

# Greenhouse News

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## GHGT-12 Seeks Sponsors, by Toby Aiken, IEAGHG



It is a pleasure to announce that the 12<sup>th</sup> event in the Greenhouse Gas Control Technologies conference (GHGT) series will be held in Austin TX, USA, between the 5<sup>th</sup> and 9<sup>th</sup> of October 2014.

The GHGT conference series has established itself as the principal international platform for exhibiting and discussing new greenhouse gas mitigation technologies. This series has become a focal point for international research on CO<sub>2</sub> Capture and Storage (CCS).

The GHGT conference series is a non-profit event that traditionally attracts significant government and industrial sponsorship. We are now inviting key companies and organisations in CCS to join in sponsoring the conference.

As well as providing exposure at the conference for your organisation, supporting this prestigious international conference will help in advancing the understanding, development and deployment of CCS.

Funding for the GHGT-12 meeting will come from two major sources: sponsors (Platinum, Gold and Silver) and delegate fees. For Platinum and Gold sponsors, we offer the option of 'add-ons' so they can sponsor individual items or events related to the conference. Sponsor add-on items will be identified throughout the planning for the conference, but examples of sponsored items are: badge lanyards, registration desks, lunches and conference dinner sponsorship. The individual costs for these items are negotiable, and should be discussed on an individual basis with the conference organisers.

Anyone wishing to discuss sponsorship of the conference should approach Gary Rochelle through the following email: [gtr@che.utexas.edu](mailto:gtr@che.utexas.edu), in the first instance. ●

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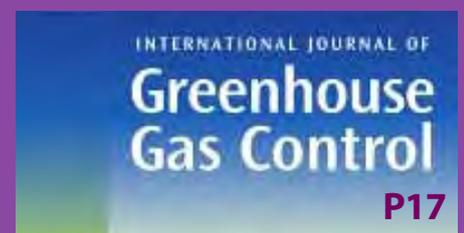
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# PCCC2 Conference, by Prachi Singh, IEAGHG

Following the success of the 1<sup>st</sup> Post Combustion Capture Conference (PCCC1) in Abu Dhabi, 2011 and the 12 International Post Combustion Capture Network workshops held during the period 2000 - 2009, IEAGHG is proud to announce that the PCCC2 Conference is to be held on 17<sup>th</sup> - 20<sup>th</sup> September 2013 at the Hotel Grand Terminus, Bergen, Norway.

On the 17<sup>th</sup> September, as part of the conference, there will be a special session entitled "Milestone Mongstad" which will celebrate the 1 Year Anniversary for the Technology Centre Mongstad's (TCM) CO<sub>2</sub> Capture Demonstration projects.



CO<sub>2</sub> Post Combustion Capture Pilot Plant located at CO<sub>2</sub> Technology Centre Mongstad, the world's largest facility for testing and improving CO<sub>2</sub> capture

There will also be Keynote speakers at PCCC2 who are experts from the field of CO<sub>2</sub> capture. These will be as follows:

- Tore Amundsen, CEO, Gassnova, Norway
- Dr. Paul Feron, Research Program Leader, CSIRO, Australia
- Dr. Paitoon Tontiwachwuthikul, Professor, University of Regina, Canada

On the 20<sup>th</sup> September 2013, there will also be a site visit to the CO<sub>2</sub> Post Combustion Capture Pilot Plant which is located at TCM.

Registration for the conference is now open. Please visit the following website for more information and to register: [www.ieaghg.org/index.php?/2nd-post-combustion-capture-conference.html](http://www.ieaghg.org/index.php?/2nd-post-combustion-capture-conference.html) ●

## IEAGHG Summer School, by Siân Twining, IEAGHG

The 21<sup>st</sup> - 26<sup>th</sup> July will see 34 experts from both academia and industry attend the 2013 IEAGHG International CCS Summer School in Nottingham. The experts will present during the week alongside mentoring the students throughout their group work – a sizeable but enjoyable task that encourages team work and thinking outside the box.

The 60 students from 24 countries will also benefit from the attendance of the two best students from last year's Summer School who will act as student mentors throughout the week. As relief from the classroom, on the Wednesday of the School, the whole group will visit the British Geological Survey



The University of  
Nottingham

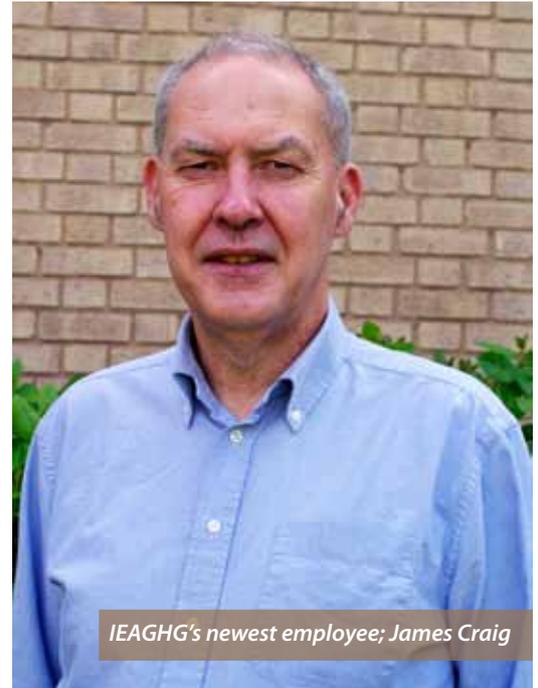
Laboratories, E.ON Ratcliffe Technology Centre, PACT facilities and the Health and Safety Laboratory giving an insight into capture, transport and storage issues to support the learning and work done throughout the week.

