GHGT-11

Conference Summary

11th International Conference on
Greenhouse Gas Control Technologies

CCS: Ready to Move Forward

18th - 22nd November 2012
Kyoto International Conference Center - Japan

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The GHGT-11 Steering Committee & Secretariat

(left to right) Tim Dixon, IEAGHG; Yoko Yamamoto, RITE; Akemi Sasaki, RITE; Yoichi Kaya, RITE; John Gale, IEAGHG; Kenji Yamaji, RITE; Takashi Honjo, RITE; Toby Aiken, IEAGHG; and Siân Twinning, IEAGHG

Thank You

The Steering Committee of GHGT-11 would like to take this opportunity to offer their thanks to all the delegates for making the conference such a success, and also all the staff behind the scenes, who worked to ensure everything ran smoothly.

The conference would not have been the success that it was without your help.

The Steering Committee would also like to thank once again the Technical Programme Committee for their sterling work in putting together the 4 days of technical presentations. They were invaluable, and their efforts were outstanding. They are:

Professor Kenji Yamaji and Mr Tim Dixon as co chairs, supported by Professor Kozo Sato, Mr Chris Hendriks, Dr Howard Herzog, Professor Sally Benson, Professor Olav Bolland and Ms Peta Ashworth.

Our most sincere thanks for your work and dedication.

Contents

GHGT-11 in numbers...
Delegates: 1293

Welcome Addresses

Kelly Thambimuthu, IEAGHG Executive Committee Chairman

Kelly Thambimuthu, chair of the IEAGHG Executive Committee, opened this 11th conference in the Greenhouse Gas Control Technologies series, highlighting the history of the venue the conference was to take place in. Back in 1997, this very venue was the location that saw the meeting that first drew countries together to try to work towards an agreement to tackle climate change. After long discussions, the Kyoto Protocol was born.

Much has changed since then, and although progress has slowed in recent years, advancements continue and the changes in the worlds energy mix means that in order to meet the 2 degree Celsius target, we must be serious about deploying CCS. Kelly gave the message to take away to the leaders of the world that the time is right to deploy CCS, not to otherwise adapt to a changing climate. CCS needs policy drivers in order to take the next steps.

Professor Yoichi Kaya, President RITE

Professor Kaya, President of RITE and co-chair of the GHGT-11 Steering Committee then addressed the conference on behalf of the co-organisers, RITE.

In 2009, The Copenhagen Accord devised at COP 15 recognised the view that temperature increases must be kept below 2°C. In order to achieve this, and according to the IPCC fourth report, we have to halve the global CO_2 emissions by 2050. This ambitious goal, given that more than 85% of the worlds primary energy comes from fossil fuels, will require CCS as an indispensable technology as shown in the IEA's recent scenario which expects 17% of the total CO_2 mitigation to be accomplished by CCS by 2050.

Mr Koichi Akaishi, METI

The delegates were then addressed by Mr Koichi Akaishi from METI.

In the preparatory talks for COP18, it has been recognised that technological breakthroughs both for mitigating emissions, and for the capture and storage of emissions, are truly pivotal in achieving the ambitious climate goals without detrimentally impacting economic activities.

In Japan for example, after the Fukushima nuclear accident in 2011 and subsequent halt of almost all the nuclear power plants in the country, the government has to seek a way to reduce CO_2 emissions while utilising fossil fuel plants more than ever. To address this situation, mid and long term efforts to realise CCS deployment became a crucial part of the energy supply mix.

Japan is proud to host this key conference to make improvements on, and to try to remove practical barriers that surround CCS technologies.

Keynote Talks

Mr Atsutoshi Nishida, Chairman of the Board, Toshiba

Mr Nishida presented a keynote speech titled 'Aiming for True Harmony between Energy and the Environment'. He presented outlook forecasts for energy consumption, CO_2 emissions and population growth between now and 2050. The dramatic increase in energy demand and subsequent emission increases will be biased towards developing countries. Unabated, this will mean a rise of up to 3.8 degrees by the end of the century; the major impacts of this would include (according to the Stern report) at least 10% of land-based species would face extinction, and between 150-550 million people would be at risk of hunger. The effects of climate change on the severity and frequency of severe weather events can be felt even now; Hurricane Sandy in the USA was the strongest on record, and the economic cost of the clean-up is estimated to be over $30 billion.

Action is therefore needed, and needed now.

