GEO ENeRGY

BALTIC EXPERTISE NETWORK ON CCS

The Baltic Sea Region Energy Cooperation (BASREC) is a ministerial process with a mandate for a three-year period. BASREC is under the umbrella of the Council of the Baltic Sea States (CBSS) and covers the issues of energy and energy-related climate policy in the region.

BASREC has taken an initiative to establish a network of and for CCS expertise with the objective of supporting deployment of CCS in the Baltic Sea region. The Network is also supported by Global CCS Institute and in 2015 by the Nordic Council of Ministers.

CCS is very much about large scale infrastructure development and so the Baltic Sea region forms a natural geographic area for collaboration. Issues such as environmental care and safe transport and storage solutions are key areas of common, regional interest. There will be a clear need for the use of joint and transboundary solutions for transportation and storage of CO_2 between BASREC nations.

BASREC has therefore, as the third phase of its CCS initiative, initiated and funded a project to strengthen regional cooperation. The objective is to promote and fast-track the development of a CCS network in the Baltic Sea Region. The region should benefit from active collaboration on CCS transport and storage development, as well as issues like public perception, environmental impact and legal/fiscal aspects of cross border transfer of CO_2.

Through structured and regular information exchange the Network should support further regional CCS competence development. This should, as a consequence, assist in the wider assessment of regional CCS initiatives as part of a climate change mitigation action plan in the Baltic Sea Region (BSR).

The first stage of the project has been finalised. The project has identified professionals with CCS expertise in universities, research institutes, industry, government, agencies and among policy makers. On-going CCS projects have been listed and categorised in order to detect potential cross-fertilization opportunities through the establishment of this network. The BASREC initiative has presented aims and frames for the creation of a network which can maintain and develop activities over time. By now the network includes participants from several present and former ENeRG partner institutions representing Estonia, Lithuania, Finland, Germany, Poland and Russia.

The second Baltic Carbon Forum and the Network launching meeting took place in Tallinn on 22-23 April, 2015. It is composed now of three task forces (Capture, Transport and Storage) and coordinated by Per Arne Nilsson.

The third Baltic Carbon Forum with 45 participants took place in Warsaw on 29-30th October 2015, focusing on visions and barriers for CCS in the BSR with presentations on European, BSR, Nordic and Polish CCS issues and the EU BSR strategy (Fig. 1). In addition, projects and plans for the future networking process were discussed in the Task Force meetings.

The next stage of the network development is planned to continue with transformation of the BASREC CCS Expertise Network into an independent Baltic Sea Region CCS Network in 2016. The Network is open for new participants and project initiatives.

Welcome new members by clicking on the link: *http://basrec.net/ccs-initiative/network/*.

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Fig.1 The 3rd Baltic Sea Region CCS Conference took place in Warsaw on 29-30th October 2015 (pictured and designed by Peter Molander)

The Newsletter content

ULTimateCO_2: Understanding the long-term fate of geologically stored CO_2

The UltimateCO$_2$ project, funded by the European Commission FP7 for four years (Dec 2011-Nov 2015), allowed the study of long-term processes associated with geological storage of CO_2. The project, coordinated by Pascal Audigane of BRGM, brings together 12 partners from seven countries (research institutes, universities and industry) and a panel of experts.

Innovative approaches were used to help establish conditions of storage security over periods up to several thousands of years. At the heart of the project, numerical calculations and observations in the laboratory or of natural analogues were made to improve knowledge about the effects of long-term geological storage of CO_2. Samples were derived from the offshore UK in the North Sea and onshore Germany and the Netherlands.

An experiment was conducted at real-scale in the underground laboratory of Mont Terri (Switzerland), in which a clay caprock of Opalinus Clay was studied for several years to analyze the behavior of wells, which are considered to be potential leakage pathways. A mock section of a well was created then subjected to stresses similar to those of a deep well used in CO_2 storage. Several parameters were tested: an increase in temperature and pressure, and contact for one year with brine acidified by dissolved CO_2. For all but the pressure parameter, the results tend to show an increase in the sealing (tightness) of the well under these conditions.

Tests were conducted on the Opalinus clay, which is considered as an analogue of a caprock located above a storage reservoir and, because of its impermeability, makes it possible to contain the CO_2. Tests were also conducted on faulted or fractured caprock, which may present risks of CO_2 leakage. The experiments consisted of a first step to degrade argillaceous rocks, mechanically or chemically, as they may be in the presence of CO_2 over the long term. In a second step, the samples are brought to failure to assess their strength and flow properties. The observations showed that the impermeability of this clay, under the conditions studied, was maintained despite mechanical or chemical deterioration.

