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IEAGHG/OPEC: REPORT OF WORKSHOP ON CCS AND CDM

Report: 2013/17

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INTERNATIONAL ENERGY AGENCY

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DISCLAIMER AND ACKNOWLEDGEMENTS

This report outlines the discussions and outcomes from a workshop jointly held by the IEA Greenhouse Gas R&D implementing agreement (IEAGHG) and the Organisation of Petroleum Exporting Countries (OPEC) on the topic of “Carbon Dioxide Capture and Storage in the UN Clean Development Mechanism”. The workshop was the latest in a series of activities by IEAGHG in supporting CCS in the CDM. The objective of the workshop was to share knowledge amongst IEAGHG technical experts and OPEC secretariat and member country delegates, and enhance the understanding amongst all participants of the issues, challenges and approaches to developing CCS projects under the UNs clean development mechanism (CDM) with a focus on OPEC member countries.



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IEAGHG /OPEC : Report of Workshop on CCS and CDM

1. INTRODUCTION

This report outlines the discussions and outcomes from a workshop jointly held by the IEA Greenhouse Gas R&D implementing agreement (IEAGHG) and the Organisation of Petroleum Exporting Countries (OPEC) on the topic of “Carbon Dioxide Capture and Storage in the UN Clean Development Mechanism”. The workshop was the latest in a series of activities by IEAGHG in supporting CCS in the CDM. The objective of the workshop was to share knowledge amongst IEAGHG technical experts and OPEC secretariat and member country delegates, and enhance the understanding amongst all participants of the issues, challenges and approaches to developing CCS projects under the UNs clean development mechanism (CDM) with a focus on OPEC member countries.

It was held on 29-30th October 2013 at OPEC’s headquarters in Vienna, Austria.

2. WORKSHOP STRUCTURE AND PARTICIPATION

The main topics covered in the workshop were as follows:

1. CCS technical, economic and regulatory matters;
2. Case studies of CCS projects under development around the world; and,
3. CDM regulatory and methodological requirements for CCS.

The final session of the workshop involved a group task, where participants worked together to develop solutions for CCS CDM related issues and challenges.

Participants were made up of technical experts on various aspects of CCS and CDM, IEAGHG and OPEC secretariat staff, and OPEC member country delegates whose work involves consideration of CCS and climate change policy. Participants in the workshop were from the OPEC member countries of Algeria, Iran, Libya, Qatar, Saudi Arabia, United Arab Emirates, and Venezuela. A full list of participants is set out in Annex A.

3. FRAMING ISSUES

The CDM allows emission reduction projects in developing countries to generate tradable carbon credits – know as certified emission reductions or “CERs” – that can be sold to developed country Parties to the Kyoto Protocol to help them meet their emission reduction targets. According to statistics published by the UNFCCC, the CDM currently has stimulated over 7000 low-carbon projects in developing countries, representing over 2,000 Mt of CO₂ emission reductions.

The CDM is governed by rules set out in its modalities and procedures,¹ which covers methodological, procedural and governance aspects for registering emission reduction projects as CDM project activities. Several unique issues posed by CCS projects compared to other emission reduction project types meant that several Parties held concerns regarding the inclusion of CCS in

¹ Decision 3/CMP.1

the CDM under the existing modalities and procedures. For this reason, new modalities and procedures specific to CCS projects were agreed at the Durban UN Climate Conference in 2011 (the CCS M&Ps).² The CCS M&Ps address several concerns of Parties through inclusion of the following elements:

1. *Technical standards and guidance* – in order to mitigate the risk of carbon dioxide (CO₂) leaking from geological reservoirs into the atmosphere (known as “seepage”), it is essential that only properly selected and managed geological reservoirs are used. To address this, the CCS M&Ps contain technical standards and procedures for geological storage site selection, risk assessment, monitoring and management;
2. *Environmental integrity* – in the event of seepage, the environmental integrity of CERs generated by a CCS project activity would be compromised. This risk is managed through provisions in the CCS M&Ps relating to a “net reversal of storage”, which allocates responsibilities and procedures for replacing emission reduction units equal to the amount determined to have seeped;
3. *Damages, remediation and liability* – in case of seepage and local impacts, especially over the long-term, the CCS M&Ps set out provisions for the allocation of “liability” for the geologically stored CO₂ and obligations for remediation and compensation;
4. *Participation requirements* – because many of the issues described above are best governed under local laws and regulations, new participation requirements are included for countries wishing to host CCS CDM project activities.

