Greenhouse News

• the official newsletter of IEAGHG and its members •

June 2016 • Issue 122

GHGT-13 Technical Programme, by Siân Twinning, IEAGHG

IEAGHG are very pleased to have announced the technical programme for GHGT-13, which can be found on our website at www.ghgt.info/. Almost 1,000 abstracts have been accepted for presentation at the conference, with 341 as oral presentations in 7 parallel sessions. Over 600 abstracts will also be presented in the poster session. All papers (either presented orally or as a poster) will be published in the conference proceedings.

Getting the programme out on time (by the 1st of June) involved a mammoth effort by the Expert Review Panel, Technical Advisory Group and of course the Technical Programme Committee. Over 2,500 individual reviews and comments were considered during the process. We are extremely grateful to everyone who gave their time and effort to ensure this conference will again be the foremost global CCS event.

A taster of what the programme has to offer can be seen in the overview, with 71 sessions covering both technical and non-technical aspects of CCS, there truly is something for everyone (Please see overleaf for this table).

With the new and improved abstract submission facility we have used this year comes a few more toys. The full agenda can be viewed and by clicking on the session title the content and abstracts can also be accessed. It is also possible to view a list of the nominated presenting authors and read their abstracts and, once submitted, the full paper.

In this issue

A	B	C	D	E	F	G
Solvent and configuration modelling	Trapping Mechanisms I	Demonstration Projects I	Transport: Safety and CO2 Quality	Industrial Sources: Technology and Costs	Geomechanics I	Oxy-combustion I
Amine Aerosols	Trapping Mechanisms II	Demonstration Projects II	Transport: Networks, Logistics and Costs	Industrial Sources: Advances in Cement Capture Technologies	Environmental Impacts of Geological Storage	Oxy-combustion II
Amine Degradation	Risk Assessment for Geological Storage	Panel Discussion	Other Storage	Capture in Industry	Geomechanics II	Membranes
Liquid Biphasic Solvents	Wellbore Integrity	Panel Discussion	CCS and Global Climate Policies	Negative Emissions I	Injectivity	Calcium Looping
Alternative Solvents	Geological Site Characterisation	Panel Discussion	CCS and National Energy and Climate Policies	CO2-EOR: Lab & Field Studies	Monitoring - deployment of time lapse seismic	Chemical looping combustion I
Amine Pilot Testing	Geological Storage Case Studies I	Panel Discussion	Capture System Studies I	CO2-EOR: Simulation, Economic & Offshore Case Studies	Monitoring Leakage - Near Surface	Chemical Looping Combustion II
Pilot Testing -TCM	Geological Storage Case Studies II	Panel Discussion	Deployment at National and Regional Scales	CO2 and Geothermal Energy	Modelling CO2 Storage I	Solid Sorbents I
Capture Pilot and Demonstration Projects	Storage - Field Monitoring	Panel Discussion	Quantifying Impacts and Benefits- LCA	CO2 for Geothermal and Water Management	Modelling CO2 Storage II	Solid Sorbents II
Corrosion	Geomechanical Response - Monitoring	Capture Dynamic Modelling	Capture System Studies II	CO2 Conversion	Leakage Mitigation and Remediation	Solid Sorbents III
Solvent Properties I	Storage Engineering	Storage Pilot and Demonstration Projects	Monitoring - Subsurface and Marine	Social Science and Communication I	Unconventional Storage in Hydrocarbon Formations	Capture System studies III
Solvent Properties II	Storage Capacity Assessment	Regulatory & Legal Aspects of CCS	Negative Emissions II	Social Science and Communication	Long Term Behavior of Stored CO2	Other Capture Concepts

As at GHGT-12, we will be using Elsevier's 'PosterinmyPocket' app which greatly enhances the experience of the poster session for both presenters and attendees allowing the pdf to be viewed before the conference and also facilitating communication between the presenter and audience.

The technical sessions are undoubtedly the main draw of the conference, but these have become increasing supported by the discussion panels which have seen audiences grow quickly. The topics of the panels for GHGT-13 have been confirmed as:

* 'Creating value for CCS in future energy systems'
* 'CO_2 utilisation and conversion'
* 'What have capture demonstrations told us and how can we learn more?'
* 'How do we transfer learnings from 20 years of Sleipner globally?'
* 'Will advanced technologies significantly reduce the cost of capture?'
* 'Collision between technology and policy in assurance of storage performance'

A brief paragraph outlining the objective of each panel will be available online. We expect these to have large audiences and stimulate much discussion between the panellists and audience.

Of course whilst this is the vast majority of the programme, we also try to contrast the very technical nature of these sessions with the opening and technical plenary sessions. These are in development and we will keep you in suspense for a little longer before the announcement of these and the closing panel discussion.

Registration for the conference is open and the Early Bird fee (CHF900 – 450 for students) is valid until the 13th July. Lausanne is a very popular city in November and hotels will fill up quickly, a large selection is available through the registration site at discounted rates, but the most popular will sell out quickly so get in, get registered and secure your attendance and hotel!

49th IEAGHG Executive Committe Meeting,

by Becky Kemp, IEAGHG

Beautiful Bergen, location of the ExCo

The 49th bi-annual IEAGHG Executive Committee (ExCo) meeting was held on the 11th and 12th May 2016 in the beautiful Norweigen city of Bergen. Hosted by Gassnova, the meeting began on the 10th May with a visit to the Technology Centre Mongstad (TCM). This centre is the world's largest facility for testing and improving CO_2 capture. Knowledge gained will prepare the ground for CO_2 capture initiatives to combat climate change. TCM is a joint venture between the Norweigen state, Shell and Statoil and SASOL.

Site visit to Technology Centre Mongstad

Following this site visit, an exciting seminar was held titled 'Milestone Mongstad 4' (see page 10 of the newsletter). An extremely interesting array of talks were presented and an exciting announcement was made which confirmed that TCM and SINTEF had formalised their collaboration. An in-depth article for this announcement can be found here: **www.tcmda.com/en/Press-center/News/2016/TCM-and-SINTEF-formalizes-CCS-collaboration**. The seminar was rounded off with a fabulous dinner, which allowed the delegates that had attended to discuss everything they had heard and learnt that day.

The two day IEAGHG ExCo meeting itself began on 11th May and was held in the Scandic Neptun hotel. This meeting is held twice yearly, at different locations across the world each time, and gives IEAGHG an opportunity to provide our Members and Sponsors with programme progress, an update of recently completed and on-going activities and to approve any future work to be undertaken. It also gives our Members a chance to report back to the Programme on their activities over the last 6 months and any activities planned for the near future.

The Programme's Members were given an overview of recent activities such as the recently completed Costs to CO_2-EOR study and Fault Permeability amongst others. Recent and upcoming events were reported on too – these included the extremely important side-event which was held at COP-21, feedback from our LCA workshop, an update on our Summer School (both 2015 feedback and also 2016 progress) and of course, the ever-popular, outstanding GHGT conference which will be held in Lausanne, Switzerland in November (**www.ghgt.info**).

Members agreed to take forward 3 new studies this year plus a set of guidelines – stay tuned to see the progress in these various areas - more details soon!

The ExCo dinner at this meeting was held in the elegant restaurant of the Scandic hotel. Members were all very eager to discuss the outcomes of the first day and to have a chance to relax and enjoy the Bergen setting.

CLIMIT; Annual Report 2015, Norway Update

CLIMIT's long-standing work has significantly advanced CCS research and has made Norwegian research environments highly attractive partners for researchers in other countries. A decision has already been made to continue the programme for five more years until 2020.

