What's on 2014-1

BIGCCS

International CCS Research Centre

www.bigccs.no

Message from the BIGCCS Team

Dear CCS friends!

On March 7, the Norwegian Environment Agency published a report stating that Norway needs to take more drastically measures in use to meet the 2020 CO_2 emission target of 47 million tons CO_2/year. CCS is a central measure, and we all know that it requires competitive solutions for the whole chain, CO_2 capture, transport and storage. In BIGCCS we work according to this, and now we further strengthen the efforts with new projects on CO_2 capture and storage. Report: www.miljodirektoratet.no/Documents/publikasjoner/M133/M133.pdf

This newsletter presents the new activities. Enjoy your reading!

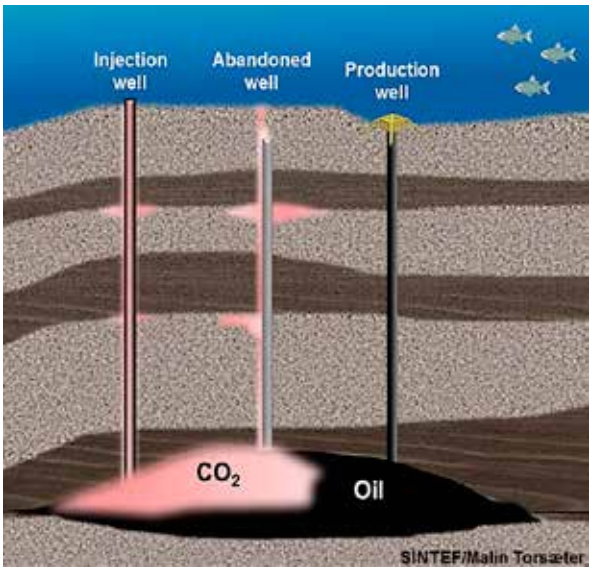
BIGCCS Director Dr. Mona Mølnvik and Chairman of the Board Dr. Nils Røkke (Photo: Gry Karin Stimo)

New KPN Projects

Ensuring well integrity during CO_2 injection

Wells have in numerous scientific publications been denoted the "weak link" of safe and cost-efficient CO_2 Capture and Storage (CCS). Whether they are active or abandoned, these wells are all man-made intrusions into the storage reservoir – and their sealing abilities depend on degradable materials like steel and cement. To ensure that stored CO_2 remains underground in long-term, it is necessary to advance current well technologies, procedures and materials.

As opposed to normal petroleum wells, wells penetrating CO_2 storage sites are exposed to low temperatures. These can occur e.g. during injection, or if a leak develops in the well. A prerequisite for maintaining well integrity during CCS is therefore to understand how wells can be constructed to withstand such low temperatures – and the resulting strong temperature variations. These can lead to de-bonding and cracking of well construction materials and subsequent leakage. Few experimental studies have so far been performed on the effect of thermal cycling on well integrity, and no studies have been performed in the temperature range relevant for CO_2 injection wells. To fill this knowledge gap, the current project aims to study, through numerical modelling and experiments, when, why, where and how well integrity is lost when a well is repeatedly cooled down and heated up – and how such detrimental temperature cycles arise.



Well integrity is important for ensuring safe and cost-efficient CO_2 capture and storage, especially if Enhanced Oil Recovery (EOR) is used as an enabler.

The project will be managed by SINTEF Petroleum Research, and research partners are SINTEF Energy Research and Lawrence Livermore National Laboratories. It has a budget of 9 million NOK over 3 years, and will be managed as an integrated part of BIGCCS. The deliverables from the project will be new knowledge about well integrity of CO_2 injection wells, as well as specific recommendations on material selection, well design and operational parameters for optimal maintenance of well integrity in CO_2 injection wells. The project is closely related to another new project at SINTEF Petroleum Research, which is an "add-on" to the German COMPLETE project, where well construction materials recovered from CCS wells at the Ketzin pilot site will be studied.

Contact person: Dr. Malin Torsæter, SINTEF Petroleum Research

Shaping of advanced materials for CO_2 capture processes (SINTERCAP)

The main objective of "SINTERCAP" is to develop Pressure Swing Adsorption (including Vacuum Swing) and Temperature Swing Adsorption processes for pre- and post-combustion CO_2 capture. Adsorption technologies are a promising technology due to high capacity to remove CO_2 from flue gases and lower the energy required for desorption.

The main innovation of the project is to produce a shaped material based on metal-organic frameworks (MOFs) as new advanced adsorbent. We expect to produce a successful technology with low energy penalty by integrating tailored materials and processes for pre-specified applications in the CCS field. We will explore several techniques for particle and honeycomb monolith formulation of MOF materials with different properties and characteristics, overcoming technological limitations using MOF adsorbents for CO_2 capture. The development of new materials can result in debottlenecking the flow limitation and extend the adsorption technology to large flows minimizing the pressure drop to affordable limits.

The project will significantly contribute to develop a "cradle-to-the-grave" research group in Norway for utilization of advanced porous materials for CO_2 capture in pre- and post-combustion processes based on adsorption technology.

Main partners are SINTEF Materials and Chemistry and SINTEF Energy Research and we will collaborate with leading researchers at the University of Porto (Portugal) and Politecnico di Milano (Italy). Total funding of the project is
9 MNOK.

Contact person: Dr. Carlos Grande, SINTEF Materials and Chemistry)

New adsorption unit that will be used in the project is available at SINTEF Materials and Chemistry.