OPEC member countries are interested to develop CCS projects to mitigate CO₂ emissions in their countries, and a key means for financing such activities is through development of projects under the CDM.

4. TECHNICAL, LEGAL, ECONOMIC AND REGULATORY ASPECTS

The workshop was opened and welcomed by Dr Abdul-Hamid, Director of Research at OPEC. Following welcoming messages, the first day concentrated on a range of technical, regulatory and economic factors affecting CCS development and deployment, based around the issues set out in the section above. CCS technology, capture applications, geological storage and costs

Participants were provided with an overview of CCS, ongoing activities around the world, and typical technical applications covering both capture and geological storage of CO₂.

Following the presentations, participants discussed how CCS can be best presented as an effective option for climate change mitigation within various fora, and in particular the UNFCCC. It was commented that in general, there is a low level of understanding about CCS technologies within this forum, and many concerns about safety and costs persist amongst UNFCCC negotiators, especially from developing countries. It was broadly agreed that greater efforts need to be made to increase awareness of the benefits and role that CCS can play in reducing greenhouse gas emissions to atmosphere, perhaps through inclusion of a common umbrella for CCS-related interests as can be seen for avoiding emissions from deforestation under the auspices of the UNFCCC (known as “REDD”). The challenge of making a case for CCS investment with low CER prices and the emergence

² Decision 10/CMP.7

of shale oil and gas at the current time was also discussed. In these contexts, it was noted that greater effort should be made to:

- Present CCS costs relative to renewable energy sources and with different fuel costs; and,
- Highlight the wider benefits available through utilisation of captured CO₂ such as with enhanced oil recovery (EOR) or use in algae growing, which can help offset the costs of capture and provide important sources of revenue to project developers.

A range of technical options for utilising CO₂ in EOR to support more rapid CCS deployment were also discussed, including the use of CO₂ flooding earlier in the life of an oilfield.

4.1. Site selection, characterisation, risk management and monitoring

A review of different techniques applied to select geological storage sites and to assess risk and safety of particular storage reservoirs was provided to participants. The experience presented was drawn from real world project examples being developed by Shell. Following this, an overview of techniques to detect CO₂, and in particular leaking CO₂, was provided, drawing on examples in the USA and Canada.

The ensuing discussions focussed on the need to increase awareness amongst the public and policy-makers about the range of measures and techniques that can be used to reduce risks and ensure the safety of CCS projects. Some concerns were raised regarding the rigour of requirements under the CCS M&Ps, although it was noted that these are similar to requirements in developed country jurisdictions, and are technically achievable.

4.2. Regulation, liability and costs

The range of legal instruments applicable to regulate CCS were introduced to participants, and specific attention was given to matters relating to liability. The presentations showed that a framework for regulating CCS is emerging in many parts of the world under international law (e.g. London Convention; 2006 IPCC Guidelines for National Greenhouse Gas Inventories; the CCS M&Ps) and also regional and local laws (e.g. in Europe and the US). It was also noted that the CCS M&Ps draw heavily on the precedents set down in international and national laws and regulations governing CCS. An overview of liabilities associated with CO₂ storage sites was presented, and the principles and models for allocating liability outlined from a project developer perspective. The example of the EU approach was used to illustrate approaches and issues.

Most of the discussions about the session focussed on liability matters, and in particular the challenges of getting private investment, the appropriate balancing of risk and rewards, and the potential role of the insurance industry in supporting such a risk/reward balance.

4.3. Case studies

Presentations were provided for various ongoing CCS project developments around the world, including the Quest Project (Alberta, Canada), Weyburn-Midale and Aquistore (Saskatchewan, Canada) and Peterhead-Goldeneye (Scotland, UK).

5. CCS IN THE CDM

The second day of the workshop was dedicated to issues relating to CDM and implementation of CCS projects thereunder.

