



Europe – South Korean Joint Workshop on CCS

Trondheim 14-15/06/2017

Newsletter



The 9th Trondheim Conference on Co² capture and storage took place in Norway on June 12-14th 2017. The biannual conference has grown to become one of the leading scientific CCS technology conferences and is now one of key meeting places for CCS experts from around the world.

With the world's CCS experts gathered together the **Europe-South Korea Joint Workshop on CCS research and Innovation** was held on 14-15th June at the Norwegian University of Science and Technology. (NTNU)

Under the European Commission's H2020 programme three CCS projects have received €12m in partial funding for their research. Each of the projects brings together a range of partners from Europe and South Korea to share ideas and lead innovation in some key areas of CCS research.

The three projects are:



NanoMEMC2 – NanoMaterials Enhanced Membranes for Carbon Capture



New process for efficient Co² capture by innovative adsorbents based on modified graphene aerogels and MOF materials.



Systematic Design and testing of Advanced Rotating Packed Bed Processes and Phase-Change Solvents for Intensified Post-Combustion Co² capture.

With sponsorship from CLIMIT and the Research Council of Norway the workshop was the first opportunity for the three CCS European / South Korea twinning project partners to meet, update on their progress and share ideas.



The CLIMIT Programme is Norway's national programme for research, development and demonstration of Co₂ capture and storage technology (CCS).



The Research Council of Norway serves as the chief advisory body for the Norwegian government authorities on research policy issues and distributes roughly NOK 9 Billion to research and innovation activities each year.

Carbon Capture and Storage – European Perspectives



The workshop was opened by Mr Peter Petrov from the Innovation and Networks Agency (INEA) of the European Commission.

INEA is responsible for turning the policies of the European Commission into action and manages the H2020 program which has a budget of over €5bn. The H2020 Energy Portfolio has a total budget in excess of €1.2bn of which >€1bn has been allocated to low carbon energy including the decarbonisation of fossil fuels and CCS technology.

Mr Petrov gave an update on EU policy and funding in relation to CCS with a target to reduce Greenhouse Gases by 40% as part of the 2030 Climate-Energy package. Fossil fuels will be used in Europe's power generation as well as in industrial processes for decades to come. A forward-looking approach to CCS for the power and industrial sectors is crucial for reaching Europe's 2050 climate objectives in a cost effective way and meet the commitments agreed at the World Climate Summit in Paris 2015.



One of the 10 priority actions within The European Commission's integrated SET-Plan is research and innovation in the area of CCS.



It is as part of this initiative that the three projects represented at the Trondheim workshop received their funding. It is the ultimate aim of INEA to enable zero emissions from fossil fuel , power plants and carbon intensive industries. More information on the work of INEA can be found at: <http://inea.ec.europa.eu>

About Horizon 2020



All three projects have received funding from the European Union's Horizon 2020 research and innovation programme. The H2020 LCE-24-2016 project supports the development of high potential novel technologies or processes for post and/or pre-combustion Co² capture.

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020). It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the laboratory to the market.

Coupling research and innovation, Horizon 2020 has its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

For more information:

<https://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>

A Restaurant with A View



The workshop opened with a welcome dinner for all participants at the top of the Tyholt Tower. At a height of 75m the restaurant rotates 360 degrees in an hour and gave spectacular views of Trondheim and the surrounding area and got the workshop off to a “flying start”.



H2020 International Co-operation – South Korea



International cooperation has always been a key feature of scientific research. Horizon 2020 is open to the world, allowing European researchers to cooperate with their counterparts around the world in H2020 projects. The area of Low Carbon Energy has been flagged as being particularly suitable for international cooperation and twinning activity has been endorsed by the South Korean Ministry of Science, ICT and future planning (MSIP)

The three CCS projects are actively cooperating with some of the leading research institutions in South Korea.