To round off the week, the students will present their group work to all, which will be assessed by the expert mentors, followed by an award presentation for the best group and best students (based on input throughout the School and on their group work effort) during the well-earned dinner on the Friday. Students will travel home on the Saturday with a new network of both student and expert contacts, an extensive overview on CO<sub>2</sub> Capture and Storage, new friends and great memories. ●

After 6 years with us, Toby Aiken is now moving on to start his own graphics and design company, Digital Creative. Please have a look at his website: [www.digital-creative.co.uk](http://www.digital-creative.co.uk)

Millie Basava-Reddi will also be leaving us in September to start a PhD at Bristol University. We wish them both all the best in their new careers.

On a positive note, we have recruited a new senior geologist, James Craig, who was formerly employed at AEAT in the United Kingdom. He comes to us with a wealth of experience primarily on geothermal energy but he also has experience on other renewable energy options such as tidal power. James has already attended his first international network meeting, the Joint Monitoring and Risk meeting in Trondheim, Norway and I am sure will be a regular participant at our networks and conferences in the years to come. Welcome James, we hope you will enjoy working at IEAGHG. ●



IEAGHG's newest employee; James Craig

## Lifetime award for Dr. Tore Torp, by Philip Ringrose

During an international workshop of the IEA Greenhouse Gas R & D Programme, held at Statoil RDI, Rotvoll, Trondheim, Tore Andreas Torp received an award in special recognition of his lifetime contributions and achievements in progressing greenhouse gas reduction from fossil fuels through carbon dioxide capture and storage.



Tore Torp receiving his lifetime award

The award was presented to Tore by Tim Dixon, Manager of the IEAGHG CCS and Regulatory Affairs programme, on behalf of John Gale, General Manager, IEAGHG.

Dr. Tore Torp has championed the cause of CCS since the start of the world-pioneering Sleipner CO<sub>2</sub> project in 1996, and is recognised around the world for his contributions.

In presenting the award, Tim Dixon described Tore as the famous Viking who spread CCS throughout the world, a bit like the famous Vikings of the past. Tore was delighted with the award and described the early days of CCS and the steady growth in the science and technology of carbon dioxide capture and storage.

The IEAGHG Joint Network meeting held in Trondheim, 10<sup>th</sup> - 13<sup>th</sup> June 2013 and hosted by Statoil, brings together 60 international experts in the field of modeling and risk management of CO<sub>2</sub> Storage, and was chaired by Tim Dixon of the IEA Greenhouse Gas R & D Programme.

In the previous week, Tore Torp also received the NTNU/ Sintef research prize for CCS at the 7<sup>th</sup> Trondheim CCS Conference (TCCS-7), June 4<sup>th</sup> - 6<sup>th</sup>, 2013. ●

# 43<sup>rd</sup> ExCo, by Samantha Neades, IEAGHG

The 43<sup>rd</sup> IEA Greenhouse Gas R&D Programme Executive Committee (ExCo) meeting was held on the 7<sup>th</sup> – 9<sup>th</sup> May 2013, in downtown Regina, Canada. Hosted by Canada and PTRC, this meeting was the bi-annual chance for the Programme to update members with activities throughout the past 6 months and to discuss future endeavours within the Programme.

The meeting involved two days of fruitful discussions, plus an exciting site visit to Boundary Dam on one day and a CCS Symposium on another.

Studies discussed by Members included those on shale gas, the CCS cost network, the CO2RISKMAN project, CO<sub>2</sub> migration mitigation options, developments on incorporating future change in existing capture plants, a review of non-CO<sub>2</sub> gases and biomethane and CCS – among many others!

Other activities discussed included the International IEAGHG CCS Summer School and various conferences run by the Programme, including the hugely successful GHGT series, OCC and PCCC series.

Members approved the undertaking of future technical studies including:

- Evaluation for Various Process Control Strategy for Normal and Flexible Operation of Post Combustion Capture;
- Energy Storage and CCS;
- Oxy Gas Turbine Power Plants;
- Evaluation of CO<sub>2</sub> Adsorption Process in Natural Gas;
- Techno-Economic Evaluation of the Potential CO<sub>2</sub> Capture Application in Pulp and Paper;
- Others were also approved subject to some 'fine-tuning' prior to the next ExCo meeting.

The next IEAGHG Executive Committee meeting will be hosted by Sweden and held in Stockholm on the 2<sup>nd</sup> and 3<sup>rd</sup> October 2013. ●

## New IEAGHG Report: Briefing Notes on CCS Elements Now Available, by Toby Aiken, IEAGHG

CO<sub>2</sub> Capture and Storage (CCS) is becoming more visible to the general public and as such, more and more stakeholders are taking an interest as the technology progresses from pilot scale to larger demonstration and commercial scale initiatives. With this increase in visibility and the increased focus of many groups of interested parties, it is important that there is a repository of information accessible by all stakeholders and interested parties to allow them to learn about the subject and its intricacies without having to try to comprehend verbose and lengthy reports and scientific papers.

Recognising this need, IEAGHG invited tenders from key organisations and research bodies around the world who were felt to have the capability to extract this information from IEAGHG's library of reports and from other sources, and present it in a plain and accessible way, without reverting to excessive technical jargon. The successful tender was a consortium bid from the University of Edinburgh, Scottish Centre for CCS and CSIRO in Australia.

### Perceptions

During the course of the focus groups and other stakeholder meetings, it became clear that there are perceptions of CO<sub>2</sub> that are not true, and often misconceptions. The result of this finding was the introduction of a briefing note to set the scene for CCS. The following is a brief run through of the perceptions that were commonly held.

### CO<sub>2</sub>

In general perceptions of CO<sub>2</sub>, what it is, what are its effects, and other characteristics were limited among most respondents. There were some misconceptions that relate to CO, and this represents a potential issue – in many cases, asking local residents to accept CO<sub>2</sub> pipelines or capture and storage activities requires them to remember chemistry lessons that may have taken place a long time previously, and have been not required since. Very few respondents could list any commercial uses of CO<sub>2</sub>, and perceived it as having no commercial value.