Toshiba are aiming to secure status as an Eco-Leading Company through green manufacturing, green products and green technologies. Their development of these technologies is aimed to reduce the impact of their business activities, and the impacts of the use of their products.

Toshiba are deploying energy efficiency measures in their facilities to reduce their greenhouse gas emissions as much as possible; air conditioning, lighting, heat pumps, nuclear, advanced thermal plants, solar, wind, hydro and geothermal power generation are among Toshiba's activities aimed at this goal.

This harmony between energy and the environment provides a good model for the future, and represents a strong and definite step in the right direction by the manufacturing industry; if others follow suit, then it is positive indeed.

Mr Brad Page, CEO, Global CCS Institute

Brad showcased the new publication 'The Global Status of CCS: 2012'. The publication summarises that action is needed to address the issue of climate change, and CCS is already making a contribution to this need. Although progress has been steady, and not to the level that had been hoped, important developments have been made, and will stand the CCS community in good stead when funding and policy instruments are in place. It is encouraging to see the beginnings of policy support for projects, although more is needed to trigger wider scale roll out of projects. There are still other barriers to the wider scale roll out, and these also need to be overcome with alacrity. The costs still appear high, but with demonstrations come reductions in costs, so more demonstrations should have a sizeable impact on the cost reductions required. Finally, the report summarises that the acceleration of CCS is dependent on knowledge sharing and collaboration; something this conference series positively encourages.

The report identifies and updates the list of projects around the world at varying stages of initiation, and when these projects are plotted against the IEA scenario, it can be seen that by 2015 we are on track for around 70% of target, but by 2020 we are considerably lacking.

GHGT-11 in numbers...
Countries represented: 48

However, this updated report also identifies a lot of new projects at the first stages of recognition, and this is largely due to development of CCS, CCUS and EOR projects. So despite this apparent lack against the IEA targets, there are still important developments to recognise that could be promising, and could bridge this gap. The dramatic increase in EOR inclusion is also promising; if these projects develop into permanent storage then this picture could well be dramatically improved.

CCS has been criticised for costs of CO_2 avoided, but in fact CCS could be very competitive given the right government support.

Demonstration projects such as Quest, TCM Monstad and Boundary Dam are key in demonstrating and facilitating technology improvements, which will play important roles, and knowledge sharing will also prove pivotal for such improvements. For example the experience of large scale pipeline networks resides predominantly in the US, and if this experience can be shared to reduce development costs and promote deployment around the world, the impact will be resoundingly positive.

Brad closed with the comment: 'We must look at the needs of developing nations, this is a significant challenge, but one that we are up to'

Dr Jay Braitsch, Senior Advisor, Office of Fossil Energy, US DOE

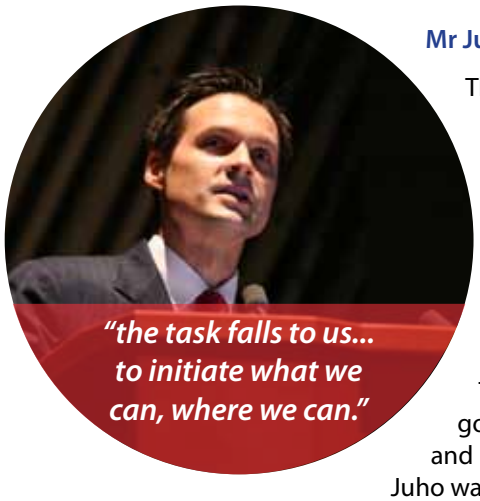
Jay Braitsch from the US DOE described the projects within the USA and explained that the costs of 2nd generation and subsequent generation are predicted to fall by up to 80% which is a very important message to take from this. The developments within the US have maintained their progress thanks to the maturity of the EOR industry and the commitment to CCUS activities.

The projects within the US are varied, with different capture technologies and many selling more than one product; i.e. selling CO_2 to EOR projects, or urea based fertilisers.

The detail of the projects described can be viewed on the slides which will be posted to the conference website.

The highlights presented showcase the knowledge repository within the US. It provides the counterpoint to Brad's expression of the need for knowledge sharing by demonstrating the knowledge and development work underway throughout the Regional Carbon Sequestration Partnerships programme.

On an end note, Jay said that we have come a long way in a short time, and we are really looking at a question of when, not if.