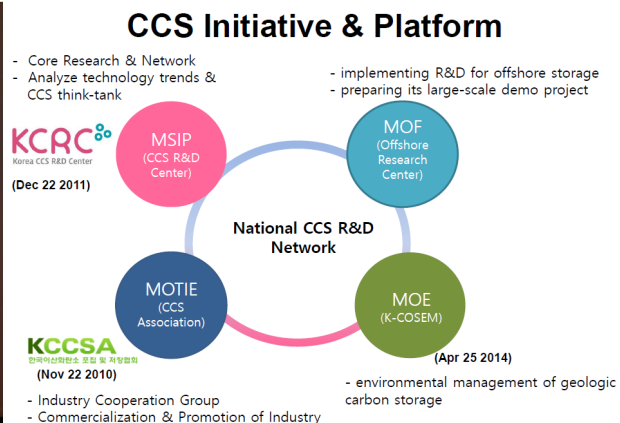
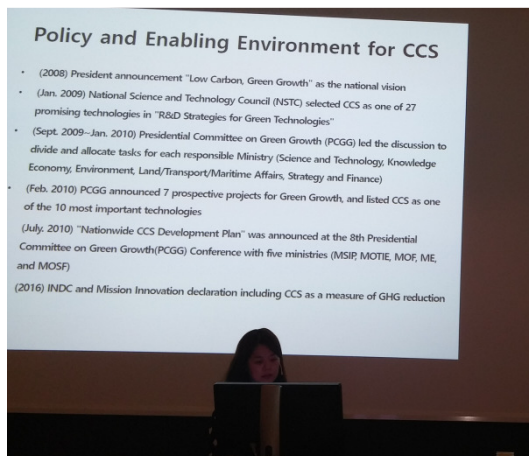


In addition, twinning activities will take place with:

Chonnam National University - Gwangju

Korea University – Seoul

South Korea – Current State of CCS



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Ms Hye Jin Lee from the Korea Carbon Capture and Sequestration R and D centre updated the workshop on the ambitious plans of South Korea in the development of CCS technology.

South Korea is the 11th largest economy in the world (Worldbank statistics 2016) but is the 9th largest energy consumer and the 7th largest producer of carbon dioxide emissions. The demand for electricity has grown annually by 4% since 2005 and 64% of electricity is produced from fossil fuels.

In 2008 the South Korean President acknowledged the need for change and announced “Low Carbon, Green Growth” as the national vision for future energy provision setting ambitious targets for Co² reduction by 2020.

This Korean CCS project has a budget of \$151m and employs 650 researchers from 40 institutions and places South Korea at the forefront of CCS development.

The initiative has over 30 projects developing new carbon capture technologies across wet and dry sorption and membrane technologies. A further 7 projects are developing geological storage techniques and sites within South Korea.

Not content with their ambitious plans to 2020 South Korea is now drafting a revised National CCS master Action Plan to 2030 with the aim of leading global CCS development.

South Korea has set the demanding objectives of a 150MW large scale integrated capture and storage system in place by 2025 and a 500MW system in place by 2029.

Project Overviews and Objectives

Rolincap



The Rolincap Partners



CHALMERS



CERTH

CENTRE FOR RESEARCH & TECHNOLOGY HELLAS



The University Of Sheffield.



Newcastle University



Gwangju Institute of Science and Technology

KAIST



elpeidison

COWI



ROLINCAP will search, identify and test novel phase-change solvents, including aqueous and non-aqueous options, as well as phase-change packed bed and Rotating Packed Bed processes for post-combustion CO² capture. These are high-potential technologies, still in their infancy, with initial evidence pointing to regeneration energy requirements below 2.0 GJ/ton CO² and considerable reduction of the equipment size, several times compared to conventional processes.

These goals will be approached through a holistic decision making framework consisting of methods for modelling and design that have the potential for real breakthroughs in CO² capture research. The tools proposed in ROLINCAP will

cover a vast space of solvent and process options going far beyond the capabilities of existing simulators.

ROLINCAP follows a radically new path by proposing one predictive modelling framework, in the form of the SAFT- γ equation of state, for both physical and chemical equilibrium, for a wide range of phase behaviours and of molecular structures. The envisaged thermodynamic model will be used in optimization-based Computer-aided Molecular Design of phase-change solvents in order to identify options beyond the very few previously identified phase-change solvents.

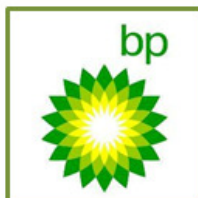
Advanced process design approaches will be used for the development of highly intensified Rotating Packed Bed processes. Phase-change solvents will be considered with respect to their economic and operability RPB process characteristics. The sustainability of both the new solvents and the packed-bed and RPB processes will be investigated considering holistic Life Cycle Assessment analysis and Safety Health and Environmental Hazard assessment. Selected phase-change solvents, new RPB column concepts and packing materials will be tested at TRL 4 and 5 pilot plants. Software in the form of a new SAFT- γ equation of state will be tested at TRL 5 in the gPROMS process simulator.

The ROLINCAP project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 727503.

NANOMEMC2



The NANOMEMC2 Partners



Membrane separation processes can be applied to many capture processes from Pre-Combustion (CO₂-H₂ / CO₂-CH₄ separation) to Post-Combustion (CO₂-N₂) and Oxyfuel (O₂-N₂) and are generally endowed with high flexibility and potentially low operative costs with respect to other capture methods. However the current materials are still lacking of separation performance and durability suitable for an efficient and economically feasible exploitation of such technology.