5.1. Legal, technical, procedural and methodological aspects

The first session gave participants an overview of the CDM, covering its origins, its rules and governance arrangements, its basic principles and procedures for CDM applications. This was followed by specific presentations regarding the CCS rules as set out under the CCS M&Ps, and the existing standards and documentation for CCS CDM applications, namely: the guidelines and templates for:

- (i) completing an *proposed new methodology* for CCS (CCS PNM), and;
- (ii) completing a *project design document* (PDD) for a CCS project activity under the CDM.

This included brand new up-to-date provisions specific for CCS within the PNM and PDD templates. Thoughts were also provided about the future of the UN process, the CDM and other new forms of climate finance that emerge under the UNFCCC (e.g. the Green Climate Fund, the New Market Mechanism).

Participants then discussed a variety of aspects of CCS inclusion under the CDM, including how future mechanisms could draw from the CCS CDM experience to-date, and the general challenges for launching a CDM process for CCS today given the uncertainty around the future of the international carbon market. It was generally agreed that even though CDM may not be a clear incentive to develop CCS in developing countries today, much of the experience and knowledge designed into the CCS M&Ps and related implementation aspects (e.g. the PNM and PDD guidance) could be readily transferrable to new forms of climate finance that may emerge over coming years.

5.2. Group Work

The final sessions of the workshop focussed on a group work exercise based on a hypothetical case study involving the capture and storage of CO₂ from natural gas processing plant that currently vents to atmosphere, and its dehydration, compression and storage in saline formation. In the group work, participants were asked to solve questions around project boundaries, project emissions, baselines, additionality, regulatory issues, and monitoring.

The group work provided participants with an opportunity to learn about the approaches and issues for CDM project development in a more nuanced way, based the particular issues presented by the case study example. The participants from OPEC member countries brought an interesting range of views to the discussion based on their own expertise and perspectives, covering technical research managers in petroleum engineering to senior climate change negotiators in the UNFCCC. Based on the information provided in the workshop, and their own perspectives, the participants identified the key issues, and answers and approaches to these. Rapporteurs from each group presented their answers in plenary, and results were compared to a set of model answers prepared by the technical experts. On the whole, the group session demonstrated that participants had grasped many of the technical, legal and methodological issues associated with developing a CCS CDM application. It was again noted that many of the items under consideration were likely to be transferable to wider discussions regarding CCS and climate finance under the UNFCCC.

6. CONCLUSIONS

The workshop provided an opportunity for OPEC member country participants to learn more about the various aspects of CCS project development, how these would apply in developing a CCS project under the CDM, and how the issues may be transferrable to other types of climate finance in the future. It also allowed technical experts to discuss various issues of interest in the context of OPEC member country specific circumstances, responsibilities and respective capabilities. The spirit of open dialogue and information exchange meant that all participants were able to gain new knowledge and ideas through from the workshop. More broadly, participants appreciated and enjoyed the workshop as a learning exercise.

Many thanks go to Paul Zakkour of Carbon Counts, the hosts OPEC, and to the technical experts from CCSA, The University of Texas, Shell, PTRC, and from IEAGHG.



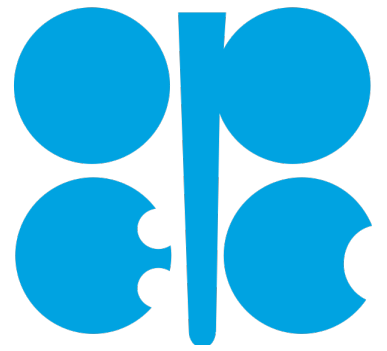
Attendee List



Zohra Bouhouche	Algeria
Abdelkrim Ouamer	Algeria
Ehsan Taghavinejad	Iran
Mohamed Amammer Adbrib	Libya
Bakr Elbouaishi	Libya
Saif Al-Naimi	Qatar
Nasser Al-Mohannadi	Qatar
Ayman Shasly	Saudi Arabia
Abdullah Tawlah	Saudi Arabia
Albara Tawfiq	Saudi Arabia
Rashid Khalifa AlShaali	United Arab Emirates
Ramiro Ramirez	Venezuela
Omar S. Abdul-Hamid	OPEC Secretariat
Oswaldo Tapia	OPEC Secretariat
Mohammad Taeb	OPEC Secretariat
Taher Najah	OPEC Secretariat
Mohammad Danesh	OPEC Secretariat
Eleni Kaditi	OPEC Secretariat