Mr Juho Lipponen, Head of CCS Unit, IEA

The IEA are revisiting the IEA CCS Roadmap activity, and Juho reviewed the energy demand and emission levels from the last 40 years; it is clear to see that these have doubled; a pattern that cannot continue. However, global energy use does continue to grow, and this underlines the need for climate change mitigation technologies, now more than ever. The need cannot be met by any single mitigation option, and CCS has the benefit of being a technology option that can help us to meet this need while continuing to utilise fossil fuels whilst we develop alternatives, and these alternatives become mature and ready for wide scale marketability.

The IEA roadmaps offer a strategic plan that charts the pathway to the desired goal, they provide milestones for technology development and deployment, and provide recommendations for necessary framework conditions. However, Juho was careful to clarify that they are not predictions of what is likely to happen!

Looking at the scenario in detail, it shows that in the near-term, CO_2 capture is predominantly in OECD countries, but by 2030, it is estimated that non-OECD countries will dominate the picture.

Juho then identified parallel actions that need to be put into action:

- Climate policy focus; there will not be wide scale deployment without strong drivers,
- Governments should consider and clearly define the role of CCS in their future energy strategies,
- Governments should drive more actively policy to enhance storage site screening and development,
- Government and industry to redouble efforts to demonstrate CCS technologies,
- Governments to develop incentives to encourage further CCS deployment.

Juho concluded that policy is more relevant for CCS than for most other climate mitigation options at present, and the task falls to us, the delegates, to disseminate a clear message about the need for CCS technologies.

Dr Francis O'Sullivan, Executive Director, Energy Sustainability Challenge Programme, MIT

With a slight switch in focus, Dr Francis O'Sullivan presented to the delegates on unconventional gas, and the estimates of technically (but not necessarily economically) recoverable gas resources. As an example, the USA has seen a 100% increase in estimates for technically recoverable unconventional gas reserves over the last 7 years.

Despite these figures, shale gas and other unconventional gas production is still very much in its infancy, these estimates are subject to large scale uncertainties. The physics of production are not completely understood yet, so these assessments are still undergoing refinement and are subject to substantial change.

What is being investigated in the USA will be of interest to many areas of the world; shale and thefore the potential for shale gas production, is widespread throughout South America, parts of North and South Africa, Europe and Asia, so this technology has great potential around the world.

Of course, the potential environmental impacts of shale gas production are contentious, and are predominantly linked to hydraulic fracturing of the reservoir, and this practice has received a great deal of negative press in recent months and years, with associated and expected public and social concerns. Local impacts, both on local resources and community awareness are of paramount importance, and a great deal of work is required here to reassure and share the knowledge with key stakeholder groups.

GHGT-11 in numbers...
Abstracts submitted: 1221

Dr Kozo Sato, Director; Frontier Research Centre for Energy & Resources, University of Tokyo

CCS in Japan is a very realistic prospect. Estimates of storage capacity in off-shore reservoirs are around 146 Gt at the theoretical capacity level. Japanese CO_2 emissions are currently around 1.3Gt per year, so this would equate to 100+ years storage capacity.

Japan also has several CCS projects. The first one was the Nagaoka project which stored 10,000 tons of CO_2 into a formation at a depth of about 1000m. The monitoring of this project included time-lapse well loggings, cross-well seismic tomography, and fluid sampling to evaluate geophysical and geochemical behaviour of stored CO_2. The monitoring data after 2 magnitude 6.8 earthquakes which occurred during and after injection, was invaluable in confirming the safety of CO_2 storage during such natural disasters.

Another project is in the Tomakomai area to inject 200,000 tons of CO_2 per year from 2016, which is expected to provide two notable outlooks; stochastic approach for the uncertainty problems and OBC system for off-shore monitoring.

In summary, carbon storage in Japan is full of informative field observations regarding migration, trapping, geochemical reactions, monitoring earthquake issues, and uncertainty issues. Those will be a source for an inductive approach to find 'something extra' in CCS.

Mr Henk Reimink, Director of Technology & Safety, World Steel Association

The increase in steel production over recent years has been substantial, underlining the need for the application of CCS in industry. This production increase is due to the development and growth of the steel industry in China, and the current global production volume is produced at a ratio of 70:30 from iron ore and recycled steel respectively. This is expected to rebalance to around 50/50 by about 2050.

The challenge to reduce the CO_2 emissions to atmosphere however starts now. Currently the world steel industry are reporting and analysing CO_2 emissions; a process set up by an industry expert group and which has been turned into a ISO standard. Alongside this activity other topics such as air quality, reliability, and improving energy efficiency across the industry are being carried out to improve the industries' competency.