### CCS

The perceptions of CCS show great variety, largely depending on the location of the sample group and the propensity of CCS projects proposed, accepted or rejected in the local vicinity. Among those who had heard of CCS, the major knowledge gaps tended to be in terms of the maturity of the technology, and that it was being proposed as an alternative to renewable energy, efficiency improvements etc, and this can easily be addressed by

defining the scenarios described by the IEA Energy Technology Perspectives, and that in fact all options will be required in order to mitigate the effects of anthropogenic climate change.

- **‘What is CO<sub>2</sub>?’** With so many perceptions about CO<sub>2</sub> being misconceptions, it was decided to start with a very short briefing note, describing the physical properties of CO<sub>2</sub>, clarifying the difference between CO<sub>2</sub> and CO. Due to the introductory nature of this BN, it is much shorter than the others, and will be a first step in the public engagement process.
- **‘Setting the Scene for CCS: Human Caused Climate Change.’** This explains the need for CCS, briefly going into the basics of climate change science, and the effect greenhouse gasses (GHG) have on the earth’s climate. It also explains the carbon cycle and the dramatic increase in GHG emissions over recent decades and the reasons we need to act.
- **‘A Brief History of CCS Development and its Current Status.’** Explaining the different type of CCS project, this note goes back to the historical development of the CCS technology in general, as well as explaining the scale and number of projects required. Enhanced Oil Recovery is also contained within this note.
- **‘From Sources to Stores; Matching Sources of CO<sub>2</sub> with Potential Storage Sites.’** This note explains the need to match sources to sinks, taking into account transport and infrastructure elements, and addresses storage capacity as well.
- **‘How is CO<sub>2</sub> Captured?’** Now that the scene has been set, the history has been defined and the need explained, this briefing note explains the different options for CO<sub>2</sub> capture, and their relative merits and developmental progress. It also touches on the energy penalty and briefly mentions the costs of capture.

- **‘The Costs of CCS.’**

Following on from the capture briefing note, this note goes into more detail on costs, explaining the uncertainties and expressing that costs will reduce over time, and compares these to other options for energy generation.

- **‘What Infrastructure is Needed for the Transport of CO<sub>2</sub>?’** This note explains the history and record of gas transport by pipeline, and also covers transport by ship, before explaining the possibility of reuse of existing infrastructure.
- **‘Carbon Dioxide Naturally Occurring Underground’** Addressing natural sources of CO<sub>2</sub>, both volcanic and sedimentary in origin, this note tackles the subject of leakage incidents from natural stores such as Lake Nyos. While this is an emotive and possibly controversial aspect, we felt that this couldn’t be ignored as there is a great deal of information available, and the focus groups concluded that clarity must be maintained.
- **‘Storage & Site Integrity’** This note explains that site selection is a very involved process, and all sites selected will be verified as suitable for storage, and explains the role of caprocks, and storage mechanisms.
- **‘Impacts of Leakage Onshore’** This note explains the likely effects of leakage from an onshore storage location, both on people and flora and fauna. It also explains that technologies exist to detect and mitigate leaks.
- **‘Impacts of Leakage Offshore’** Similar to the previous note, this note is focussed on the same topics for offshore storage, sub-seabed storage.
- **‘Monitoring: Safe Storage of CO<sub>2</sub>’** An important topic, this note explains that there are a multitude of technologies and tools available to monitor the CO<sub>2</sub> both during injection and after to ensure that the injected CO<sub>2</sub>

remains where it is intended, and that methods are also available to fix and remediate leaks if they do occur.

- **‘Legal Issues of CCS’** The legal aspects were summarised in this BN, and it addresses the classification of CO<sub>2</sub>, the permanence of storage, ownership issues, and the different laws being established around the world.
- **‘What do the public think about CCS?’** This note examines the issues that have most frequently come up when dealing with the public and CCS projects, and looks at how we can learn from these interactions to improve the communication between operators and local residents.

### Conclusions

The series of interviews and focus groups that were held covered a wide range of stakeholders, and allowed the contractor to determine the information needs for the set of Briefing Notes. The needs that were defined were all subjects that are covered within the IEAGHG technical study library, and this study has served to extract the key messages and communicate them in a non-technical manner that should prove accessible to interested parties and stakeholders alike.

The report and Briefing Notes can be accessed via the technical reports page of the IEAGHG website which can be found at: [www.ieaghg.org](http://www.ieaghg.org) under report number 2013-07. ●

# Regulatory Gaps Being Overcome At Project Level CO<sub>2</sub> Capture Project Releases Latest Report

The CCP has made available findings from its latest CCS regulatory study, *Regulatory Challenges and Key Lessons Learned from Real-World Development of CCS Projects*. The study shows that pathways do exist for regulatory approvals of CCS projects and that gaps and barriers in regulatory frameworks are being overcome.

The study focuses on CCS projects that have undergone, or progressed significantly through, the regulatory process. Eight CCS case studies from Australia, Canada, Europe and the US were considered as part of this study. Interviews with both project developers and regulators highlighted lessons learned from experience of the regulatory approval process.

Arthur Lee, CO<sub>2</sub> Capture Project Policy & Incentives Team Lead, comments: "We've seen the slow development of policy and regulatory developments across the world, with many gaps remaining. But encouragingly, our interviews with project developers showed that, on the ground, they are working with regulators to find a practical way forward."

The report is available to download at [www.co2captureproject.org](http://www.co2captureproject.org)

The CCP is a partnership of major energy companies, working to advance the technologies that will underpin the deployment of industrial-scale CO<sub>2</sub> capture and storage. Since its formation in 2000, the CCP has undertaken more than 150 projects to increase understanding of the science, economics and engineering applications of CCS. Currently in its third phase of activity (CCP3) its members are BP, Chevron, Eni, Petrobras, Shell and Suncor.

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## Press Release: Four energy policies can keep the 2 °C climate goal alive

*IEA report shows how to stop growth in energy-related emissions by 2020 at no net economic cost*

Warning that the world is not on track to limit the global temperature increase to 2 °C degrees Celsius, the International Energy Agency (IEA) on Monday urged governments to swiftly enact four energy policies that would keep climate goals alive without harming economic growth.