Both the Paris Agreement and UN's Intergovernmental Panel on Climate Change emphasise that CCS is an essential technology that is needed in order for the world to achieve the two-degree target. While many developments are taking place within renewable energy sources, there is little doubt that fossil fuels will also be a part of the energy mix for several decades to come. Many industrial processes also result in substantial CO_2 emissions. It is therefore crucial to capture, transport and store large volumes of CO_2 from power plants and industry in upcoming years.

Ten years after the establishment of the CLIMIT programme in Norway, we can safely say that there have been technological advances within CCS. We can also be proud that Norway has already influenced technology development, and continues to do so, and that our work is recognised on the international stage. First generation technology for capture, transport and storage of CO_2 is now in place, and the first plant is operational in Canada. CLIMIT views this development in a 10-20-year perspective, and we must continue the research efforts to develop second and third generation technology that will be even cheaper, more efficient and environmentally friendly than current technology. CLIMIT will take part in this development. There have been several important changes since the previous programme plan was adopted in 2013, and international cooperation will play a bigger role. This is why CLIMIT's programme board asked the secretariat to prepare a new programme plan for CLIMIT, starting in 2017. For more information and to download the Annual Report, please follow this link: www.climit.no/en/Pages/CLIMIT-Annual-report-2015.aspx

New IEAGHG Report 2016-05: Can CO_2 Capture and Storage Unlock 'Unburnable Carbon'?, by Jasmin Kemper, IEAGHG

'Unburnable carbon' refers to fossil fuel reserves that cannot be used and the resulting greenhouse gases emitted if the world has a limited 'carbon budget'. This situation leads to the question: what role does technology have in addressing these concepts and concerns related to them?

The International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC) both mention the role of carbon capture and storage (CCS) as a way to preserve the economic value of fossil fuels in carbon-constrained scenarios. Organisations such as Carbon Tracker Initiative (CTI), the Smith School Stranded Assets Programme (Oxford University), and University College London (UCL) have recently assessed these topics. These include assessments of the role of CCS, suggesting it will have an insignificant impact on the amount of the world's fossil fuel resources that can be utilised in a 2°C climate scenario. However, some of these reports view CCS from a resource-limited perspective, for example taking conservative views of the amount of CO_2 storage capacity available and on availability of CCS before 2050.

Therefore, IEAGHG has commissioned a study on this topic to the Sustainable Gas Institute. The study has undertaken an assessment of the relevance of CCS in terms of the 'unburnable carbon' concept. This study does not aim to assess or provide evidence of the 'unburnable carbon' concept but rather to look at the role of CCS technologies in such concepts. This report will also not

evaluate other approaches to reduce CO_2 emissions from fossil fuel use other than CCS, such as high efficiency low emission (HELE) technologies.

The key messages from the report are:

- The global 'carbon budget' in emission scenarios for climate change mitigation implies that a certain amount of fossil fuel reserves should not be used and their resulting greenhouse gases emitted to atmosphere. This concept is often referred to as 'unburnable carbon'.
- As CCS is a technology that prevents or reduces the emissions of CO_2 to the atmosphere, it has the potential to enable use of fossil fuels in carbon-constrained scenarios.
- In order to evaluate the potentially unburnable carbon of fossil fuel reserves, it is necessary to estimate the overall remaining fossil fuel reserves and compare them with the global carbon budget.
- Integrated assessment models (IAMs) are a good means to evaluate carbon budgets as they have a large coverage of technologies, geographical scope, economics and climate data. These models are widely used in publications of the Intergovernmental Panel on Climate Change (IPCC), the International Energy Agency (IEA) and academia, and most of them cannot achieve a 2°C or lower scenario without CCS. This report selects and investigates a subset of models that focus on technology options and include CCS.
- This study does not aim to assess or provide evidence of the 'unburnable carbon' concept but rather to look at the role of CCS technologies in this regard. It will assess the assumptions, methodologies, any contentious subjects and differences related to this topic.
- This study found that the impact of CCS on unburnable carbon appears to be material up to 2050 and further increases up to 2100. This applies especially to coal but also to gas to some extent.
- Model assumptions and cost data availability do generally not limit uptake of CCS in IAMs. However, other reasons seem to limit CCS uptake in models, and the authors of this report hypothesise it could be that residual emissions from CCS, for which CO_2 capture rates of 85-90% are usually assumed, are the reason. It is recommended to investigate this further and to give consideration in R,D&D to increasing capture rates.
- Uncertainties in IAMs and fossil reserve estimates can influence the total amount of carbon considered as unburnable.
- The authors review estimates of global CO_2 geological storage capacity, and find that estimates obtained from volumetric approaches are large and well above the extent of the CO_2 emissions related to fossil fuel reserves.
- Storage capacity estimates from dynamic approaches are likely to be lower, and hence further work on improving dynamic storage efficiency, such as pressure management by brine extraction, is required.
- The related additional costs for pressure and brine management should be considered in IAMs.

This report fits into a larger exercise undertaken by SGI on the topic. You can find the follow-on SGI White Paper here: www.sustainablegasinstitute.org/technology-unlock-unburnable-carbon/

Tim Dixon's blog on the launch event of the SGI White Paper is available here: www.ieaghg.org/publications/blog/118-general/669-can-technology-unlock-unburnable-carbon

New IEAGHG Technical Review 2016-TR3: Review of GHG Accounting Rules for CCS, by Tim Dixon, IEAGHG

A range of greenhouse gas (GHG) monitoring and accounting protocols and guidelines currently exist for CCS activities, and various activities continue in this area. This report aims to provide a comparative review of how current GHG accounting rules apply to CCS activities worldwide. These include international, regional and national approaches employed under policies and measures such as mandatory GHG emissions reporting, carbon taxes and emission trading schemes (ETS). Twelve GHG accounting schemes and nine CCS-specific accounting schemes are reviewed. Based on the review, the report identifies issues, gaps and potential barriers.

Key messages:

Three key GHG accounting requirements are found to be fundamental to all CCS activities:

1. Recognising captured CO_2 for storage as "not emitted". MRV rules need to allow for captured CO_2 to be deducted from the relevant inventory (e.g. sector; installation).
2. Including transport and storage within the scheme accounting rules. MRV rules need to be developed also for monitoring of transport and storage, and these need to dovetail across the project chain.

Continues overleaf.

3. A mechanism to address permanence. Appropriate accounting and MRV rules must provide assurances that the injected CO_2 remains in the intended geological formation and isolated from the atmosphere over the long-term, and quantify any leaks that occur.

The review finds that these three key 'fundamental' requirements are addressed within existing CCS-specific accounting schemes. Hence the review therefore finds that existing GHG accounting rules are broadly able to account for emissions and emissions reductions associated with 'standard' CCS projects.

Some specific gaps, challenges and issues arise however when considering the following 'special cases' and these are discussed:

1. Recognition of negative emissions from bio-CCS.
2. Accounting for CO_2-EOR..
3. Accounting for CO_2 utilisation.

New IEAGHG Study - 2016-TR4: Review of Project Permits under the London Protocol, by Tim Dixon, IEAGHG

The London Convention and Protocol promotes the protection of the marine environment by prohibiting the dumping of wastes and other matter into the sea. Under the Protocol all dumping is prohibited, with the exception of a limited number of selected substances. In 2007, an amendment entered into force which permitted CO_2 streams for geological storage beneath the seabed to be considered under the London Protocol. The amendment was supported with a set of "Specific Guidelines for Assessment of CO_2 Streams for Disposal into Sub-seabed Geological Formations", developed to support the National Authorities of Contracting Parties in evaluating permit applications for CO_2 disposal activities in their marine territories.