The Project NANOMEMC2 aims in overcoming the current limitation focusing on the development of innovative CO₂ selective membranes with high flux and selectivity suitable for application to both Pre and Post-combustion Capture processes.

To that aim nanocomposite or mixed matrix membranes will be considered with particular focus on facilitated transport mechanisms promoted by carrier attached to the polymer or the filler. Graphene based nano-sheets and cellulose nano-fibres will be studied in detail considering their possible modification to improve polymer compatibility and affinity with Co².

A new generation of Facilitated Transport Mixed Matrix (FTMM) membranes for CCS applications will be developed with increased CO₂ flux and selectivity beyond the current target for industrial deployment of carbon capture membrane technologies.

The NANOMEMC2 project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 727734.

GRAMOFON



The GRAMOFON partners



Global warming resulting from the emission of greenhouse gases has received widespread attention with international action from governments and industries, including a number of collaborative programs, such as SET-Plan, and very recently the International Climate Change hold 2015 in Paris.

Key European Commission roadmaps towards 2030 and 2050 have identified Carbon Capture and Storage (CCS) as a central low-carbon technology to achieve the EU's 2050 Greenhouse Gas (GHG) emission reduction objectives, although there still remains a great deal to be done in terms of embedding CCS in future policy frameworks.

The selective capture and storage of CO² at low cost in an energy-efficient is a world-wide challenge. One of the most promising technologies for CO₂ capture is adsorption using solid sorbents, with the most important advantage being the energy penalty reduction during capture and regeneration of the material compared to liquid absorption.

The key objectives of GRAMOFON projects are:

(i) to develop and prototype a new energy and cost-competitive dry separation process for post-combustion CO₂ capture based on innovative hybrid porous solids Metal organic frameworks (MOFs) and Graphene Oxide nanostructures.

(ii) to optimize the CO₂ desorption process by means of Microwave Swing Desorption (MSD) and Joule effect, that will surpass the efficiency of the conventional heating procedures.

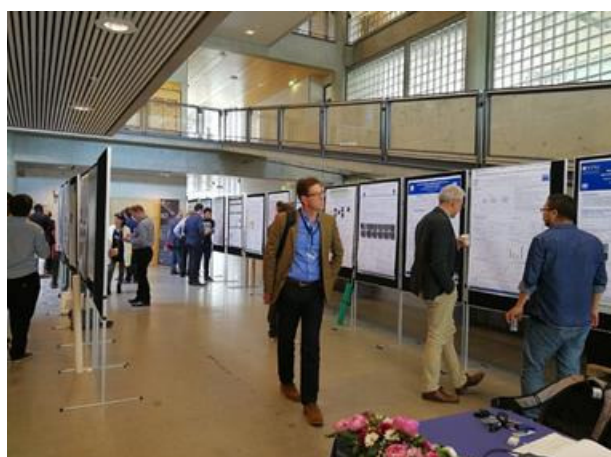
This innovative concept will be set up by world key players expert in synthesis, adsorption, characterization and modelling, as well as process design and economic projections.

The GRAMOFON project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 727619

Poster Session

The workshop concluded with an interactive poster session which allowed partners from all projects to present in more detail progress in all work packages to the other projects and Korean partners.

The workshop highlighted the scale and ambition of all three projects and also the significant progress that has been made in a relatively short space of time.



Contact the Projects

To request more information on any of the H2020 2016 LCE projects please contact the following partners:

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What's Next.....

A second Europe-South Korea joint workshop on CCS is now being planned which is likely to take place in 2018. Details are still being finalised but register your interest with one of project partners above to receive detailed information as soon as it is available.

And Finally.....Trondheim Did You Know

As the largest university in Norway, the [Norwegian University of Science and Technology](#) (NTNU) is the host of some 36,000 students.

Trondheim boasts the northern most [tramway](#) line in the world

[Trøndelag Teater](#), is situated in Trondheim. Built in 1816, the theatre is the oldest theatre still in use in Scandinavia

Trondheim's [Adresseavisen](#) is the oldest active newspaper in Norway, having been established in 1767.

Trondheim is twinned with..

Graz – Austria

Split – Croatia

Darmstadt – Germany

Tampere – Finland

Norrköping – Sweden

Odense – Denmark

Dunfermline – Scotland

Vallejo - US

And.....Trondheim boasts the world's only bicycle lift, [Trampe](#).