

# What's on 2014-3

# BIGCCS

International CCS  
Research Centre

[www.bigccs.no](http://www.bigccs.no)

## From the BIGCCS Team

As many of you know, the new IPCC reports are published this spring. The reading is another reminder of the urge for starting implementation of CCS in large-scale as soon as possible. There are no obvious alternatives if we shall manage the transition to, and the realization of, the future sustainable energy system. This message is further strengthened by the recent IEA Energy Technology Perspectives (ETP-2014) where CCS is seen as key to reaching global warming targets due to the unprecedented growth of coal power in the world. It also states that gas can provide a step in the right direction but it cannot be seen as a low carbon option unless it is gas CCS. The situation in Europe with Ukraine and Crimea has put energy security at the top of the agenda in EU. Relying more on coal and keeping to greenhouse gas targets cannot be done without CCS. CCS is thus suddenly an issue of security which is a new setting and driver for deployment of this important technology.

This newsletter presents a demonstration project for CO<sub>2</sub> injection and transport (DeFACTO). Further, the CO<sub>2</sub> storage initiative is presented. We are also proud to present another PhD student that has defended his theses. Last, but not least, we have the pleasure to announce the new BIGCCS web-site (<http://bigccs.no/>). By this, we aim at further improve the communication from the BIGCCS. Enjoy your reading!

## News

### Demonstration of Flow Assurance for CO<sub>2</sub> Transport Operations (DeFACTO)

This project aims to provide technology development and demonstration that improve large-scale CO<sub>2</sub> transport and injection. The project will reduce uncertainty for operations, flow assurance, and improve Health, Safety and Environment. This will be obtained by constructing a 200-250m demonstration vertical well, use Statoil's existing rigs, using flow assurance tools, and by preparing a design basis document for CO<sub>2</sub> transport and injection.

DeFACTO is building on results from a previous project, CO<sub>2</sub> IT IS, that together with BIGCCS have given Statoil and SINTEF Energy Research distinct competence on CO<sub>2</sub> transport. The CO<sub>2</sub> IT IS project had two unique rigs that will be available in the DeFACTO project. One rig is for horizontal pipeline flow, consisting of a down-scaled pipeline for steady state and transient depressurization experiments. It consists of a 139 m long tubing with sight glasses and measurements of temperature, pressure, and flow. A separation tank and a compressor and pump enable continuous operation. The other existing rig is for investigating heat transfer from ambient into a 1 meter long piece of pipeline identical to what has been used in Snøhvit. A picture of the test facility is shown in Figure 1. The tank can be filled with any medium covering the pipe, and the pipeline segment can be partly or fully buried.

The planned demonstration well will connect to the existing infrastructure, and a nearly finalized design at P&ID level of the demonstration well was performed in CO<sub>2</sub> IT IS. A simple sketch of the vertical CO<sub>2</sub> well is shown in Figure 2.



Figure 1: Heat transfer rig with 1 meter long piece of real Snøhvit CO<sub>2</sub> pipeline that can be submerged in variable surrounding medium (photo: Statoil)

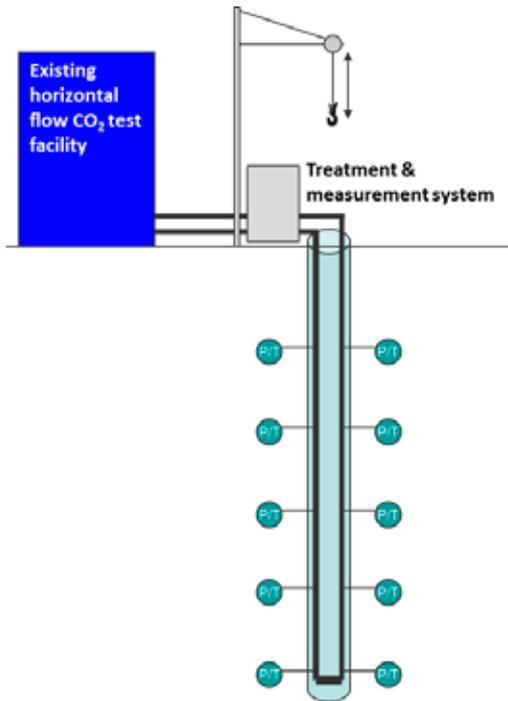


Figure 2: Sketch of the vertical CO<sub>2</sub> test loop to be built at Statoil, Rotvoll.

The demonstration project will provide competence building for the involved partners and gather unique results from both vertical and horizontal pipeline geometries. CCS transport knowledge gaps will be addressed in DeFACTO through an experimental campaign supported with flow modeling and simulation. A SINTEF Energy Research in-house tool for simulating CO<sub>2</sub> flow, developed in CO<sub>2</sub> Dynamics (CLIMIT) and BIGCCS Task 2.1, will be used for experimental planning and analysis.