The P18-4 field, originally part of the ROAD CCS Project, is a near-depleted gas field at a depth of 3.5 km under the seabed, located approximately 20 km off the Dutch coast in the North Sea. The operator of the gas field applied for a CO_2 storage permit to the Dutch authorities in 2011. The objective of this report is to assess to what extent the proposed P18-4 storage site complies with the London Protocol's 2012 Specific Guidelines for Assessment of Carbon Dioxide Streams for Disposal into Sub-seabed Geological Formations, and therefore the 1996 London Protocol itself. The assessment has been achieved through a simple, but systematic, cross-check of the requirements of the Specific Guidelines against the contents of the application material provided by the operator to the National Authority.

It was found that the material submitted to the National Authority is broadly sufficient to allow an evaluation of the planned CO_2 storage activities in a manner consistent with the provisions of the 1996 London Protocol. This compliance assessment indicates overall technical compliance with the CO_2 Specific Guidelines, no information was sufficiently absent that would indicate clear non-compliance with the CO_2 Specific Guidelines.

A number of recommendations are provided to address some areas that would benefit from further clarification. The recommendations are relevant both for this specific case study, but also for future CO_2 storage permits in marine territories of contracting parties.

International Workshop on Offshore Geological CO_2 Storage, by Tim Dixon, IEAGHG

The world of offshore CCS gathered together over the 19th - 21st April 2016 at the Bureau of Economic Geology (BEG) at The University of Texas, Austin, Texas, for a workshop on offshore geological storage of CO_2. The workshop was organized by the Gulf Coast Carbon Centre at BEG, IEAGHG, and the South African National Energy Development Institute, and was supported by the Carbon Sequestration Leadership Forum (CSLF). Over 50 people attended from 13 countries, including from six developing countries.

The workshop followed a recommendation in the report by the CSLF's Task Force on Offshore Storage for international knowledge-sharing through such activities.

The aims of the workshop were to undertake a global needs assessment for offshore geological CO_2 storage, to initiate a discussion about the various aspects of offshore transport and storage, and to build an international community of parties interested in offshore storage. This was achieved by bringing together those who are doing offshore CCS to share knowledge with those who are interested in doing, and by facilitating countries to identify their specific issues, challenges, opportunities, and then to Identify synergies, common

Delegates who attended the workshop

gaps and goals, and define common action items. There was a pre-workshop survey to assess the status and needs assessment survey for each country.

Experts shared their knowledge and experiences on the first day, with the current state of knowledge from Norway (Statoil), The Netherlands (TNO), Brazil, Japan, and the UK. These "How To…." talks covered storage assessments, CO_2-EOR, transport options, risk management, monitoring, environmental impacts, infrastructure and regulations. Of particular interest were the subsea engineering solutions being developed by Aker Solutions to take gas-processing systems off the platforms and onto the seabed, and the potential for shipping with hubs.

Other countries presented their status and needs, including South Africa, China, USA, Nigeria, Ghana, Korea, Mexico, and Australia. Information was also provided on the East Asian CCOP initiative and the CGS Baltic programme, both undertaking regional storage assessments. It was notable that although each country is in very different stages of pursuing offshore CCS, there are common interests.

Participants formed breakout groups to discuss issues around themes identified by the workshop, including technology transfer, infrastructure, moving from pilot to larger-scale projects, and regulations. This activity developed a list of recommendations on areas to be addressed and actions to be taken. Common issues were how to assess storage potential, and the many aspects of re-use of existing offshore infrastructure.

In a very brief form, the list of recommendations included:

- International collaboration and funding mechanism for a demonstration project
- Development of a test programme and pilot project for infrastructure developments
- Workshops and training on a range of topics including: storage resource assessment, funding sources for early stages of CCS resource assessment in developing countries, on platform infrastructure and transport infrastructure issues and developments, and on comparing specific aspects across projects such as environmental monitoring.
- Assistance with access to existing key information sources, and a common language on storage.
- Creation of an 'Offshore Network' or other means of continuing the momentum from this workshop.

The workshop concluded with demonstrations and posters of offshore work, including a demonstration of the P-cable monitoring system and its results from the Gulf of Mexico.

To note that the UNFCCC's Climate Technology Centre and Network (CTCN) supported attendees from Nigeria and Ghana, and this was possibly the first activity on CCS supported by CTCN. There was a lot of interest from all the developing country attendees in the CTCN (IEAGHG and The University of Texas are members of the Network).

A report of the meeting will be produced and the presentations made available. A follow-up up survey will review the benefits of the workshop and gather views on how best to take-forward recommendations and actions. Many thanks to the Gulf Coast Carbon Centre at BEG for hosting, to the International Steering Committee, and to CSLF and CTCN for their support to delegates.

Overall, the enthusiasm from attendees suggested they considered the workshop a success. There was common recognition that there is a nexus of interests and needs converging in progressing CCS offshore, and that momentum was being created towards international collaboration not just in knowledge-sharing but towards pilot and demonstration projects. ●

New IEAGHG Staff Members

Lydia Rycroft

Lydia, who joined IEAGHG in April, graduated from Imperial College, London with a first class honours plus an MSci in geology with a year abroad at the University of California in Los Angeles. Before joining IEAGHG, Lydia worked for a UK based consultancy supervising site investigations across London and the south-east of England. Lydia's CCS credentials include a masters project with the Shell sponsored Qatar Carbonates Carbon Capture and Storage Research Centre. The project included a range of fluid dynamic experiments with the aim of quantifying the rate of convection with a CO_2 storage reservoir. One of the challenges that Lydia encountered with this project was the design and implementation of experimental work.

Lydia has joined our technical team and will work with James Craig managing research projects on the geological storage aspects of CCS.

Dr. Keith Burnard

Dr Keith Burnard joins IEAGHG in late June, where he takes up post as Project Manager, Capture and Systems Analysis. Until recently he worked for the International Energy Agency in Paris as Head of the Energy Supply Technology Unit in the IEA's Energy Technology and Policy Division.

Prior to joining the IEA, Keith enjoyed spells with British Coal, ABB, EPRI and AEA Technology (now Ricardo Energy & Environment). He has spent much of his career working on energy technology and policy issues, focusing particularly on fossil fuels and power generation. His publications for the IEA have covered upstream oil and gas technologies, gas-fired power generation, clean coal technologies and CCS. He has extensive international experience and has worked in both the public and the private sectors.

Keith is a Chartered Engineer. He holds a PhD and MSc from Bristol University and a BSc with Honours from Liverpool University.

Kemper County Energy Facility, by Siân Twinning, IEAGHG

During our recent ExCo held in Bergen, Dr. Richard Esposito of Southern Company gave an overview presentation to those present on Mississippi Power's Kemper County IGCC Project. The Kemper Energy Facility will use state-of-the-art electric power plant technology called integrated gasification combined cycle (IGCC). IGCC converts lignite to gas. Simply put, the process sends lignite through a device called a gasifier where, by being subjected to high temperatures and high pressure, the lignite undergoes a chemical reaction creating a synthesis gas. The cleaned gas is then used to generate power by firing it in a gas turbine. While IGCC technology is relatively mature, this facility will incorporate, at a scale of 582MW, CO_2 capture technology integrated into the plant operations.

The plant is 99% finished with respect to coal gasification and is going through the start-up testing and is scheduled to come online in the 3rd quarter of 2016. With this said, for more than a year now, the facility's NGCC turbines have been generating electricity, for the benefit of Mississippi Power customers, from natural gas. The flexibility to operate the NGCC units with either synthesis gas from coal or natural gas is unique to this facility.