The industry is aiming to improve the manufacture and usage of steel components, developing materials that enable a reduction in emissions during their lifetime usage. As an example, high strength steel grades are developed for car bodies; making the material stronger so that the quantity of steel used can be reduced, resulting in lighter weight vehicles, which use less fuel during their life and so generate less emissions overall.

This is a key point, and it is very interesting (and positive) that the industry is looking 'outside' of its own activities with the end user and end use in mind. This bigger-picture thinking is an excellent example for the steel industry of looking at all of its options and ways to reduce emissions from its processes as well as its products. To achieve the 2DS the Iron and Steel Industry does not yet have an answer from its own technology and this makes CCS a key option for the industry.

Mr Chris Hendriks, Managing Consultant, Ecofys

Chris Hendriks presented a keynote talk on transport developments, using Rotterdam harbour as a case study for a transport network. There are several industrial sources of CO_2 in the region, and there is an established network of pipelines that convey the CO_2 to various locations that utilise the CO_2 to enhance the growth of flowers in commercial greenhouses. The CO_2 has been used for some time in this manner, and plans are in place to expand this network in the future.

Transport at large scale will involve either pipelines or ships. There are specific benefits of each; pipelines need high initial investment, they are inflexible, the lead times can be long but the relative transport costs are low. Ship transport involves lower initial costs, flexibility in routing and capacity and relatively short lead times, but the relative cost of transporting by ship is comparatively high.

Early consideration of the transport network element of the chain is of great importance to the longer term costs of CCS projects and networks, and the development of national and international standards will be required in order to bridge gaps and remove barriers to deployment.

Dr Keigo Akimoto, Group leader; Systems Analysis Group, RITE

Kiego Akimoto presented a keynote talk looking at future frameworks on climate change, looking beyond the current Kyoto Protocol commitment period.

Looking at several factors, it can be shown that on a global scale, CO_2 emissions per GDP has reduced year on year between 1971 and 2000, and has remained constant since then due to an increase in CO_2 per GDP emissions in Non-Annex I countries. The majority of this increase is seen in Asian countries, and when looked at alone, CO_2 emissions in Asian regions have greatly increased, especially since 2000, and the CO_2 intensity of energy in this region has increased for the past 40 years.

Keigo concluded with a series of remarks, including that changes will only be brought about through comprehensive bottom-up emission reduction actions, with international cooperation. Such changes will be more effective than national, regional or global targets for emission reductions.

The Asian region is a centre of production for many goods in the world, and actions taken here in a sustainable manner and the frameworks under whcih they are taken, will be key in avoiding dangerous climate change.

GHGT-11 in numbers...
Oral Presentations: 296

Key Messages

Industry Key Messages

It was refreshing to see a much higher attendance from industries than at previous conferences. The inclusion of several industry lead keynote speeches also highlights the importance of industry in the fight against climate change. The keynotes and technical plenaries from the likes of Toshiba and the World Steel Association emphasises this increase in focus. The work that these groups are undertaking is significant and vital if we are to comply with the targets set out in the IEA's 2DS.

Of particular interest was the idea of looking at products entire life cycle, and working to reduce the emissions products produce over their life; the prime example of such a concept was the research into producing lighter, stronger steels to reduce vehicle weight and subsequently increasing fuel economy. Solutions such as these will be significant in the bigger picture, and the inclusion of these research studies and activities in the GHGT conference series is a step forward in itself.

Storage Key Messages

With the current economic climate as it is, and the general slowing of investment in projects, it was very encouraging to hear positive notes and messages coming from the storage based technical sessions. Although there is a delay in the start of demonstration scale projects, and this can be seen as a negative point, there are still key developments and lessons being learned from existing projects.

For example, messages taken from the conference were positive for monitoring technologies; the Kerr Farm allegations surrounding the Weyburn-Midale project in Canada, although initially damaging, led to the development and proving of several new monitoring techniques, which improve the ability to demonstrate safety and security of storage.

With the slow pace of project start up, and the confidence in the technology being at an all time high, it is clear that in order to generate the funding required, we need policy drivers to push demonstrations forward. In the mean time, other economic drivers must be sought, and with the USA leading the way in 'CCUS' (CO_2 capture utilisation and storage), it is apparent that tertiary economic benefits such as those gleaned by EOR projects are likely to be the initial driver needed to drive CCS deployment forward.