These experiments were supplemented by numerical models to simulate the evolution over 10000 years of particular geological reservoirs onshore in the eastern part of the Paris Basin and offshore UK in the North Sea, with a moderate level of uncertainty after 100 years predictions, to a higher level of uncertainty after 1000 years.

No critical threshold reached

The models confirmed, in the cases studied, that the impact of long-term storage of CO_2 is low: no critical thresholds were reached in terms of pressure, fault reactivation or development of CO_2 flux/flow to a stable situation.

Simulations have also shown that, in some cases, a large amount of CO_2 can remain trapped in gaseous form up to 10000 years later. CO_2 can change in its nature over time, or by dissolving in water (as in a bottle of sparkling water), or by precipitating as rock. However, in the cases studied, it was estimated that at least 30% of the CO_2 remains in gaseous form, which is higher than the last IPCC report in 2005 suggests for the storage of CO_2. The risk of ascent of this gas therefore remains over the long term, making the impermeability of the well and the caprock even more important.

The project focused finally on expanding and upscaling the study of reservoir processes to basin scale, based on the sedimentary Paris basin. In the long term, the impact could indeed reach beyond the storage areas.

Outcomes

The UltimateCO$_2$ closing workshop took place on 28 and 29 October, one month before the end of the project. A Guidance report, summarising the highlights of the research results, and particularly aimed at CO_2 storage operators and regulators dealing with the transfer of responsibility of storage sites, is due out at the end of 2015 and will be available on the website (*www.ultimateco2.eu*).

Pascal Audigane

BRGM

Fig. 2 Well integrity experiment in the Mont Terri Underground Rock Laboratory in Switzerland (© Swisstopo)

Fig. 3 The ULTimateCO$_2$ consortium at the final meeting in Paris hosted by IFPEN

The 3rd EAGE Sustainable Earth Sciences Conference took place in Celle, Germany

Building on the success of the 1st Sustainable Earth Sciences (SES) conference in Valencia, Spain (2011) and the 2nd SES conference in Pau, France (2013), the 3rd SES conference took place in Celle, Germany, at 40 km from Hanover on 13-15 October 2015. This 3rd edition entitled ***"Technologies for Sustainable Use of the Sub-surface to Serve the Energy Transition"***, was organized with the support of ENeRG and CO_2GeoNet alongside the European Association of Geoscientists and Engineers (EAGE). The aim was to enable geoscientists to discuss how the underground can contribute significantly to the transition to a clean, efficient and secure energy system, compatible with the requirements of environmental protection, climate change mitigation and sustainable use of the Earth and its limited resources. This SES 2015 conference was held in parallel with the 2nd EAGE Workshop on Geomechanics and Energy (GME) focused on the mechanical behaviour of the underground during extraction or storage activities. Plenary sessions were held jointly while parallel and poster sessions were specific to each event. About 115 delegates from Europe and abroad were present in Celle and free to attend any SES or GME session.

The technical programme highlighted progress in research and innovation with respect to the following subsurface technologies:

- Geothermal energy, a non-intermittent renewable energy
- CO_2 geological storage, for massive reduction of CO_2 emissions
- Underground energy storage, for enabling massive storage of electricity and heat
- Unconventional hydrocarbon exploitation, how to improve the environmental footprint.

Cross-technology topics were also discussed, such as drilling technologies, geophysical characterization and monitoring of the subsurface, geochemical reactions between fluids and rocks, reservoir stimulation for a better efficiency of fluid injection and production, seismic risks, potential impacts on groundwater.

One session was devoted to subsurface spatial planning at the basin scale, as the increased use of the subsurface to serve the energy transition will require the management in 3D of underground space. For a given territory, it will be important to map the current and future suitable underground areas for extraction and storage activities, and to link them to human activities and future needs at the land surface. This will help managing usage competitions, avoiding detrimental interactions between two adjacent projects, and preventing any negative impact on the environment, e.g. on groundwater used to supply drinking water. Not only different levels of the underground space can be earmarked for specific functions, but it can be also possible to develop synergies and joint utilizations.