The project team is rightly very proud of the site safety record, despite having 6,000 workers onsite at the height of construction, and 39 million project hours thus far, it

Kemper County Site Aerial Photograph

has a record approximately 7 times safer than the construction industry average for its size.

The requirement for this plant came from the need to replace older units that are due for decommissioning and the location was chosen away from the coastline to reduce the risk from hurricanes that are prevalent in the southern part of the State of Mississippi. The Energy Facility will help the company to continue to serve their customers with reliable, affordable and environmentally friendly electricity. By using lignite from an onsite mine, fuel costs will not be subject to market volatility and remain relatively stable for the life of the plant. The fuel diversity in Mississippi with Kemper online, in 2020, 60% of power will be produced from natural gas, 20% from coal and 20% from lignite. This maintains a balanced fuel portfolio for the company.

The plant hosts two IGCC units with a gross capacity of 740MW netting down to 582MW at peak capacity on lignite-derived syngas. In addition to capturing approximately 3M tons of CO_2 which will be sold for EOR, sulphuric acid and ammonia will also be produced and sold providing revenue to the operations. With the lignite being up to 40% moisture, water will be extracted and used in the plant operations (20%) in addition to treating grey water from the nearest municipality (80%) as there is no local water source. This gives a very balanced water cycle with zero liquid discharge greatly reducing the plants environmental impact.

The project itself is much greater than just a power plant, with the mine, IGCC, CO_2 capture unit, 61 mile CO_2 pipeline, and 70 miles of transmission infrastructure. With Mississippi Power owning the site, also their significant holding of mineral rights, there is the potential to consider saline aquifer storage, in addition to EOR as a storage option for the CO_2 in the future. The CO_2 capture unit uses the Selexol process, this is a very mature technology with many commercial units already in use. The Selexol unit at Kemper is one of the largest systems in the world and the H_2S absorber was one of the largest piece of equipment ever moved on Mississippi roads.

The Kemper County energy facility is built by Mississippians, for Mississippians, and it is having a major positive impact on the state's economy, creating thousands of jobs. The project has partnered with more than 500 Mississippi companies - including contractors, suppliers and vendors - with contracts worth more than $1.0 billion. At peak construction, nearly 12,000 direct and indirect jobs were created, including 6,000 direct construction jobs. Once operational, approximately 500 permanent jobs will be created at the plant and adjacent lignite mine. These jobs will increase Mississippi income by $42 million in the first year of operation, while royalty payments related to the mine and oil recovery will total an additional $49 million in income. A total of approximately 1,300 direct and indirect jobs are expected with a payroll of $79 million. The estimated state and local tax

H_2S Absorber

impact is approximately $232 million in the six years since construction began. Once operational, more than $40 million annually will be generated in ongoing local and state taxes.

In addition to environmental benefits of the plant, the company has signed long-term contracts to sell the marketable products from the gasification process such as CO_2, sulfuric acid and ammonia. Revenue from the sale of these products – estimated at approximately $50 million annually - will lower the overall costs for customers once the plant is in service. The location of the Kemper County plant and its ability to capture CO_2 will help expand Mississippi and American energy supplies through enhanced oil recovery efforts. Using captured CO_2 from Kemper will increase U.S. oil output by 2 million barrels per year, playing an important role in reducing Mississippi's and America's use of foreign oil and keeps oil revenue at home rather than sending it overseas.

It has been widely reported that the facility has gone $2.3B and two years over on budget and time. Most of this can be attributed to a first of a kind technology (FOAK) deployment issues including the compact nature of the site meaning that any problems identified during testing can require a partial deconstruction of the surrounding areas to rectify. Richard likened it to having to remove the car engine to change the oil. With all major construction projects, lessons learned are realized. Many cost savings have been identified that would be applied to the construction of similar plants based on the experiences during this project.

This project sets the state for the deployment of the technology internationally and especially with low-grade coals. With all of the publicity about the overrun and increased budget, this seems to have slipped under the radar and this project should be viewed as a major success for the advancement of advanced coal technology.

The carbon capture equipment installation went as planned and was completed within the original proposed budget.

Technology Centre Mongstad (TCM) Celebrated 4 years of Successful Operations, by Vegar Stokset, TCM

The fourth Milestone Mongstad event gathered more than 130 international CCS experts in Bergen on May 10th.

The participants heard exciting presentations and panel discussions about the important advances made during the last test campaigns on TCM; from technology suppliers and our stakeholders who are involved in the pioneering test campaigns, the extensive CCS cooperation especially between the energy authorities of the US and Norway, from other global projects and from the environmental organization Bellona that supports CCS as an essential climate mitigation tool.

Head of Cicero, Kristin Halvorsen, chaired the conference and led the presenters in a panel discussion on the status of CCS and how TCM and others can help speed up commercialization of carbon capture.

Ingvil Smines Tybring-Gjedde, State Secretary of the Norwegian Ministry of Petroleum and Energy, confirmed the Norwegian government's aim to invest on a broad front to develop cost-effective technology for CCS and seek to construct at least one full-scale CCS demonstration plant by 2020.

"CCS is needed to reach the climate goals. CCS is one of the five key areas of the government's climate policy. Work on TCM has yielded tangible results and is a testimony to the importance of international cooperation in this area," the State Secretary said.

Also David Mohler, Deputy Assistant Secretary, U.S. Department of Energy, emphasized the importance of global collaboration and praised the past ten years of close

Panel Discussion at the MM4 event

Ingvil Smines Tybring-Gjedde (State Secretary of the Norwegian Ministry of Petroleum and Energy

collaboration between the Norwegian and US Energy authorities in the area of CCS. Prior to the MM4 conference, the Norwegian and US Energy authorities and relevant stakeholders met for a full day meeting to further strengthen the collaboration within certain focus areas. Mohler said TCM is a necessary last step before realization of full-scale CCS, and said it was good use of resources to make use of TCM instead of building one of the same size in the US.

Trude Sundset, CEO of Gassnova, talked about the ongoing feasibility studies of three potential full-scale projects in Norway. Three industrial actors with relevant emission sources, Yara, Norcem and Oslo Waste Company (EGE) have ben participating in the feasibility studies that will be sent the government for consideration in a few weeks.

Roy Vardheim, Director of TCM, presented the results from the past year's test campaigns and also talked about ongoing and new testing and collaboration efforts.

"Since our startup in 2012, TCM has been playing a key role progressing CCS globally by helping companies like Aker, Alstom, Shell Cansolv and Carbon Clean Solutions to test their technologies and by that reducing the costs and risks of scale-up carbon capture. We are pleased that they all were very satisfied with their test campaigns at TCM, and that Shell Cansolv now returns for further development of their technology," he said.

Early May, Shell Cansolv started its second test campaign with further testing of its advanced CO_2 capture process at TCM. Shell Cansolv's enhanced solvent capture performance will be evaluated at TCM's amine test facility using exhaust gas from the Gas Turbine Plant at Mongstad. The test run aims to reinforce the strength of Shell Cansolv's CO_2 capture technology, and validate its DC-201 2nd generation solvent's readiness for deployment at industrial-scale projects.

Roy Vardheim (Director of TCM) and Nils Røkke (EVP of Sustainability at SINTEF) presenting the extended collaboration between SINTEF and TCM

Mr. Vardheim and Nils Røkke, EVP of Sustainability at SINTEF, jointly presented the extended collaboration between SINTEF and TCM where their capabilities will be jointly presented to the market.

TCM and SINTEF have a very positive dialogue, and now want to further explore possibilities to act in co-ordination in the market, and where appropriate negotiate for joint projects. SINTEF and TCM are both world leading research institutions in CCS. By joining our complementary capabilities, we expand the opportunities for technical and commercial cooperation between the facilities, and extend our reach even further, said Vardheim.