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IEAGHG-OPEC Workshop on CCS and CDM

Vienna, Austria

29th - 30th October 2013



Tuesday 29th October 2013

08.30 Registration

09.00 - 09.15 Welcome from OPEC, *Omar S. Abdul-Hamid, OPEC*

09.15 - 09.30 Welcome from IEAGHG and introduction to the objectives of the workshop, *Tim Dixon, IEAGHG*

Session 1

09.30 - 10.15 **Overview of CCS Technology**, *Tim Dixon, IEAGHG*
Broad introduction to climate change science, contribution of CCS to mitigation. Introduction to CCS chain, technologies for capture, transport and storage. Review of global projects, use of IEAGHG, GCCSI, CSLF (Carbon Sequestration Leadership Forum) and IPCC information

10.15 - 10.30 Coffee Break

Session 2

10.30 - 11.30 **Applications of CCS**, *John Davison, IEAGHG*
Applications in power sector
Application and potential for non-power sector

11.30 - 12.15 **Overview of Geological Storage**, *Neil Wildgust, PTRC*
Storage mechanisms, types of storage including CO₂-EOR, existing projects, analogues, global storage potential, public outreach issues

12.15 - 13.15 Lunch

Session 3

13.15 - 13.45 **Site Selection, Characterisation and Modelling**, *Owain Tucker, Shell*
Including data required, geological characterisation, leakage pathways, dynamic characterisation using modelling

13.45 - 14.15 **Risk and Safety Assessment**, *Owain Tucker, Shell*
Overview of techniques, risks to be covered, and applications to projects, risk management and mitigation plans

14.15 - 14.45 **Monitoring and Environmental Impacts**, *Katherine Romanak, The University of Texas at Austin*
The types and purposes of monitoring, deep/performance, shallow and surface monitoring/assurance, impacts, emissions monitoring.
Impacts of leakage, analogues, leakage monitoring. Environmental Impact Assessments

14.45 - 15.00 Coffee Break

Session 4

15.00 - 15.30 **CCS Regulatory Frameworks** *Tim Dixon, IEAGHG*
Status and requirements of international and national legal and regulatory frameworks for CCS, including trans-boundary issues.

15.30 - 16.00 **Liability**, *Luke Warren, CCSA*
Liability types, responsibilities and mechanisms
Case of EU legislation

16.00 - 16.30 **CCS Costs and Economics**, *John Davison, IEAGHG*
With focus on capture

Session 5

16.30 - 17.00 **Case Studies**, *Neil Wildgust, PTRC and Owain Tucker, Shell*
Examples of real CCS projects

Wednesday 30th October 2013

Session 6

09.00 - 10.00 **Overview of the Clean Development Mechanism**, Paul Zakkour, Carbon Counts
Overview, and procedures and requirements. Numbers and types of projects. Project Standards. Project Design Documents, Methodologies. Monitoring. Roles of Executive Board, Designated Operational Entities, Project Participants. Case study of a CDM project

10.00 - 10.30 **CDM Rules for CCS**, Tim Dixon, IEAGHG
The requirements and conditions within the 2011 Modalities and Procedures specific for CCS

10.30 - 11.00 Coffee Break

Session 7

11.00 - 12.00 **Application Procedures for CCS in CDM**, Paul Zakkour, Carbon Counts
Introduction to the process, and revised forms and procedures for CCS. CCS Working Group. Work outstanding. Introduction to Groupwork

12.00 - 13.00 Lunch

Session 8

13.00 - 15.15 **Group Work**, Led by Tim Dixon, IEAGHG and Paul Zakkour, Carbon Counts
Discussion in groups about CCS CDM applications, and exercise in drafting applications

15.15 - 15.30 Coffee Break

15.30 - 16.30 **Feedback from Groupwork**
Feedback and discussion

16.30 - 17.00 **Recap and Conclusions**, Tim Dixon, IEAGHG and Paul Zakkour, Carbon Counts
Conclusions, learnings and final points

Presenters



John Davison

John Davison has worked as a project manager at IEA GHG since 1997, where his main role is to provide impartial assessments of technologies and costs of CO₂ abatement. In recent years he has concentrated mainly on managing and carrying out studies on CO₂ capture in power generation and large energy consuming industries. He has also worked on CO₂ transportation, renewable energy and biological carbon sequestration. Prior to joining IEAGHG he worked for British Coal on coal utilisation R&D and in energy consultancy. He was one of the lead authors of the IPCC Special Report on CCS and is a chartered chemical engineer.