Experiments for steady state injection, start-up and shut-in of a vertical well, blow-out of wells, depressurization of pipeline and heat transfer to CO<sub>2</sub> pipelines, will be performed. The results of an experimental campaign will be used to verify and benchmark internal and commercial simulation tools and models. The results will be summarized in the form of a generic design basis, which is an important document for construction projects.

#### Key figures of the project

DeFACTO is a CLIMIT-Demo project administered by GASSNOVA, with a partnership between Statoil and SINTEF Energy Research. Project kick-off and first board meeting were held at 13th November 2013, and the project will run for 4 years until October 2017. DeFACTO is a continuation of the CLIMIT BIP project CO<sub>2</sub> IT IS (CO<sub>2</sub> Interface Transport Interface Storage) running from 2008 to 2013. CO<sub>2</sub> IT IS was also a collaboration between Statoil and SINTEF Energy Research.

Contact: Morten Hammer, SINTEF Energy Research

### Workshop on CO<sub>2</sub> Storage in BIGCCS

Over two days in late February 2014 the research partners investigating CO<sub>2</sub> storage in BIGCCS gathered to discuss the current challenges within CCS and the ongoing research within SP3. As a starting point, the BIGCCS centre director Mona Mølnevik placed BIGCCS into the big picture by pointing out the research in the centre as instrumental for enabling large scale CCS. Peter Frykman (GEUS) and Andy Chadwick (BGS) reviewed the status of CCS in Denmark and UK, and Erik Lindeberg (SINTEF) gave a presentation on large scale CO<sub>2</sub> storage and EOR. Aage Stangeland from the Research Council of Norway summarised the priorities of the Climit research programme and informed the participants about coming calls. The four task leaders of SP3 organised workshops to present scientific challenges and discuss strategies for overcoming the hurdles. In all, 31 representatives from GEUS, BGS, NTNU and SINTEF contributed to through inspired presentations and lively discussions. The meeting was the first gathering within SP3 CO<sub>2</sub> storage after a restructuring of the program. It will be followed up by a seminar on September 22 (the day before the BIGCCS Consortium Day), where also industry partners will be invited to participate.



Three of the PhD students in SP3: Dawid Szewczyk, Espen Raknes and Sohrab Gheibie (all NTNU)

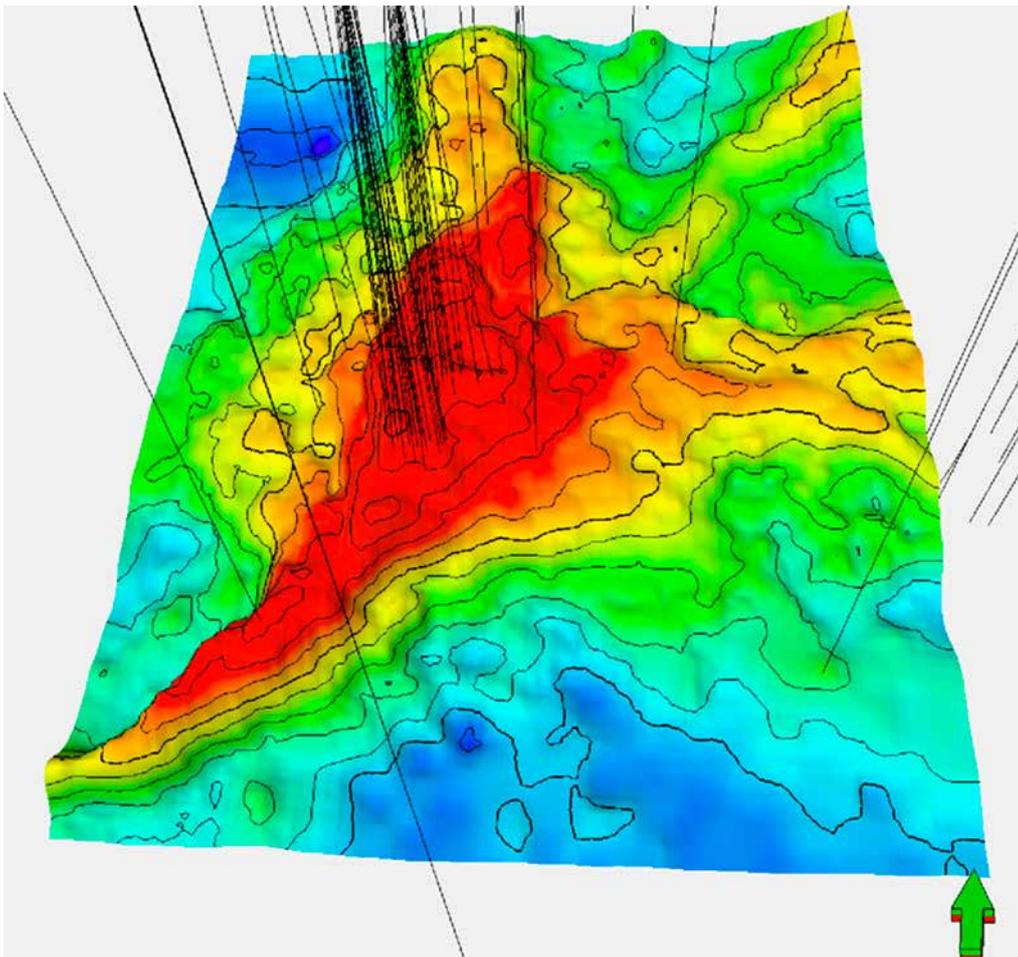
## Large-scale CO<sub>2</sub> storage - update on the Gassnova pre-project