"We see this as further strengthening our offer to the market as "one stop shop" for CCS. Together we can offer R&D and testing

facilities from the molecular engineering level to testing and optimization at an industrial relevant scale. Efficiency and high quality services are keywords for this co-operation. SINTEF is a major stakeholder in the European R&D activities in CCS and with the joint network of SINTEF and TCM we are present at a global scale," said Nils Røkke, SINTEF's EVP of Sustainability Frederic Hauge, President of Bellona, emphasized the need for CCS clusters: "Continuing solely with point to point demonstration projects will not provide sufficient bankable storage capacity at the rate needed. Strategic and Targeted development of CO_2 storage capacity is key to the future of CCS, and projects must be rated highly on storage and infrastructure provided," he said.

Olav Skalmeraas, VP at Statoil, said TCM had successfully delivered and contributed to reduced costs and risks and should continue its good work.

"TCM should also play an important role in the future to further identify and reduce technology cost/risks, and to identify design and cost improvement for next generation technologies, " Skalmeraas said.

Pictures and presentations of all the speakers, including Espen Steinseth Hamborg, Technology Manager of TCM, Prateek Bumb, CTO of Carbon Clean Solutions Ltd (CCSL), Matthew Campbell, Development Engineer, Cansolv Technologies, Oscar Graff, Head of CCS at Aker Solutions and Onno Tillema, Director of Road Project are available online at **www.tcmda.com**

Carbon Clean Solutions: the Journey from Pilot Testing to Results, by Prateek Bumb, Chief Technical Officer and co-founder of CCSL

In May 2016 Carbon Clean Solutions (CCSL) published breakthrough results following a pilot scheme that was put into operation at Technology Centre Mongstad (TCM), the culmination of a process that was first mooted in late 2014.

The pilot, which involved a drop-in solvent test using our patented APBS carbon capture chemical, was designed to measure three issues that have hampered effective carbon capture in the past: environmental emissions, corrosion and energy efficiency.

Right from the very beginning when we launched CCSL from our university dormitory room in India in 2009, we sought to put proof at the very heart of our offering. The numbers always tell the story better than words and we are delighted at the response we have received in the wake the publication of the TCM data. This is an important step in the evolution of the company although we recognise there is a long way to go.

The story of the TCM pilot goes back to an initial conversation that took place in Austin, Texas in October 2014. We worked closely with TCM to explain our ethos, our working methodology, while outlining our thoughts for a preliminary plan and schedule. Certainly the hard work put into the process by CCSL and TCM at this early juncture would prove invaluable in the future.

Having the validation of TCM was and is critical for CCSL. TCM is the world's largest and most respected carbon capture facility. We were able to test across a range of conditions and processes including gas/coal fired flue gases and refinery cracker gases.

Critically, the pilot ensured CCSL's technology was tested over the course of more than 4,000 continuous hours. The result were more successful than we had probably envisaged.

The recent TCM test prompted plant availability levels of 100% and no loss of run time due to solvent issues. Over the period, we successfully captured more than 25,000 tons of carbon dioxide. Most significantly, it demonstrated parts per billion solvent emissions compared to parts per million for traditional solvents, and aerosol emissions were 80 times lower than the permissible HSE limit.

These numbers are a major breakthrough for carbon capture technology, as solvent emissions using CCSL's chemical are essentially negligible. Our solvent's degradation was also negligible over the test campaign run, demonstrating a far superior solvent stability.

Corrosion testing confirmed that with APBS, it is possible to construct 50% of a plant using carbon steel rather than stainless steel. Traditional solvents require stainless steel, which is at least four times more expensive than carbon steel. This ground-breaking achievement can reduce the capex for commercial scale plants by over 25%.

We are still analysing the energy consumption data we gleaned from TCM, but a separate independent test at the University of Kentucky confirmed a 50% reduction in energy consumption over conventional solvents. These results show that on a commercial scale, it would be possible to reduce the cost of carbon capture by at least 50%.

Before launching the TCM pilot scheme last year, we had already embarked on a number of pilot tests intended to prove the efficacy of our offering.

CCSL has already worked with EON-TNO in the Netherlands, the Southern Company Services-run National Carbon Capture Centre in the US, the PACT plant in the UK and HZI in Germany. We are also working on an exciting new project in co-operation with Newcastle University in the UK.

As an organisation we have really benefited from working with some fantastic institutions, which ultimately helped us to achieve recognition from the World Economic Forum, who awarded CCSL Technology Pioneer status last year.

Specifically, the pilot enabled us to better understand how varied flue gas sources prompt very different carbon capture performance results. Similarly, we found out that solvent handling and solvent emissions are equally important as energy optimization.

Developing pilot schemes can take a long time and it is critical to find the right partner, but if you get it right, as I believe we have done so far, the journey from pilot testing to results can be incredibly useful and rewarding.

Success for CLIMIT'S Largest Project

Aker Solutions testing at CO_2 Technology Centre Mongstad (TCM), (Photo courtesy of www.climit.no)

SOLVit, CLIMIT's largest ever research project, was concluded at year-end. The results will help put Norway in a good position when the construction of a full-scale carbon capture plant starts.

SOLVit involved finding new and improved solvents for CO_2 capture, and was headed by Aker Solutions with partners SINTEF and NTNU (Norwegian University of Science and Technology).

Oscar Graff explained: "The project went as planned. We are now ready to deliver commercial carbon capture plants in a full-scale," says Oscar Graff, head of technology for CO_2 capture in Aker Solutions. See Oscar Graff explain the project in more detail in this video - http://future.climit.no/en/teknologien/co2-fangst-aker-solutions

Cut energy consumption by 35 per cent

The project started in 2008 and comprised three phases. The project had a budget of NOK 332 million, and CLIMIT contributed NOK 132 million. One of the primary goals was to reduce energy consumption in the process by 50 per cent through development of better solvents and process optimisation. The result ended up at 35 per cent. Graff is very pleased with this, though they did not achieve the highly ambitious 50 per cent goal. For more information, please visit the webpage below:
www.climit.no/en/Pages/Success-for-CLIMIT%E2%80%99s-largest-project.aspx

Workshop - Climate Change Mitigation: Making Progress in Challenging Times, by Monica Lupion, MIT

May 4th - 5th, 2016
University of Sevilla, (Seville - Spain)

The University of Seville (Spain) in collaboration with the Massachusetts Institute of Technology (MIT, USA) held its first workshop in Seville during May 4th - 5th. The meeting, with the support of the Spanish Department of Energy, aimed to analyze the recent milestones achieved in the CCS community along with some of the challenges ahead. The workshop brought together highly recognized European and North-American experts from MIT in USA, the European Commission, the IEAGHG, the Spanish Platform of CO_2 emissions (PTECO), the IEA, Cranfield University, CICCS and University of Seville among others.

The workshop had over 80 participants from international R&D, academia and companies with interest in low-carbon technologies, and draw the attention to several local and regional media.

The first day of the workshop was a plenary session on general topics regarding the role of CCS in addressing the climate change challenge followed by a discussion. The presentations highlighted the great strides of CCS development in the past 25 years. Experts agreed that the technology is ready for commercial scale demonstration and deployment. However, the necessary markets have not properly developed, mainly due to lack of strong climate policy.

A new instrument called ACT, an ERA NET Cofund under Horizon 2020, was also presented at the workshop by its Spanish Member - the Economy and Competitiveness Ministry (MINECO). ACT aims to Accelerate and mature CCS Technologies by establishing large common calls in Europe.