"Climate change has quite frankly slipped to the back burner of policy priorities. But the problem is not going away – quite the opposite," IEA Executive Director Maria van der Hoeven said in London at the launch of a World Energy Outlook Special Report, *Redrawing the Energy-Climate Map*, which highlights the need for intensive action before 2020.

Noting that the energy sector accounts for around two-thirds of global greenhouse-gas emissions, she added: "This report shows that the path we are currently on is more likely to result in a temperature increase of between 3.6 °C and 5.3 °C but also finds that much more can be done to tackle energy-sector emissions without jeopardising economic growth, an important concern for many governments."

New estimates for global energy-related carbon dioxide (CO<sub>2</sub>) emissions in 2012 reveal a 1.4% increase, reaching a record high of 31.6 gigatonnes (Gt), but also mask significant regional differences. In the United States, a switch from coal to gas in power generation helped reduce emissions by 200 million tonnes (Mt), bringing them back to the level of the mid-1990s. China experienced the largest growth in CO<sub>2</sub> emissions (300 Mt), but the increase was one of the lowest it has seen in a decade, driven by the deployment of renewables and improvements in energy intensity. Despite increased coal use in some countries, emissions in Europe declined by 50 Mt. Emissions in Japan increased by 70 Mt.

The new IEA report presents the results of a 4-for-2 °C Scenario, in which four energy policies are selected that can deliver significant emissions reductions by 2020, rely only on existing technologies and have already been adopted successfully in several countries.

“We identify a set of proven measures that could stop the growth in global energy-related emissions by the end of this decade at no net economic cost,” said IEA Chief Economist Fatih Birol, the report’s lead author. “Rapid and widespread adoption could act as a bridge to further action, buying precious time while international climate negotiations continue.”

In the 4-for-2°C Scenario, global energy-related greenhouse-gas emissions are 8% (3.1 Gt CO<sub>2</sub>-equivalent) lower in 2020 than the level otherwise expected.

- Targeted energy efficiency measures in buildings, industry and transport account for nearly half the emissions reduction in 2020, with the additional investment required being more than offset by reduced spending on fuel bills.
- Limiting the construction and use of the least-efficient coal-fired power plants delivers more than 20% of the emissions reduction and helps curb local air pollution. The share of power generation from renewables increases (from around 20% today to 27% in 2020), as does that from natural gas.
- Actions to halve expected methane (a potent greenhouse gas) releases into the atmosphere from the upstream oil and gas industry in 2020 provide 18% of the savings.
- Implementing a partial phase-out of fossil fuel consumption subsidies accounts for 12% of the reduction in emissions and supports efficiency efforts.

The report also finds that the energy sector is not immune from the physical impacts of climate change and must adapt. In mapping energy-system vulnerabilities, it identifies several sudden and destructive impacts, caused by extreme weather events, and other more gradual impacts, caused by changes to



## International Energy Agency

average temperature, sea level rise and shifting weather patterns. To improve the climate resilience of the energy system, it highlights governments’ role in encouraging prudent adaptation (alongside mitigation) and the need for industry to assess the risks and impacts as part of its investment decisions.

The financial implications of climate policies that would put the world on a 2 °C trajectory are not uniform across the energy sector. Net revenues for existing renewables-based and nuclear power plants increase by \$1.8 trillion (in year-2011 dollars) collectively through to 2035, offsetting a similar decline from coal plants. No oil or gas field currently in production would need to shut down prematurely. Some fields yet to start production are not developed before 2035, meaning that around 5% to 6% of proven oil and gas reserves do not start to recover their exploration costs. Delaying the move to a 2 °C trajectory until 2020 would result in substantial additional costs to the energy sector and increase the risk of assets needing to be retired early, idled or retrofitted. Carbon capture and storage (CCS) can act as an asset protection strategy, reducing the risk of stranded assets and enabling more fossil fuel to be commercialised.

The WEO Special Report Redrawing the Energy-Climate Map is available free to download at the IEA website. Accredited journalists who would like more information should contact [ieapressoffice@iea.org](mailto:ieapressoffice@iea.org).

### About the IEA

*The International Energy Agency is an autonomous organisation which works to ensure reliable, affordable and clean energy for its 28 member countries and beyond. Founded in response to the 1973/4 oil crisis, the IEA’s initial role was to help countries co-ordinate a collective response to major disruptions in oil supply through the release of emergency oil stocks to the markets. While this continues to be a key aspect of its work, the IEA has evolved and expanded. It is at the heart of global dialogue on energy, providing reliable and unbiased research, statistics, analysis and recommendations. ●*

# Press Release: CAPSOL consortium announces a new CO<sub>2</sub> capture research project



## *Design Technologies for Multi-scale Innovation and Integration in Post-Combustion CO<sub>2</sub> Capture: From Molecules to Unit Operations and Integrated Plants (CAPSOL)*

A European consortium has commenced a new EU-funded research project aimed at breakthrough innovation in solvent based post-combustion CO<sub>2</sub> capture. CAPSOL is carried out by a strong consortium comprising highly established research organisations and companies. All together there are 12 partners: the Centre for Research and Technology - Hellas (Greece) - the co-ordinator, the University of Manchester (UK), the University of Paderborn (Germany), the Imperial College of Science, Technology and Medicine (UK), the University of Pannonia (Hungary), the Swiss Federal Institute of Technology, Zurich (Switzerland), the National Technical University of Athens (Greece), Julius Montz GmbH (Germany), the Public Power Corporation S.A. (Greece), CaO Hellas Macedonian Lime S.A. (Greece), Process Design Center B.V. (The Netherlands) and Scottish Power Generation PLC (UK).