Capture Key Messages

Presentations on CO_2 capture included many developments, and advancements since the last conference in 2010, and many of these developments focussed around the energy requirements of capture. Some presentations were reporting a 35% reduction in energy requirements for solvents when compared to MEA, and that CO_2 absorption capacity for the same solvents could be 100% higher than with MEA.

The general tone of post combustion capture presentations suggested that advanced solvent developments were likely to be the key to reducing the energy penalty and costs involved with CO_2 capture, and it will be of great interest to see the impact of these developments by the time of GHGT-12 in Austin in 2014.

Public Perception Key Messages

Public perception is becoming more of a hot topic with 2 well attended sessions, and 10 posters addressing how best to affect perception and generate public acceptance of CCS. Barendrecht remains a key case study, and there are still lessons being learnt from how it was handled, but there were more examples of public engagement at this conference, and this was highlighted as a key term; engagement, rather than acceptance. The term acceptance has a slight negative connotation, suggesting that a project be reluctantly tolerated. By active community engagement, it can be possible to generate positive public support for projects.

Many results were presented, and it was interesting to see that public consultation at early stages of projects has a major impact on opinion, indeed many of the more successful public engagement exercises involved members of the local community naming the project, or having other such involvement. This seems to give a sense of local 'ownership' or even pride in a project, and it is key points such as this that could play a vital role in deploying commercial scale projects in the future.

Transportation

Transportation has generally been a lesser presented topic at GHGT conferences, however there are still some key lessons and messages to take away. Work on CCS networks and hubs has increased in recent years, and the Rotterdam harbour area in particular is an often reported case study.

Key points to take away on transportation include assessments of best method of transport, and the factors that affect the selection; for example shorter duration projects are often better suited to ship based transport rather than pipelines. Ships are also the more favourable option when either the distance increases over 1000km, or 400km if a discount rate is applied.

Pipeline transport still retains some difficulties, none of which are showstoppers, but they must still be considered in project design; heat transfer between the surrounding water and piped CO_2 can lead to ice formation which must be taken into account, and situations that are liable to cause corrosion issues must be avoided.

GHGT-11 in numbers...
Posters: 621

Closing Session

The GHGT-11 Conference ended with a closing panel session chaired by Kenji Yamaji, with invited panellists giving their views on the theme: 'As a Countermeasure to Global Warming - Best Mix on Energy Portfolio and Enhancing International Cooperation' Economic advantages of CCS were highlighted by Jae Edmonds (PNNL), by giving specific reference to studies that show that costs of CO_2 mitigation can be cut in half when CCS is available as a deployable option. Any delay in action being taken greatly increases the costs of mitigation, and in such a scenario, the differential impact CCS deployment makes to the long term costs is greatly increased.


"mitigation costs can be cut in half when CCS is available."

Juho Lipponen (IEA) looked at what we do and don't have in place for CCS deployment. This encapsulates the positives to be taken from the technical sessions, while concisely highlighting the areas that require further development.

- We have technology and knowledge, but are lacking strong enough climate policy,
- We have demonstration projects, but are lacking political attention and recognition,
- We have pilot projects, but don't have enough national visions and strategies,
- We have funding for first demonstration projects, but don't have incentives for further deployment,
- We have a small number of governments active in CCS, we don't have widespread acceptance,
- We have research and development, we have a lack of messages on benefits and synergies.


"we must manage risk so that no single issue can destroy the industry."

Yoshiharu Tachibana (CRIEPI) argued that CCS should not be used as merely an excuse for the continued use of fossil fuels, but should be deployed by serious efforts of the CCS community. He also stressed from his R&D experiences at various fields that for CCS to overcome challenges there should be an agreed party to take charge of any ultimate risk. A lack of and uncertainty surrounding carbon pricing was also highlighted.

Takeo Kikkawa (Hitotsubashi University) approached the subject from a different perspective by introducing two unique Japanese methods for cutting GHG, the 'top runner programme' for residential and transportation sectors, and the 'sector by sector approach' for industry. Both have an idea in common that entrepreneurship can, and should, contribute to the overall climate goal.

The panel then discussed why CCS remains in the demonstration stage despite its more economical nature over most renewables, and also how to overcome the barriers holding it there.

Tachibana pointed out that the complexity of the technologies hinder policymakers from understanding the full situation and grasping the value to climate change mitigation. Jae also talked about difficulties in convincing policymakers and stakeholders to see what was necessary in the near term to deploy CCS; accordingly there is lack of policy that either requires or rewards CCS. Juho added that there is a tendency to wait for climate accord, but such a delay would be damaging. Instead we need to continue on parallel fronts to develop interim policies that can keep R&D going and especially get the large demonstrations online.

