass with CCUs (BECCS) and direct air capture (DAC), will be high on the agenda. Jarad also expressed that the bilateral US-Norway is looked upon favorably. **William Christensen** took the opportunity to announce that the Norwegian government will issue a white paper on long term value creation of Norwegian energy resources, in which CCUS and hydrogen will play a part.

**Svein Ingar Semb** gave an update on activities and future plans at TCM. The recent agreement between owners of TCM lasts until December 31<sup>st</sup> 2023. Work has already started on the possibilities of extending into a following test period. A new site for emerging technologies is now up and running. It is intended for small scale, and the technology owners will have to bring modular skids for testing.

The US company TDA and MTR have started testing, after some delays due to covid-19, Mitsubishi Heavy Industries (MHI) will start testing a new solvent this summer. As part of its advisory services, TCM has provided consulting services for a number of projects for the development of carbon capture. The most recent open test campaign included the AMP/piperazine based solvent CESAR 1. The results from an open test campaign were presented at GHGT15 ([https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3814712](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3814712)). CESAR 1 has been proposed by IEAGHG as their benchmark for amine based capture.

**Lynn Brickett** followed up by stating that the delays due to covid-19 for MTR testing at TCM caused cost sharing issues but that these have been solved and the test period extended. She informed that the annual NETL conferences will be virtual also in 2021, with separate sessions on integrated projects, capture and storage, as well as on oil and gas, CO<sub>2</sub> utilization and CDR. They are planning for Norwegian contributions on TCM and Longship. Lynn emphasized that decarbonization is important to the new US administration. In addition to the points reported earlier by Jarad, she informed that higher capture rates (>90%) will be important. Finally, Lynn mentioned the most recent Funding Opportunity Announcement (FOA) on capture, which includes Carbon Capture R&D for Natural Gas and Industrial Sources and Front-End Engineering Design Studies for Carbon Capture Systems at Industrial Facilities and Natural Gas Plants. Applications are due June 21, 2021, with expected results announced around late October (<https://www.fedconnect.net/FedConnect/default.aspx?ReturnUrl=%2ffedconnect%2f%3fdoc%3dDE-FOA-0002515%26agency%3dDOE&doc=DE-FOA-0002515&agency=DOE>).

**Jørild Svalestuen** stated that there has been very good cooperation between DOE and CLIMIT/Gassnova for many years. CLIMIT and Department of Energy have jointly funded around 8 projects (mainly within CO<sub>2</sub>-capture) since 2013. The last bilateral co-funded project - a cooperation between SRI and SINTEF on SRI's mixed salt technology - was finalized this spring. Today the cooperation USA-Norway on capture is taking place in ACT2 projects. She informed that the small Norwegian start-up company Compact Carbon Capture (3C), presenting themselves at the Pittsburgh conference in 2019, has been bought by Baker Hughes. The same applies to the mixed salt technology by SRI. Åse Slagtern echoed the good cooperation in ACT2 on solvents, membranes and sorbents.

**Kari-Lise Rørvik and Philip Ringrose** pointed to the success of the data sharing consortium when it comes to downloads of available data (more than 8000 researchers from 47 countries). However, the downside is that so far only the Sleipner data and the Smeaheia are available. The USA has not yet fulfilled its data contribution. **Darin** indicated that Illinois State Geologic Survey (ISGS) will fulfill its obligation to transfer a subset of the Illinois Basin-Decatur Project micro-seismic data this summer. **Philip** emphasized that Equinor continues to see great value in data sharing. A survey to identify the

value of data sharing was proposed.

**Darin Damiani** stated that ISGS and Norsar collaboration with within the CO2CAPII project (Climit project 618233) has been completed and was highly successful. So has the well integrity atlas, a cooperation between Lawrence Livermore Nat. Lab. (LLNL), Los Alamos Nat. Lab. (LANL) and Sintef. LLNL has money left. LLNL has been advising Sintef at their request on several projects, including TOPHOLE, FEWPLUGS and COMICCS. Darin also mentioned that NORCE and the University of Texas are cooperating on a project on Gt-scale injection. In ACT3, there is cooperation on storage in one project (without ACT funding to the US partner), if the project is selected. During the discussion, it was suggested to coordinate the data sharing consortium with similar initiatives in CEM-CCUS.

**Mark Ackiewicz** informed on activities in ACT. ACT1 projects are completed, no US involvement. In ACT2 there are six projects with US and Norwegian participation, three in capture and three in storage. In addition, US is involved with one more project without Norwegian participation. ACT2 will start mid-term review June 14, lasting until first week of July. ACT3 has just completed evaluation of 36 proposals, decisions will be made by the Advisory Council June 23. New members in ACT3 from ACT2 are India, Italy, the Nordic Energy Council and the Canadian Province of Alberta. ACT had a side event, with Longship, at the Mission Innovation/Clean Energy Ministerial a week ago (<https://cem12mi6chile.com/conference/mi-6-international-co-operation-a-key-driver-for-deployment-of-ccs/>)

#### **New calls.**

USA: On capture there no new calls are in the pipeline in addition to the one mentioned by Lynn above. On storage, there have been calls on faults and early detection of leaks. This call is closed and projects are selected.

Norway: CLIMIT Demo has open calls.

Common: ACT 3 has open call, which USA are welcome to join. Planning of ACT4 has not started, and there is a possibility that ACT will be part of the new European Clean Energy Transition Partnership (CETP) where also countries from all over the world can participate.

**William Christensen** gave an update on Longship. Ground preparations have started both at the Northern Lights terminal in Øygarden north of Bergen and at the Norcem cement plant at Breivik. Well head is in place, so progress is according to plan. The Longship is spurring interest in Europe, for example, the Heidelberg cement plant on the Swedish island Gotland considers CCS due to the possibilities offered by Longship. The waste-to-energy plant in Oslo is seeking EU Innovation funds, and the city of Oslo is eager for the project to go ahead.

**Future activities and plan forward.** Possible new areas of cooperation include CDR, BECCS, industrial CCUS and hydrogen (blue hydrogen production, industrial use of hydrogen and hydrogen storage). Contact should be established between relevant persons in both countries. TCM is looking for new partners in post-2023 period.

**Next meeting.** A physical meeting is preferred. It is Norway's turn to host but covid-19 makes the time uncertain. TCM is working with test partners TDA and MTR on possibilities to get them to Norway. A physical meeting does not have to be piggy-backing on other events, with Longship progressing and much testing at TCM, there are many opportunities for site visits in addition to the meeting. The situation will be closely monitored and an update will come in August/September.