A tour to some of the R&D facilities of the University of Seville concluded the discussions of Day 1. The participants visited various pilot plants at the Environmental and Chemical Engineering Department dedicated to emissions control technologies in power generation including oxy+post combustion, biomass gasification and non-thermal plasma.

The second day focused on oxycombustion technologies with presentations on the latest developments of this technology and relevant findings from the European FP7 project O2GEN "Optimization of O2-based CFBC technology with CO_2 capture". Discussions focused on new approaches formulated to reduce energy penalties associated with CO_2 capture and advances to pave the way for the deployment of the second-generation oxycombustion technology. Results achieved in the development of novel concepts such as partial oxycombustion and solid sorbents for CO_2 capture were shared. One of the main outcomes showed a reduction of 10% of the cost of electricity (COE) in relation to the first generation oxyfuel and cost of CO_2 avoided below 30€/ton (26 €/ton).

Post/Oxycombustion pilot facility at the DIQA - University of Seville

In summary, the meeting successfully highlighted the significance of CCS as an effective t ool f or d ecarbonizing energy systems and industries. In particular, the potential role that CCS could play in a low-carbon future for Europe and North-America with a focus on technology. However, CCS is not an easy technology for financers to understand. Major effort should be made to reinforce climate change policies and proper mechanisms to accelerate CCS deployment.

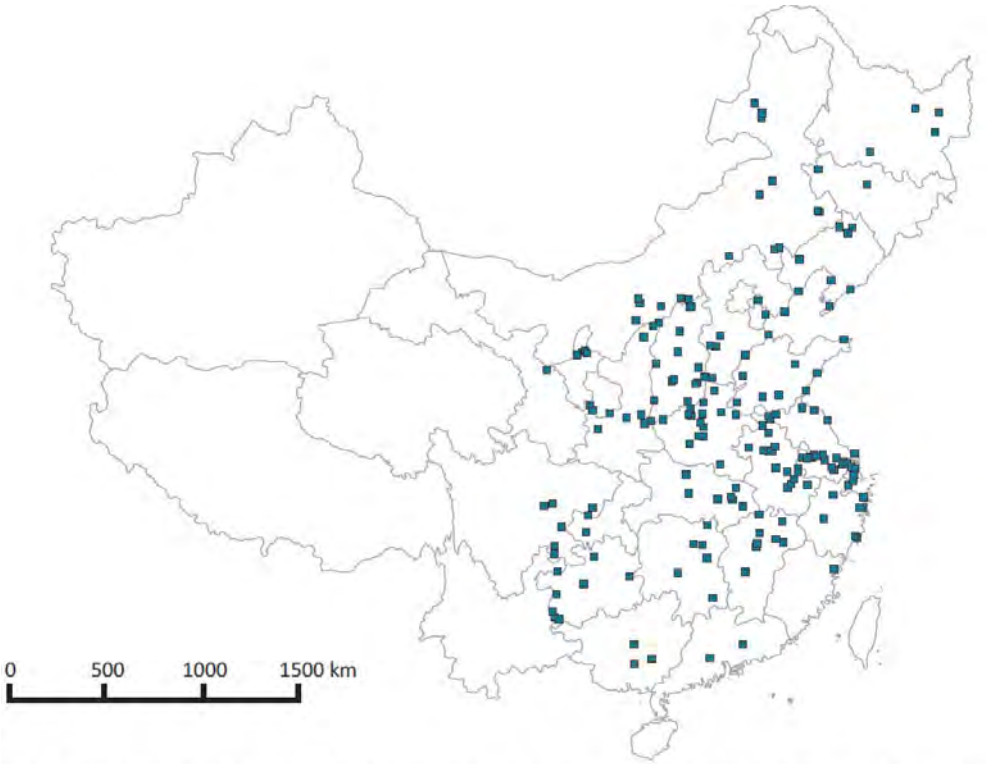
For access to the presentations of the workshop, please contact:
Monica Lupion mlupion@mit.edu.

New IEA Report: Retrofitting CCS on Coal-Fired Power in China, by Juho Lipponen, IEA

Retrofitting CCS on existing coal-fired power stations in China represents a major opportunity, with significant benefits for emission reductions. This new IEA analysis, done in partnership with China Electricity Council, indicates that there is ample potential available. In total, some 310 gigawatts (GW) of existing coal-fired power capacity meet a number of basic criteria for being suitable for a retrofit. This number is likely to increase, as new efficient plants are being commissioned during the next several years.

Through its "Intended Nationally Determined Contribution" (INDC) under the UNFCCC framework, China has committed to peaking its carbon dioxide (CO_2) emissions by 2030. The enduring emissions from China's coal-fired power plants hence present a major challenge. Simultaneously the world's leader in renewable electricity capacity and the world's largest emitter of energy-related CO_2, China emitted some 8.6 billion tonnes of CO_2 in 2014. Around half of these emissions were from coal-fired power stations. China currently has around 900 GW of installed coal-fired power capacity, representing almost 50% of global coal-fired capacity. The existing power plants considered in this study represent potential emissions of 85 billion tonnes of CO_2 ($GtCO_2$), if they continue to operate at current load factors for the remainder of their lives, even if smaller units are retired early.

A part-solution can be found in retrofitting existing coal-fired power stations with CCS, which can reduce their emissions rate by around 85% or more. The new IEA analysis explores the factors and conditions that are pertinent to the future retrofit of CCS at any of today's coal-fired power plants in China. Several key criteria have been applied to analyse the existing fleet of coal-fired plants operated by members of the China Electricity Council (CEC) and to identify retrofit potential.



Note: This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: IEA analysis.

Access to CO_2 storage is a critically important criterion for retrofitting CCS on any power station. Proximity to a suitable storage site plays an important role in determining costs, and plants with high CO_2 transport and storage costs generally do not feature among the best candidates for CCS retrofitting in China. Analysis in this study suggests that 385GW of China's coal-fired plant would find suitable storage capacity within a 250 km radius, but longer CO_2 transport distances can be attractive in some cases.

Other suitability criteria relate to the attributes of the coal-fired plant itself. Criteria used for this study are plant age, size, load factor and local or regional pollution control measures, and they have been used to determine whether a plant is likely to be a candidate for retrofitting. In total, some 310 gigawatts (GW) of existing coal-fired power capacity meet these criteria for being suitable for a retrofit. Plant size is of particular importance in China, where many smaller plants are likely to be retired before CCS retrofitting is widely deployed.

In addition, other cost factors influence a plant's relative attractiveness as a candidate for retrofitting with CCS. These factors include cooling type, efficiency, steam turbine design and pollution controls. Cost factors, including the indispensable costs of CO_2 transport and storage, have been used to rank candidate plants according to the cost premium for generating electricity with low emissions, and also to explore the relative impacts of

different power plant attributes.

The costs of retrofitting are likely to vary significantly: the additional costs of power generation after retrofitting are estimated to vary between USD 34 and 129 (United States dollars) / MWh. Some 100 GW of existing capacity are estimated to generate additional power generation costs of less than USD 50 / MWh, indicating that a significant retrofit opportunity exists within a reasonable cost range.

The units with the very lowest retrofitting costs are recently constructed. However, units with low retrofit costs can have different combinations of short or long CO_2 transport distances, hard coal or lignite, water or dry cooling, simple retrofits or retrofits with steam cycle rebuilds. This analysis highlights that it is unwise to set too rigid retrofit criteria or thresholds. On the contrary, it is necessary to include as many relevant factors as possible when guiding the search for retrofit candidates or when setting policy to stimulate investments in CCS retrofits. Retrofitting can represent a significant opportunity for emission reductions in China, but it will require establishing the right drivers.