The panel also estimated the effect of cheap and plentiful gas on CCS deployment; Kikkawa argued that there is no contradiction between natural gas and CCS+IGCC/IGFC, considering that gas will fill the gap until CCS technologies are ready for deployment. Tachibana offered practical advice that technologies need to be developed on a new assumption that coal is no longer the dominant primary energy source in the near-future, especially in developing countries; meaning that the criteria for choosing an 'optimum' technology may change. Juho restressed that even natural gas should eventually be decarbonised and CCS still occupies a significant part of mitigation technology portfolios prepared by the IEA.

The panel finally addressed how the involvement of developing countries should be incorporated into a new global agreement to mitigate GHG emissions. Jae suggested that we should first work out how to gather developed countries into a united agreement, then try to expand it to include the developing countries. Juho pointed out that, with regard to CCS, China's participation is possibly the most vital since one third of all the efforts should be made there according to the IEA scenarios. It was suggested that engagement in China would not necessarily be an issue, as the country is keen to develop and implement new technologies, and embrace new options.

In closing, comments included a recommendation that the CCS community should try to learn from the nuclear industry. The enthusiasm shown within the CCS community is encouraging, but we must manage risk so that no single issue can destroy the entire industry.

This conference has seen a lot of different options presented, and this is evidence of the potential we have at our fingertips and that we must ensure that the range of options are ready as and when the economy and policy facilitates deployment; we must be ready!

In final closing, John Gale reiterated the motto for the conference, CCS: Ready to Move Forward, and commented that in fact, the message appeared to be that CCS is moving forward, perhaps not as swiftly as we would like, but progress is being maintained.

GHGT-11 in numbers...
Technical Sessions: 77

The Future – GHGT-12

The following is a short overview from Gary Rochelle, Co-Chair of the GHGT-12 Steering Committee, on GHGT-11, and what to expect from GHGT-12 in 2014.

'From my narrow viewpoint, GHGT-11 was the best technical conference ever. Even with somewhat fewer participants than GHGT-10, there were more than enough posters to keep me totally occupied. The opportunities for networking with colleagues from Asia, Australia, and Europe further reinforced the value of this experience.

I brought 14 of my graduate students with me from Austin. Eight had never been to a GHGT meeting and found this one to be especially helpful in understanding their work and how it relates to the work of others.

We are excited to host GHGT-12 in Austin. Our venue at the Austin Convention Center will be modern and spacious with meeting rooms for 10 or more parallel sessions if needed. We are planning for 1800 participants, but will be able to accommodate many more. We have a great networking opportunity planned for the dinner under the stars in the Texas Hill Country.

By 2014 we should have several U.S. and International demonstrations of CCS that can be showcased at GHGT-12. The University of Texas itself has major activities on amine scrubbing, enhanced oil recovery, and CO_2 storage that will be presented in full. We also expect to present in full other activities supported by the U.S. Department of Energy; and of course we expect full participation of the international research community on CCS, so GHGT-12 will be the best yet.'

2012 Greenman Award

The worthy recipient of the 2012 Greenman Award was Professor Sally Benson. Sally was asked for some thoughts on being selected for the award.

'I am so appreciative of receiving the Greenman Award (even though I am the first Greenwoman). There are so many people who are deserving of this honor. CCS has advanced so rapidly over the past ten years. It is truly remarkable, but entirely dependent on the hard work and dedication of so many people.

I've had the pleasure of working with outstanding scientists and engineers from around the world. The IPCC Special Report on CO_2 Capture and Storage brought many of us together, not that we agreed on everything, but this accelerated the pace of building a worldwide community of researchers interested in CCS.

We also owe a great deal to the pioneers who started the Sleipner Saline Aquifer CO_2 Storage Project. Operating for nearly 16 years, this project has provided a wealth of data and insights. The seismic data and interpretations have taught us so much about the behavior of CO_2 in the subsurface.

The IEA Greenhouse Gas Programme has also been crucial for the development of CCS. I attended my first IEAGHG conference in Interlaken, Switzerland in 1998, and have been to every one since then. The IEAGHG has contributed so much, from the conferences, to the networks, and now a high impact journal that publishes leading research articles. So, thank you very much for this wonderful award. It made my year!

Now all we need to do is get CCS implemented in a couple of hundred projects. Then, we will all know we have succeeded.

I will be really proud to be a small part of that.'

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