Uncertainty reduction in monitoring methods for improved CO_2 Quantity estimation

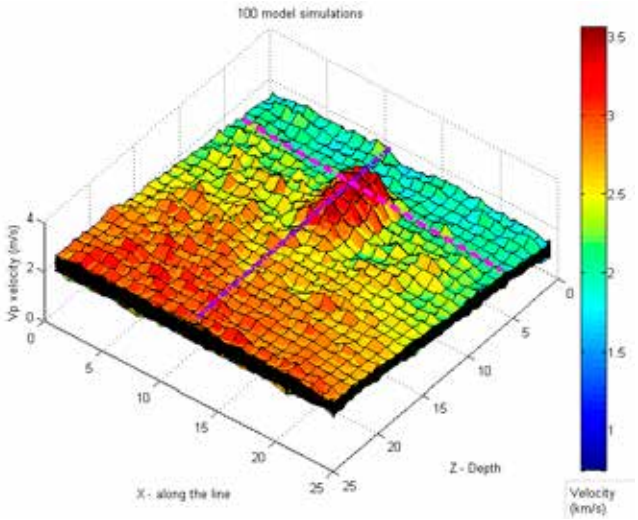
CO_2 capture and storage is considered one of the key measures for mitigation of climate changes due to emissions from fossil fuel combustion. For safe geological storage of CO_2, very good knowledge about the subsurface storage and sealing formations, as well as about the behaviour of CO_2 in the subsurface is required. Specifically, accurate and reliable monitoring methods have to be used both before and during injection, but also for subsequent surveillance of the storage site.

Commonly used methods provide an image of the subsurface which may be used for instance for early detection of leakage. This makes monitoring methods crucial for reduction of risks associated with CO_2 injection and storage. World-wide efforts have been made to study and improve the accuracy of these methods. So far very little has been done to quantify how certain the information provided by the monitoring images is. Sound knowledge of the uncertainty in an image is a vital component in quantification of risks during injection. In addition, this increases the confidence in the assessment of a storage site prior to injection.

In this new project, the focus will be on developing a methodology for quantification of uncertainties in geophysical monitoring. For given synthetic cases, the resulting uncertainties will be kept at a minimum by tuning the monitoring methods. The methods will also be tailored such as to provide monitoring at Sleipner (off-shore Stavanger) and Snøhvit (off-shore Hammerfest) with the smallest possible amount of uncertainties.

The project is a collaboration between SINTEF Petroleum Research (project manager), BGS, NTNU (Postdoc or PhD), SINTEF ICT, and University of Wyoming. It has a total budget of 8 MNOK over three years and will result in a benchmark environment for uncertainty quantification in geophysical imaging methods and five publications on uncertainty quantification and reduction for synthetic cases, as well as for Sleipner and Snøhvit.

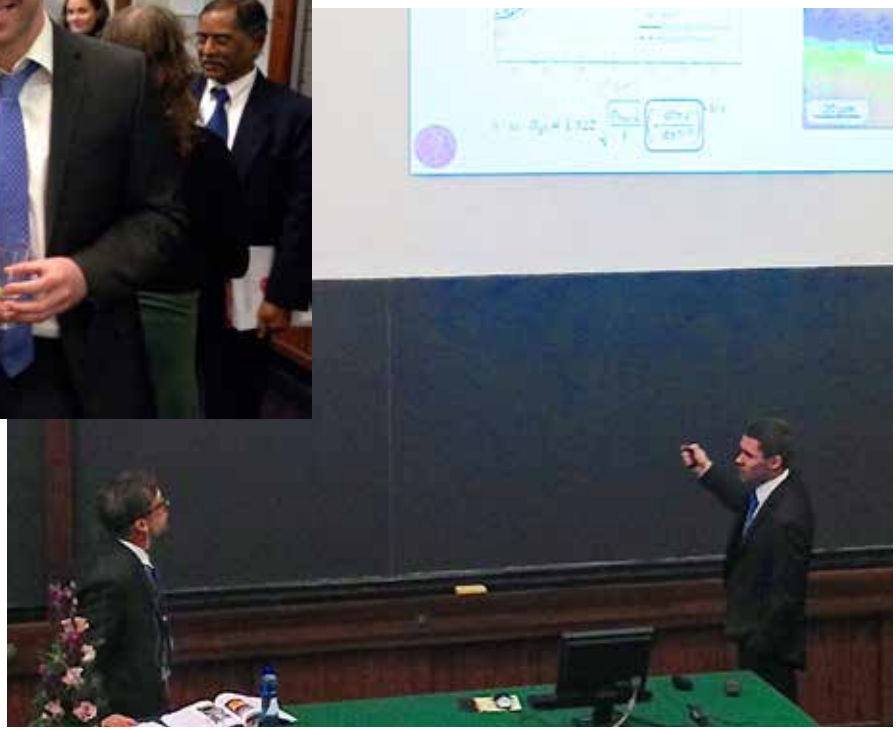
Contact person: Dr. Peder Eliasson, SINTEF Petroleum Research



Tomographic velocity image (see colors) with uncertainties indicated by a range of 100 "equivalent models" (see thickness and topography).

New BIGCCS PhD: Einar Vøllestad

Einar Vøllestad successfully defended his PhD dissertation entitled "Mixed proton electron conducting oxides as hydrogen transport membranes in electrochemical potential gradients" February 13th at the department of chemistry, University of Oslo. His work was funded through BIGCCS and he was joined by fellow SINTEF researchers and collaborators also working on Innovative Membrane Technologies (Task 1.2).



Above:
Celebrating after a successful defense – Dr. Einar Vøllestad congratulated by Ms. Camilla Vigen.

Right:
Mr. Einar Vøllestad explaining his findings during the defense lecture.

Calendar of events

May 20:	BIGCCS Board Meeting No 12, Paris, France
May 21:	BIGCCS Technical Meeting, 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,

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