This has several implications for strategy and policy in the Chinese context. Three particular areas merit further work and policy consideration from the Chinese government and industry:

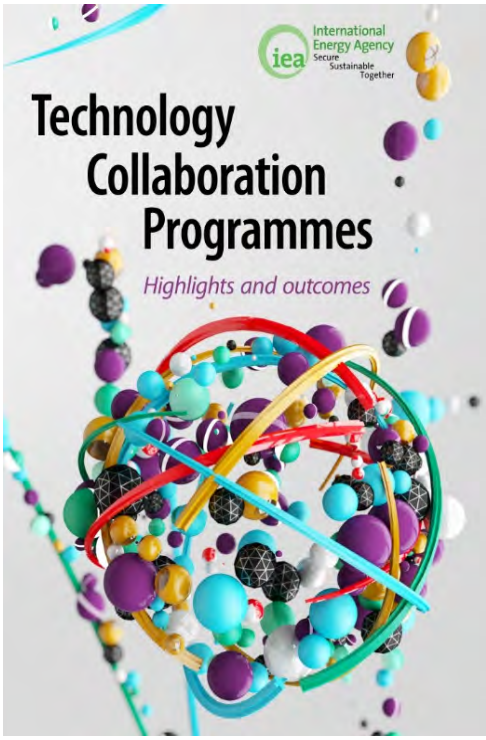
- Including CCS in Chinese climate policy, or retaining the option of future CCS retrofits, makes it imperative to continue work to analyse CO_2 storage opportunities and to develop actual project-level storage sites.
- Government and industry should continue their efforts in technology innovation and cost reduction, to further bring down costs of CCS in general and retrofitting in particular.
- Finally, given ongoing permitting of new coal-fired power stations, promoting CCS-readiness of new power stations can be an effective tool. Advancing CCS-readiness merits further attention by Chinese policy-makers in order to ensure that future retrofitting opportunities are maximised. In this regard, attention to the location of new plants is likely to be of particular importance.

For more information the study, please contact Juho Lipponen at the IEA Secretariat (juho.lipponen@iea.org). ●

New IEA Publications

IEA Publication: Technology Collaboration Programmes

Accelerating energy technology innovation is crucial to meet energy and climate goals, to support economic growth and to enhance energy security. Successful development and deployment of innovative energy technologies requires that stakeholders from both the public and private sector share knowledge, work collaboratively and, where appropriate, pool resources to deliver integrated, cost effective solutions to common challenges.



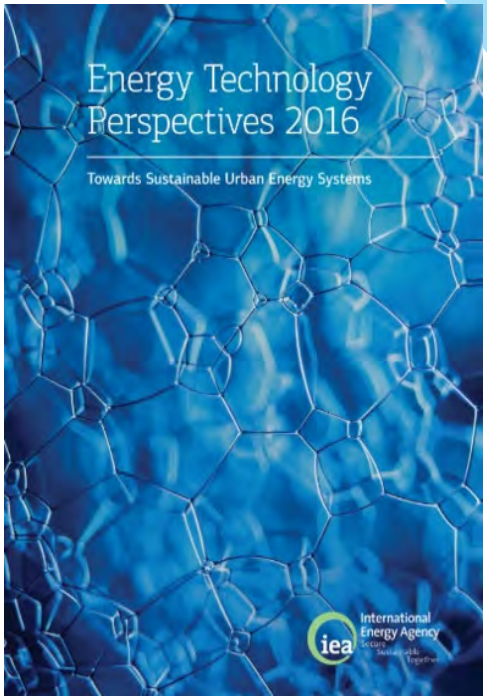
Four decades ago, the founders of the IEA had the foresight to create a multilateral technology collaboration mechanism – the IEA Implementing Agreements (IAs) – that has withstood the test of time and today is more relevant than ever to delivering solutions to global energy challenges. This network of experts produced a range of noteworthy results, including inventions, pilot plants, demonstration projects, databases and development of standards. The year 2015 marked the 40th anniversary of the mechanism as well as the rebranding of the IAs as Technology Collaboration Programmes (TCPs).

This publication provides an overview of the activities and recent accomplishments of TCPs. The 39 TCPs operating today involve about 6 000 experts from government, industry and research organisations in 51 countries around the world. Participants in TCPs have examined more than 1 900 energy-related topics in the areas of energy efficiency, renewable energy, fossil fuels, fusion power and cross-cutting issues.

The unrivalled breadth and coverage of analytical expertise seen in TCPs are unique assets that will underpin for the years to come IEA efforts to support innovation for energy security, economic growth and environmental protection.

You can download the publication for free here: www.iea.org/publications/freepublications/publication/TechnologyCollaborationProgrammes.pdf

Energy Technology Perspectives 2016



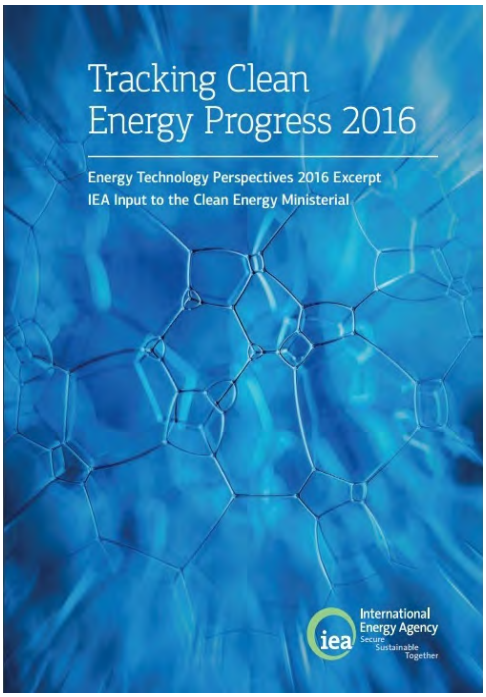
Cities drive economic growth but can also drive sustainable change. As the share of the world's population living in cities rises, ambitious action in urban areas can be instrumental in achieving long term sustainability of the global energy system – including the carbon emission reductions required to meet the climate goals reached at COP21 in Paris. Support from national governments is a strategic prerequisite for leveraging the potential for sustainable energy technology and policy in cities that too often lies untapped.

With global energy demand set to become even greater over the coming decades, Energy Technology Perspectives 2016 (ETP 2016) looks at the technology and policy opportunities available for accelerating the transition to sustainable urban energy systems. Such potential could be the key to successfully driving an energy transition that many still think impossible, provided that local and national actions can be aligned to meet the sustainability objectives at both levels. Indeed, policies still have a long way to go in this regard: ETP 2016 presents the annual IEA Tracking Clean Energy Progress report, which finds once again that despite some notable progress, the rate of needed improvements is far slower than required to meet energy sector sustainability goals.

By setting out sustainable energy transition pathways that incorporate detailed and transparent quantitative analysis alongside well-rounded commentary, ETP 2016 and its series of related publications have become required reading not only for experts in the energy field, policy makers and heads of governments, but also for business leaders and investors.