Capture and storage of CO<sub>2</sub> is a large-scale option for significant long-term emissions reduction. Even though several CO<sub>2</sub> capture

technologies have become available today, the high capital cost and the high energy penalty associated to them are significant barriers to their full commercial deployment. The CAPSOL project aims at overcoming such barriers through advances in the identification of highly performing solvents and solvent blends in CO<sub>2</sub> absorption, the design of innovative separation equipment internals, and the development of optimal and fully integrated process configurations. The results are expected to have a tremendous impact on gas-fired, coal-fired and lignite-fired power plants as well as quick-lime production plants, where solvent based post-combustion CO<sub>2</sub> absorption can emerge as a viable solution.

CAPSOL challenges the main-stream thinking in solvent-based post-combustion CO<sub>2</sub> capture by proposing advanced multi-scale computer-aided tools and systemic design methods to deliver innovative solvent options and intensified process systems, which will be validated through lab and pilot scale experiments and industrial applications.

The main steps towards the fulfilment of the project goals involve:

- The development of novel solvents with improved performance against the current state-of-the-art process based on

monoethanolamine (MEA) solutions assessed towards the satisfaction of relevant process, economic, operability and sustainability criteria.

- The development of innovative column equipment and internals for solvent-based CO<sub>2</sub> separations that enhance the efficiency of the absorption based separation.
- The integration of solvent-process CO<sub>2</sub> capture plants with optimally retrofitted CO<sub>2</sub> emitting plants including a supercritical lignite fired steam power plant, a modern supercritical hard-coal fired power plant, a natural gas fired combined cycle plant and a quicklime plant

The fulfilment of the projects objectives require the employment of computer-aided design methods and technologies along with laboratory and pilot plant experiments, leading to innovative techniques and procedures in areas as broad as computer-aided molecular design, integrated solvent and process design, conceptual and first-principles simulations, integrated process and control design and plantwide process integration.

Please see '[www.capsol-project.eu](http://www.capsol-project.eu)' for further information. ●

# Press Release: 8<sup>th</sup> CO<sub>2</sub> GeoNet Open Forum: European Developments on CO<sub>2</sub> Storage Pilots and International Research Collaboration



Researchers from all over Europe have met in Venice on 9<sup>th</sup> - 11<sup>th</sup> April 2013 to propose a scientific perspective on the way forward for the geological storage of CO<sub>2</sub> in Europe and discuss progress together with stakeholders.

Pilot projects have a key role for the advancement of CO<sub>2</sub> storage related research in Europe, which could bring a significant contribution to the innovation goals of the Horizon 2020 European programme. Further, the importance of pilot projects has been highlighted for the strategic developments they can offer, at a moment when large demo projects are facing delays. Pilot projects will also provide vital information to enable the wide deployment of CO<sub>2</sub> geological storage.

The climatologist Hervé Le Treut, member of the IPCC panel, explained that the climate change patterns which are presently observed do correspond to the changes anticipated by models since three decades. This makes it all the more important to act for the reduction of CO<sub>2</sub> emissions. "CCS can contribute 20% of the necessary reductions and combined with biomass energy it is the only carbon negative technology available" declared Nick Riley, Chair of CCS Europe General Assembly.

Unfortunately, the low value of carbon credits has undermined public efforts for supporting CO<sub>2</sub> capture and storage demonstration and increased the uncertainty in investment planning. In this situation storage pilots remain the place for different stakeholders to work together and further improve methodologies that can apply to specific geological aspects of storage sites: "Each site is unique and requires individual evaluation. European researchers are developing tools and sharing knowledge that will enable safe and reliable CO<sub>2</sub> storage in Europe" affirmed Isabelle Czernichowski-Lauriol, President of CO<sub>2</sub>GeoNet and Co-ordinator of the CCS Europe project. Store CO<sub>2</sub> in the underground may become, under conditions to be investigated, a resource for the future, suggested Lionel Perrette, representative of the French Ministry of Ecology. Within this forward looking perspective there is an important role for CO<sub>2</sub>GeoNet in explaining to the wider public what CO<sub>2</sub> geological storage is and why we need to achieve the urgent goal of first reducing CO<sub>2</sub> emissions in the atmosphere and in the second half of this century even reduce CO<sub>2</sub> concentrations, suggested Manfred Treber from Germanwatch.

A new paradigm for CO<sub>2</sub> storage public involvement was proposed by Samuela Vercelli, CO<sub>2</sub>GeoNet Executive Committee member: "People should not find themselves in the position to 'accept' a storage site. If given the possibility to identify and understand the advantages of storing CO<sub>2</sub> and hosting a storage site they will have their own reasons for doing it. Instead of looking for public acceptance, dialogue should be sought. Storage pilots can be an excellent opportunity to experience a dialogue approach with the population".

Many delegates expressed appreciation for the event for the high level of presentations, open discussions and opportunities for exchange.

Each year, the CO<sub>2</sub>GeoNet Open Forum offers a unique opportunity for stakeholders to meet and interact directly with Europe's largest group of researchers on CO<sub>2</sub> geological storage. Over 150 delegates from more than 30 countries have participated in the 2013 Forum. Academic experts, Research institutes, Industry leaders, Scientific journalists, Regulators, Representatives of the European Commission, of several government services, of international bodies and from civil society have participated in the debates and lectures offered during the three days of the agenda. Presentations will soon be available on the website.