In 2013, Gassnova granted the FMEs BIGCCS and SUCCESS a pre-project to develop a collaborative feasibility study for large-scale storage of CO<sub>2</sub> on the Norwegian continental shelf. The underlying idea is to mobilise the research community in Norway, industry, and institutions that manage public R&D funding within CCS to enable large-scale storage of CO<sub>2</sub> (10-100 million tons). Despite of no technical showstoppers, implementation of CCS has lost its momentum. Meanwhile, CO<sub>2</sub> emissions are steadily increasing. The gap between the amounts of CO<sub>2</sub> that must be captured and stored to meet UN and EU climate objectives, and the amounts CO<sub>2</sub> managed in actual CCS projects continues to grow. It is uncontroversial that there will be a shift in framework conditions to resolve this situation, and that CCS will be a critical part of future solutions for low-carbon energy. It is uncertain exactly when this shift will happen, but the need for transformation will be urgent when it occurs. Hence, it is essential to maintain the drive to progress the research, innovation and demonstration to ensure that the solutions are ready.

The feasibility study will apply and advance current knowledge and methodologies to meet the industries need for up-scaled, validated, and cost-efficient solutions. Further, the study will investigate business models and adequate regulations required to make CCS commercial. The work will build on data from selected storage sites. The CO<sub>2</sub> is foreseen to come from countries bordering the North Sea. Based on meetings with industry and the Norwegian Petroleum Directorate, the pre-project has identified four interesting geological formations that will form the basis for the study. The formations have different characteristics, and pose a range of challenges and opportunities. For instance, the Frigg depleted gas field has challenges related to well integrity, whereas Bryne/Sandnes is an immature, deep site with major faults, raising questions related to strategies for early-phase site assessment. Troll and Utsira are also candidates for investigation.

The next step is to specify the activities required in a main project. We will keep you posted in a later BIGCCS Newsletter.

Contact: SP3 leader, Grethe Tangen



*The abandoned gas field Frigg  
- structural map with all wells*

*(source: NPD CO<sub>2</sub> storage atlas  
- Norwegian North Sea)*

## New PhD - Xiaoguang Ma

Xiaoguang Ma successfully defended his PhD dissertation with the title "Precipitation in Carbon Dioxide Capture Processes" on April 29. The use of precipitating systems is one of the options to improve the feasible CO<sub>2</sub> capture technologies. Three different precipitating systems were chosen for the study, varying with respect to the location of crystallization in the absorber/desorber swing operation. Potassium carbonate and amino acid salts were chosen as examples of systems that will precipitate as a result of absorption since the solubility of the absorption products are lower than the reactants. Piperazine (Pz) was chosen as an example of the opposite, in which case solid formation by crystallization might occur as a consequence of desorbing CO<sub>2</sub>. Their precipitating behavior accompanying with the corresponding CO<sub>2</sub> absorption kinetics was investigated.



From left: Jens-Petter Andreassen (supervisor), Xiaoguang Ma, Hanna Knuutila (co-supervisor), Maria G. Lioliou (second opponent), Earl Goetheer (first opponent), and Halvard Svendsen administrator

## New BIGCCS Web

We are happy to inform you that we have launched a new BIGCCS web. The address is (<http://bigccs.no/>). The new web is designed also to work on smartphones and pads. Hopefully, you will find that this one is more dedicated to communicating news from the BIGCCS Centre. We hope that you find interesting and useful information.

Enjoy your reading!



PS! It might be that you need to click "update" in your browser a couple of times before you get access to the new web. Alternatively you can try to delete the "browser cache".

## Calendar of events

- May 20: BIGCCS Board Meeting No 12, Paris, France
- May 28: Site visit by The Research Council of Norway, Trondheim, Norway
- Jun 4-5: 3rd Trondheim Gas Technology Conference, Trondheim, Norway  
Organised by the Gas Technology Centre NTNU-SINTEF
- Sep 23: BIGCCS Consortium Day 2014, Trondheim, Norway
- Sep 24: BIGCCS General Assembly No 7, Trondheim, Norway
- Nov 27: BIGCCS Board Meeting No 13, Trondheim, Norway

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