The most outstanding outcomes of the SES conference were the growing interest and research activities on energy storage in the underground, which has a great potential for smoothing out the electricity supply from variable renewable sources, such as wind and solar. Many investigations are carried out in Northern Germany to map salt structures for future storage operations in cavities, and sedimentary formations for storage in porous media. Diverse technologies are being studied, such as H_2, Compressed Air or Pumped Hydro storage. A field trip was organized to visit the first Compressed Air Energy Storage (CAES) facility in the world, situated at Huntorf near Bremen. This air-storage gas turbine power plant (290 MW), commissioned in 1978, has fulfilled for the first time the desire of having a storage power plant in flat areas. At night, when power demand is low and costs are lower, air is taken from the atmosphere, then compressed and stored in two salt caverns at 650-800 m depth. During periods of peak load demand, this stored air is drawn out and burned together with natural gas.

http://www.eage.org/event/index.php?eventid=1259&Opendivs=s3

Fig. 4 Visit of the Compressed Air Energy Storage Facility at Huntorf. The head of one of the wells reaching the salt cavern is in the small building

Isabelle Czernichowski-Lauriol
Conference Chair
BRGM

Geoscience for a sustainable Earth
brgm

ENeRG – European Network for Research in Geo-Energy

ENeRG – European Network for Research in Geo-Energy is an informal contact network open to all European organisations with a primary mission and objective to conduct basic and applied research and technological activities related to the exploration and production of energy sources derived from the Earth's crust.
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GEO ENeRGY country profile – Bosnia and Herzegovina

The University of Tuzla, which was founded in 1976, has 59 study programs and 13 faculties. The Faculty of Mining, Geology and Civil Engineering was founded in 1960 and became a member of the University of Tuzla in 1976.

The Faculty of Mining, Geology and Civil Engineering in Tuzla has, for the five decades of its existence, made a huge technical and scientific contribution to the economy and scientific research institutions. The Faculty has graduated 2570 students, defended 12 specialists, 285 master theses and 109 doctoral theses.

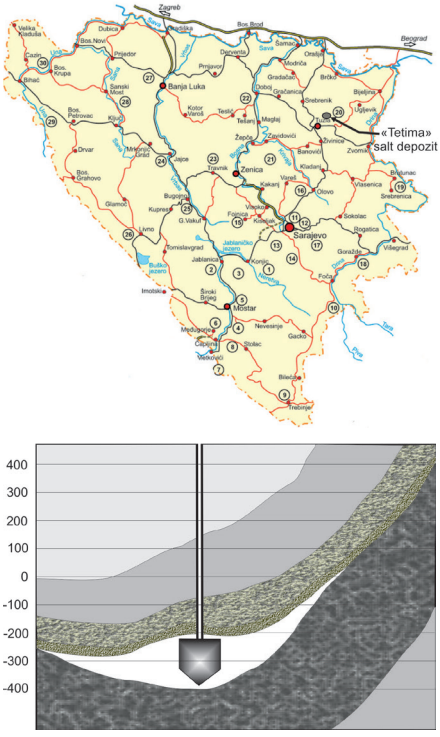

Fig. 5 Location and cross-section of salt deposit Tetima

Currently there are 47 teachers and staff who are permanent employees at the Faculty, as well as a number of prominent experts participating in the teaching process. Many teachers and staff are very active members of professional organizations.

The Faculty has five programs of study in the first level and a number of directions at the second level of study. Study programs in the first level are Borehole Mining Geology, Civil Engineering, Mining and Safety Engineering.

Main research directions at the Faculty of Mining, Geology and Civil engineering

The main research areas are mining of mineral resources, mineral processing, transport and export of mining materials, geoenvironmental engineering, well engineering, geology, mineralogy and petrology, geological engineering, security and assistance, geodynamics and geotechnical engineering, geospatial information, engineering graphics and numerical modelling, hydrogeology and water engineering, construction engineering, roads and construction management and applied geophysics.

Other institutions

The Faculty has a very good cooperation with the Mining and Geological Institute in both subdivisions of Bosnia and Herzegovina, and with a number of related faculties in the region and in Europe.

Main activities in the field of geo-energy

The Faculty of Mining, Geology and Civil Engineering in 2007 studied potential sites for the storage of energy in Bosnia and Herzegovina. As a result of this study a salt mine "Tetima" near to Tuzla was estimated as the most favorable location for the underground gas storage (UGS) (Fig. 5). The "Tetima" salt deposit has the necessary geological, geomechanical, hydrological, safety, environmental and economic benefits for UGS. So far 25 wells have been drilled into the reservoir corresponding to 25 chambers in the salt, each having a useful volume of 200 000 m^3. It is planned to drill 105 wells, so that the total volume of storage space will be more than 20 millions m^3.

Other current activities are focused on the research of geothermal energy, available in most parts of the territory of Bosnia and Herzegovina. The water temperature measured at the surface of the field is in the range of 20-95°C.

The next planned phase involves detailed geological and geophysical surveys, followed by exploration drilling aimed on utilization of this potential of the country.

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