The ETP 2016 is available to purchase from the IEA bookshop via the following link:
http://www.iea.org/bookshop/719-Energy_Technology_Perspectives_2016

Tracking Clean Energy Process 2016



The annual Tracking Clean Energy Progress (TCEP) report highlights the development and deployment of key clean energy technologies year on year. An excerpt of the publication Energy Technology Perspectives (ETP), which lays out pathways towards a sustainable energy system in 2050, this comprehensive overview tracks the evolution of select technologies and sectors against the interim 2025 targets of the International Energy Agency (IEA) 2°C Scenario (2DS). Each assessment includes three sections:

- Recent trends discusses the latest progress with reference to technology development and penetration as well as market creation
- Tracking progress includes a quantitative evaluation of progress towards meeting the 2DS
- Recommended actions outlines measures to overcome barriers to meeting the 2DS

TCEP 2016 features some good news: after record growth for the second year in a row, both solar photovoltaic and onshore wind are on track to meet the 2025 2DS targets; the number of electric vehicles passed the 1 million milestone in 2015; and the outlook for nuclear power improved, with the long-term 2DS targets more achievable than previously thought. However, most of the clean energy technologies examined are not on track. Therefore policy makers must build on the momentum from the Paris Agreement at COP21 and accelerate progress to make the technologies the new norm for energy systems.

TCEP 2016 – prepared for the Clean Energy Ministerial meeting where 23 member countries collaborate on solutions to advance clean energy globally – is an integral part of the specific recommendations to governments in ETP 2016 on how to scale up deployment of these key technologies to ensure a secure, clean and competitive energy future.

You can download the publication for free here:
www.iea.org/publications/freepublications/publication/TrackingCleanEnergyProgress2016.pdf

SCCS Press Release: Scotland and Mexico Forge Links on Climate Action

Scottish and Mexican scientists have strengthened links to help support Mexico's ongoing efforts to develop carbon capture utilisation and storage (CCUS) as a route to reducing the country's carbon emissions.

Representatives from SENER (Mexico's Energy Ministry), leading university UNAM (Universidad Nacional Autonóma de México) and the Scottish Carbon Capture & Storage (SCCS) research partnership met in Mexico City on 25th May to explore future research collaborations and capacity building as well as opportunities for academic exchanges.

CCUS is a suite of technologies that captures CO_2 from power plants and industrial facilities and stores it permanently in deep geological formations or provides CO_2 for processes, such as enhanced oil recovery (CO_2-EOR).

SCCS Director, Prof Stuart Haszeldine, and Prof Elena Centeno Garcia, Director of UNAM's Institute of Geology, signed a Letter of Collaboration, which lays the foundations for working jointly on CCUS research – drawing on the UK's broad expertise in the technology – and exploring international funding initiatives.

Jazmin Mota, of SENER, highlighted the significance of the meeting for the Mexican Government's future energy and climate policy. UNAM attendees, meanwhile, expressed particular interest in knowledge exchange opportunities and MSc and other training options offered by SCCS and its partner institutes.

Prof Stuart Haszeldine, SCCS Director: "This is a very positive development between international research institutes at a time when signatories to the Paris Agreement on climate change, including the UK and Mexico, must pursue effective measures to reduce carbon emissions.

"We are delighted to be exploring opportunities for research and knowledge exchange with fellow academics in Mexico, and with the Mexican Government. SCCS is also making connections with additional research partnerships in Canada, South Africa and China. We can provide experience and guidance in CCUS development, capture technologies, CO_2-EOR and offshore engineering as well as identifying CO_2 storage assets and creating links to existing and future businesses."

The next stage of the Mexico agreement will be the signing of a formal Memorandum of Understanding, which paves the way for SCCS and UNAM to seek formal collaborations on aspects of CCUS development. ●

Norway: National Meeting on ECCSEL R&D Infrastructure

ECCSEL is a joint, distributed European research infrastructure for CCS that will strengthen Europe's research on capture, transport and storage of CO_2. The Norwegian ECCSEL node gathered at Lysaker on 29th April to inform the Norwegian research community.

The objective of ECCSEL is to contribute to the development of technology that could reduce emissions of the greenhouse gas CO_2. ECCSEL is expected to be in full swing by the end of 2016. NTNU (Norwegian University of Science and Technology) is heading the project and will coordinate the use of CO_2 infrastructure in the countries that are taking part in ECCSEL. An upgrade of the CCS infrastructure gap analysis is under way and will form the foundation for further planning of both upgrades and new infrastructure.

The CCS infrastructure at NTNU, SINTEF and IFE makes up the Norwegian national node in ECCSEL. Overall, it has received NOK 200 million in funding for upgrades and new equipment. The infrastructure is available to all researchers, including researchers that do not work in the institutions where the equipment is located.

Researchers can apply to use available equipment by contacting ECCSEL. Expenses related to using the equipment generally have to be covered through the researchers' own projects (e.g. CLIMIT or Horizon 2020).

However, it is possible to apply for other funding to use ECCSEL's equipment. The meeting provided information on the possibility of applying for funding to use ECCSEL infrastructure through the INFRADEV project. The announcement will be made in June and will be published on ECCSEL's website.

Discussions at the meeting also centred around development of the national node and the work leading up to a new infrastructure application in the autumn of 2016. NTNU is spearheading this and invited all relevant groups to provide input on infrastructure needs. The basis is ECCSEL's gap analysis. Please contact ECCSEL directly if you want to take part in this process.

At the meeting, Gassnova provided a status update for the feasibility studies within CO_2 capture (Norcem, Yara and the energy recovery plant at Klemetsrud), transport and storage. Information was also provided on the technologies that have been tested at the Mongstad Technology Centre (TCM) and the possibilities of cooperation through use of open available data from TCM test campaigns.

The Research Council of Norway provided information about the ACT announcement (ERA-Net Cofund CCS), which is scheduled for June, as well as upcoming CLIMIT announcements. The deadlines for these announcements is September.

A new corresponding national meeting will be scheduled for August.

The presentations from the meeting on 29th April are available here - www.climit.no/no/Sider/Nasjonalt-m%C3%B8te-om-ECCSEL-FoU-infrastruktur-.aspx ●

Accellerating CCS Technologies

Nine European countries are joining forces and making funds available for research and innovation actions related to CO_2 Capture and Storage (CCS). The initiative is called ACT – Accellering CCS Technologies.

The ambition of ACT is to facilitate the emergence of CCS via transnational funding aimed at accelerating and maturing CCS technology through targeted innovation and research activities.

The following countries participate in ACT: Norway (coordinator), Germany, Greece, the Netherlands, Romania, Spain, Switzerland, Turkey and the United Kingdom.

The national funding agencies participating in ACT are supported by funding from the European Union's Horizon 2020 research and innovation programme.

Euro 41 M is available for a joint call that will be published 7th June 2016.

Further information can be found on the ACT web-site, www.act-ccs.eu. ●

Conferences & Meetings

This is a list of the key meetings IEAGHG are holding or contributing to throughout 2016. Full details will be posted on the networks and meetings pages of our website at 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.

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

Monitoring Network and Modelling Network Combined Networks Meeting

5th - 8th July 2016, Edinburgh Centre for Carbon Innovation, Edinburgh, UK

IEAGHG Summer School

17th - 23rd July 2016, University of Regina, Saskatchewan, Canada

GHGT-13

14th - 18th November 2016, Lausanne, Switzerland

Greenhouse News
ISSN 2047-2218 (Online)

Greenhouse News is the newsletter of the IEA Greenhouse Gas R&D Programme (IEAGHG). IEAGHG is funded by member contributions from IEA member countries as well as other developed and developing countries and industrial organisations that have an interest in implementing technical options for GHG mitigation. A list of this membership can be found on the website. Greenhouse News provides information on worldwide developments in the field of GHG abatement and mitigation. It is published four times a year and is free of charge. Mailing address changes and requests for copies of this newsletter should be sent to the address below. For further information about IEAGHG and suggestions for articles, please email or write to the :

IEAGHG ● Pure Offices ● Cheltenham Office Park ● Hatherley Lane ● Cheltenham, Glos. GL51 6SH ● United Kingdom.
Tel: +44 (0) 1242 802911 ● mail@ieaghg.org ● www.ieaghg.org