Full details of the 8<sup>th</sup> CO<sub>2</sub>GeoNet Open Forum are available at: [www.co2geonet.eu](http://www.co2geonet.eu)

#### What is a storage pilot?

A storage pilot is a CO<sub>2</sub> injection into a geological formation of usually less than 0.1 Mt in order to perform research experiments on geological CO<sub>2</sub> storage

#### What is a CCS demo?

A CCS demonstration project has to implement the full chain of technologies for CO<sub>2</sub> capture, transport and storage at an industrial scale of several Mt of CO<sub>2</sub>, as a stepping stone to commercial deployment, e.g. on a power plant or a steel plant

#### What does carbon negative mean?

Carbon negative means extracting CO<sub>2</sub> from the atmosphere and storing it. In the context of CCS - CCS, this means using biomass as a fuel (the plants take CO<sub>2</sub> from the atmosphere), capturing the CO<sub>2</sub> from burning the biomass and storing that CO<sub>2</sub> in a geological formation, thereby removing CO<sub>2</sub> from the atmosphere. ●

# 2<sup>nd</sup> Annual ECO<sub>2</sub> Meeting, by Samantha Neades, IEAGHG

13<sup>th</sup> – 16<sup>th</sup> May 2013, Bergen, Norway

The second annual ECO<sub>2</sub> meeting was hosted by the University of Bergen in Norway, from the 13<sup>th</sup> to 16<sup>th</sup> May 2013 and was attended by 90 experts, all interested in an update on the project progress to date and next steps. Representatives from the 27 organisations involved in the ECO<sub>2</sub> consortium attended the meeting, along with those from additional organisations involved within the Scientific Advisory Board (SAB) and Stakeholder Dialogue Board (SDB). IEAGHG are involved in the SDB, the main role of which is to act as the project's stakeholder sounding board, providing general comments and specific advice where necessary.

The ECO<sub>2</sub> project is a 4 year undertaking that began in 2011 and is a Collaborative Project funded under the European Commission's Seventh Framework Programme. It aims to assess the risks associated with the storage of carbon dioxide (CO<sub>2</sub>) in offshore environments (so below the seabed). Little is known about the short-term and long-term impacts of CO<sub>2</sub> storage on marine ecosystems and the ECO<sub>2</sub> project will assess the likelihood and impacts of leakage on such ecosystems. The objectives of the project include investigating the likelihood of leakage from sub-seabed storage sites; to study the potential effects of leakage on marine ecosystems; to assess the risks of sub-seabed CO<sub>2</sub> storage; to develop a

comprehensive monitoring strategy; and to define guidelines for the best environmental practices in implementation and management of sub-seabed CO<sub>2</sub> storage sites.

The project is split into 7 work packages (WPs): integrity of the sedimentary cover; fluid and gas flux across the seabed; fate of emitted CO<sub>2</sub>; impact of leakage on ecosystems; risk assessment, economic and legal studies; public perception; and coordination and data management. The first four work packages form the scientific core of ECO<sub>2</sub>, with the latter three uses these studies to assess, analyse and disseminate the findings. The work packages are cross-cut with four themes (the 'cross-cutting themes', or CCTs) to support and strengthen the information flow between packages, providing products by integrating and evaluating the outcomes of the work packages. CCT1 will provide a comprehensive monitoring strategy (using contributions from WPs 1 – 4); CCT2 will integrate the various numerical models developed (WPs 1 – 5); CCT3 will foster international cooperation; and CCT4 will define guidelines for environmental best practices (drawing information from all work packages and cross-cutting themes).

For more information on the ECO<sub>2</sub> project, please visit: [www.eco2-project.eu/home.html](http://www.eco2-project.eu/home.html) ●

## Natural Gas CCS Networking Meeting,

by Robin Cathcart, UKCCSRC

Although CCS has historically mostly been considered in connection with coal utilisation, natural gas with CCS offers the potential to give the lowest cost per MWh for low-carbon electricity supply in many situations. The cost of CCS per tonne of CO<sub>2</sub> captured from a coal CCS power plant is likely to be lower, but gas plants with CCS only produce about half the amount of CO<sub>2</sub> per MWh for subsequent capture, transport and storage.

An informal discussion of this promising potential for natural gas CCS took place at a UKCCSRC networking reception at GHGT-11 in Kyoto, that led to an international natural gas CCS networking meeting in London on 30<sup>th</sup> - 31<sup>th</sup> May 2013 with approximately fifty delegates from over ten countries.



Attendees of the Meeting

After an initial presentation on drivers and incentives for gas CCS by Jeff Chapman, from the Carbon Capture and Storage Association, the first day's speakers focused on national contexts for gas CCS developments in the UK, China, Norway, Europe in general, Mexico and the USA respectively. There were perhaps surprisingly optimistic estimates for timings for some first gas CCS project final investment decisions: USA 2014/2015, UK and China in 2015, Norway 2016 and Mexico 2017-2020. Enhanced oil recovery was a significant factor in North American gas CCS plans, electricity price support in the UK and Norway.

On the second day John Davison described IEAGHG programme work on gas CCS before a series of presentations covering technical issues for gas turbine based CO<sub>2</sub> capture and novel gas capture technologies from CES technology, NET Power and Inventys/Howden respectively and also three talks on utility and consultant perspectives on gas CCS and capture readiness.

The meeting closed with a description of the world's first full chain gas power CCS pilot project at Lacq by Dominique Copin from Total.

The next network meeting will be hosted by Instituto de Investigaciones Electricas in Cuernavaca, Mexico, with planned dates of 11<sup>th</sup>- 12<sup>th</sup> February 2014. As well as updates on research and technology it is hoped that there will be news from proposed natural gas CCS projects, as these become more developed.

Presentations from the London meeting can be downloaded from: [www.ukccsrc.ac.uk/30-31-may-natural-gas-ccs-networking-meeting-london](http://www.ukccsrc.ac.uk/30-31-may-natural-gas-ccs-networking-meeting-london) For further information, including interest in participating in this network, please email: [ccs.network@ed.ac.uk](mailto:ccs.network@ed.ac.uk).

## UK Press Visits TCM



UK Journalists visiting the TCM site

On the 12<sup>th</sup> of June, the CO<sub>2</sub> Technology Centre Mongstad opened up its facility to journalists from some of the UK's leading energy, science and environment industry publications, enabling them to have a tour of the site and see the facility in action.

Present at the facility was Bill Spence, Head of CCS at Shell, who gave the journalists an executive briefing on the state of the global CCS landscape, and discussed the significance of TCM's role as the world's largest, functioning carbon capture test facility.

"The insights gathered through collaborations between industry and government, like this one at TCM, are central to supporting the development and wide-scale deployment of CCS, which is currently the only technology that could prevent the build-up of CO<sub>2</sub> in the atmosphere," said Bill.

Frank Ellingsen, Managing Director of TCM, also presented the results of the TCM's first year of testing and what the results mean for the industry, and discussed how the facility and these results is preparing the ground for widespread CCS deployments to combat climate change.

"The last year has brought new levels of certainty to expected capital expenditure and ongoing costs of CCS by establishing the viability of capture processes. These advancements have reduced the knowledge gap of CCS technological development. It's very exciting to see that off the back of these achievements, world-leading technologists are lining up to take advantage of the ongoing programme," said Frank.

The tour illustrated first hand to the journalists how CCS technology has the potential to transform fossil fuels into a low carbon energy source, and how the industry needs to take a proactive approach to advance and de-risk CCS technology in order to support policy and investment. ●

# IEAGHG and the World of Social Media,

by Becky Kemp, IEAGHG

IEAGHG has been continuing to grow in the realm of online social media. We have branched out into using Linked In and have found it a powerful tool with distributing news from around the world and from ourselves.

We are continuing to use both Facebook and Twitter as it means we are able to connect with a variety of different people.



## Linked In

For those who are unfamiliar with Linked In, it is a social networking website for people in professional occupations. It gives a user the ability to connect with people from around the world. We have created a group on Linked In (IEAGHG) and, even though we have not been using it for a substantial amount of time, we have found it an incredibly useful tool for sharing discussions and news with a wide audience from both our field of work and outside. Due to the fact that we can link it to both our Facebook and Twitter accounts, it saves a lot of time as when Linked In is updated; both the other two accounts are also.

Join us on Linked In at: [www.linkedin.com/groups/IEAGHG-4841998?trk=myg\\_ugrp\\_ovr](http://www.linkedin.com/groups/IEAGHG-4841998?trk=myg_ugrp_ovr)

## Facebook

We continue to use Facebook, but with the feed for discussions coming from Linked In.

Like us on Facebook at [www.facebook.com/pages/IEA-Greenhouse-Gas-RD-Programme/112541615461568?fref=ts](http://www.facebook.com/pages/IEA-Greenhouse-Gas-RD-Programme/112541615461568?fref=ts)

## Twitter

We continue to use Twitter, but with the feed for discussions coming from Facebook.

Follow us on Twitter at: <https://twitter.com/IEAGHG> ●

## EnBW's post-combustion capture pilot plant at Heilbronn (Germany), by Jasmin Kemper, IEAGHG

From 15<sup>th</sup> to 18<sup>th</sup> April 2013 I visited EnBW's amine scrubbing pilot plant at Heilbronn in Germany. After a warm welcome from Dr Sven Unterberger and his team, who are operating the pilot plant, I was invited to tour the facilities. The Heilbronn Combined Heat and Power Plant has a total electric output of 1010 MWel and also supplies 320 MWth for district heating. The boilers are equipped with state-of-the-art flue gas treatment systems such as DeNOx, ESP and wet FGD.

A flue gas slip stream of 1500 Nm<sup>3</sup>/h (representing about 0.05 % of the total flue gas volume of Unit 7) is taken downstream of the FGD and passed on to the CO<sub>2</sub> capture plant, which is designed to capture 300 kg CO<sub>2</sub>/h (or 7.2 t CO<sub>2</sub>/d) at a capture rate of 90%. The pilot plant was constructed by German engineering company atea Anlagentechnik GmbH as an "IP-free" design and started operation on 1<sup>st</sup> March 2011.

The layout includes a pre-scrubber that cools the flue gas to about 30°C and reduces the SO<sub>2</sub> concentration to a minimum by adding NaOH.

Both the pre-scrubber and absorber are made of polypropylene and contain random packing of polypropylene.

Due to structural requirements the absorber, which has a total height of about 40 m, is reinforced with glass-fibre plastics. The desorber in contrast is made of stainless steel with a random packing of stainless steel as well.



EnBW's combined heat and power plant at Heilbronn



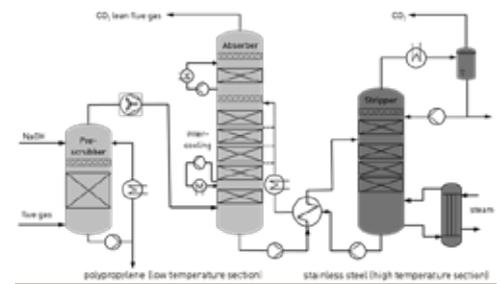
Middle part of the absorber



Bottoms installations with pumps, heat exchangers and intermediate storage tank for inter-cooling



Top of absorber with emission measurement facilities



Simplified process flow diagram of amine scrubbing pilot plant

published in the conference proceedings Energy Procedia.

For further information on the pilot plant please contact:

Dr Sven Unterberger  
[s.unterberger@enbw.com](mailto:s.unterberger@enbw.com)

During my stay there was a test campaign with 30 % MEA as a solvent in order to investigate the performance of the capture plant under different loads and dynamic load change conditions of the power plant. Another important issue that has been examined in parallel is the degradation of the solvent. In a preceding test campaign a sudden increase in inorganic and organic acid anions as well as dissolved metals after about 900 hours of operations was observed. This was accompanied by a typical discoloration of the solvent that is frequently reported

for MEA in the literature. In order to address the solvent degradation issue and minimise the concentration of degradation products EnBW is currently testing different reclaiming technologies at the pilot plant. From this, a solvent management system will be developed and approved.

Results of the first year's testing programme were presented at GHGT-11 and will be soon

# 6<sup>th</sup> IEA CCC Conference on Clean Coal Technologies, 12<sup>th</sup> - 16<sup>th</sup> May, Thessaloniki, by Debo Adams, IEA CCC



Attendees of the IEA CCC Conference

Attendance was slightly down for CCT2013, but this reflects the state of the global economy rather than the quality of the event. CCT2013 easily maintained the high standard set by previous conferences in the series.

About 140 delegates from 28 countries attended the Conference in the ancient Greek city of Thessaloniki. It was a broad programme: there were sessions on carbon capture including oxyfiring, pre-combustion and post-combustion carbon capture; combustion; gasification; cofiring; mercury; emissions and their control; low rank and low grade coals; coal characterisation; coal preparation

and upgrading; underground coal gasification; and international perspectives.

Presentations at CCT2013 reinforced the view that there is a massive need for coal-fired power generation, and major efforts are underway to make it cleaner. The importance of RD&D was highlighted in Thessaloniki. There was an emphasis on carbon capture, as at previous CCT events, but at this conference there were more papers on other aspects of coal use and various ways to reduce emissions which reflects the slow take-up of CCS.

Didier Houssin (IEA) gave the opening plenary and updated the audience on the work of the IEA. As he pointed out, the demand for coal is still increasing and the share of non-fossil



Meliti power plant, site visit of CCT2013

fuel generation has failed to keep pace with that of fossil fuels. He stressed that demand for energy is growing and that greater efficiency is possible. Increasing the global average efficiency of the coal-fired fleet could have a substantial impact on reducing emissions of CO<sub>2</sub>.

Other plenary lectures were delivered by Dr Ibrahim Gulyurtlu (LNEG, Portugal), Dr Peter Redlitch (Department of Primary Industries, Australia) and Dr Marion Wilde (European Commission, Belgium). According to Dr Redlitch there is 430 bt lignite in Victoria, and about 2 bt has been used in the last 90 y. As a result of the Energy Technology Innovation Strategy significant sums of money have been given to pre-commercial technologies such as the Otway Brown Coal Innovation Australia, CO2CRC Otway Basin CCS pilot project

and the CarbonNet Project which has identified a good potential for carbon storage in Victoria. Currently the potential for a large-scale multi-user CCS network in Gippsland is being investigated. Dr Wilde described the EU Energy Roadmap which shows that CCS is needed for the long term future of coal in the EU.

There were many papers on developments in oxycombustion, pre- and post-combustion capture of CO<sub>2</sub>. There were also interesting papers on a wider range of topics such as binding coal and biomass to make briquettes for cofiring, energy issues for Mongolia, the state of play in underground coal gasification, emissions control, efficiency improvements and how to reduce mercury emissions.

In conclusion, as Dr Topper said in his wrap-up speech, the 'EU is tickling CCS rather than tackling it'. Research on CCS has made good progress and isn't holding back commercial use of the technologies – rather the finance and legislation is not in place. So it's even more vital that a broad range of work continues to reduce emissions from coal-firing and to improve its efficiency. CCT2015 will take place in May 2015 in Krakow, Poland.

For more information about the IEA Clean Coal Centre, its publications, events and webinars, visit [www.iea-coal.org](http://www.iea-coal.org). IEA CCC reports can be downloaded at no charge after a one-off registration if you are resident in a member country or an employee of a sponsoring organisation. ●

## International Journal of Greenhouse Gas Control Impact Factor, by John Gale, Editor in Chief, IJGCC

2012 Impact Factor			
Cites in 2012 to articles published in:	2011 = 542	Number of articles published in:	2011 = 192
	2010 = 653		2010 = 111
	Sum: 1195		Sum: 303
Calculation: <u>Cites to recent articles</u>	<b>1195 = 3.944</b>		
	Number of recent articles 303		
2011 Impact Factor			
Cites in 2011 to articles published in:	2010 = 531	Number of articles published in:	2010 = 111
	2009 = 440		2009 = 79
	Sum: 971		Sum: 190
Calculation: <u>Cites to recent articles</u>	<b>971 = 5.111</b>		
	Number of recent articles 190		
2010 Impact Factor			
Cites in 2010 to articles published in:	2009 = 195	Number of articles published in:	2009 = 79
	2008 = 356		2008 = 56
	Sum: 551		Sum: 135
Calculation: <u>Cites to recent articles</u>	<b>551 = 4.081</b>		
	Number of recent articles 135		

*Calculations used for the past three impact factors, and the results of the calculations*

The 2012 Impact factors were recently released and the IJGCC now has an impact factor of 3.944. While this is lower than last year, the reasons for this are due to the calculation method. While we received more citations in 2011/2010 than 2009/2010, we also published around double the amount of papers, hence the lower relative impact factor.

This is still a great impact factor, and one to be proud of. Another contributing factor was the loss of a few of the very highly cited 2009 papers which affected the top line numbers.

The other GHG related Journal has just received its first IF this year, and they have come in at 2.679.

Ranking wise, IJGCC is still in the Q1 quartile, though the ranking has moved from 6 last year to 12 this year. The image above shows the calculations used for the past three impact factors, and the results of the calculations.

3.944 is an impressive result with the increase in published papers, and Elsevier and IEAGHG are justly proud of the IF and the continued success of the IJGCC. ●

# Conferences & Meetings

This is a list of the key meetings IEAGHG are holding or contributing to throughout 2013. Full details will be posted on the networks and meetings pages of our website at [www.ieaghg.org](http://www.ieaghg.org).

If you have an event you would like to see listed here, please email the dates, information and details to: [becky.kemp@ieaghg.org](mailto:becky.kemp@ieaghg.org).

Please note that inclusion of events in this section is at the discretion of IEAGHG.

## Summer School

21<sup>st</sup> - 26<sup>th</sup> July, Nottingham, UK

## Combined Monitoring & Environmental Research Network Meeting

26<sup>th</sup> - 30<sup>th</sup> August, Canberra, Australia

## 5<sup>th</sup> High Temperature Solid Looping Network Meeting

2<sup>nd</sup> - 3<sup>rd</sup> September; University of Cambridge, UK

## OCC3

9<sup>th</sup> - 13<sup>th</sup> September; Leon, Spain

## PCC2

17<sup>th</sup> - 19<sup>th</sup> September; Bergen, Norway



## Greenhouse News

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