Tim Dixon

Tim Dixon is the Technical Programme Manager for IEAGHG, an international research programme established since 1991. He has been at IEAGHG since 2008, and is responsible for ensuring IEAGHG activities provide the evidence-base to support the growing regulatory and policy developments for carbon dioxide capture and and storage (CCS), including the IEAGHG technical studies, IEAGHG Research Networks, and GHGT Conferences. Previously he worked in CCS, emissions trading, and related areas for the UK Government's Department of Trade and Industry and for AEA Technology. He was UK negotiator for the London Convention and OSPAR CCS amendments, and for CCS in the EU ETS. He still assists UK government in the UNFCCC, and was the negotiator for the UK and EU on CCS in CDM. Tim has a BSc in Applied Physics and an MBA.



Katherine Romanak

Dr. Katherine Romanak is a Research Associate at The University of Texas at Austin's Bureau of Economic Geology. She has a MSc in Geology from the University of Texas at Arlington and a Ph.D. in Geology from The University of Texas at Austin with a specialty in environmental geochemistry. Dr. Romanak has developed near-surface monitoring programs for several US DOE Regional Carbon Sequestration Partnership projects and was instrumental in planning and implementing deep subsurface geochemical monitoring at the Cranfield CO₂ pilot injection, Mississippi, USA. She served as the Principal Investigator for the IPAC-CO₂ investigation into claims of leakage at the Kerr Farm, Saskatchewan, Canada. She has informed stakeholders to the UNFCCC Clean Development Mechanism (CDM) on CCS monitoring and environmental research at the 2011 UNFCCC SBSTA technical workshop on modalities and procedures for CCS under the CDM and at COP 17.

Dr. Owain Tucker currently works in Shell as a Global Deployment Leader - CCS & Contaminated Gas. His previous employment with Shell has seen him move from evaluating the economics of activities in the UK oil and gas fields, tariffs, acquisitions and divestments to begin his work in CSS as a reservoir engineer in the North Sea and continuing his role in CCS and contaminated gas through to management. Owain was also a member of the CCS Cost reduction Task Force advising the government and industry on the steps needed to reduce the cost of CCS. Owain gained his PhD in Solid State Physics with a BSc in both Physics and Physics and Geophysics.



Owain Tucker

Luke Warren is the Chief Executive at the Carbon Capture and Storage Association (CCSA) and started his current position in October 2013. He joined the CCSA in 2009. Luke has worked on a wide range of CCS policy issues for the association, including UK Electricity Market Reform, CCS regulations, European CCS activities as well as international bodies working on CCS and climate change issues. In his role he has provided evidence to Governments, developed multiple papers and spoken widely on CCS matters. He is regularly invited to participate in various national and international activities and groups that promote CCS as a response to concerns over climate change. Prior to joining the CCSA Luke worked in a number of positions in the energy industry.



Luke Warren

Neil Wildgust is Acting CEO at the Petroleum Technology Research Centre, overseeing research programs on Enhanced Oil Recovery (EOR) and CO₂ geological storage. Previously he worked for the IEA Greenhouse Gas R&D Programme, based in the UK, as Project Manager for Geological Storage and was responsible for coordinating international storage research networks and commissioning studies. He holds an MSc in Applied Environmental Geology from Cardiff University and a BSc in Geology from Southampton University, is a chartered geologist and has 25 years of industrial experience in mining, land contamination and hydrogeology.



Neil Wildgust

Paul is a Director of Carbon Counts, a consultancy specialised in international climate change policy. He has worked for over 12 years in the field of low carbon policy, strategy and implementation. Paul is also currently a member of the recently formed CCS Working Group of the CDM Executive Board. He has worked extensively on CCS policy implementation, including with the European Commission in the design of its CCS Directive and linking to the EU emissions trading scheme, with the UNFCCC on CCS modalities and procedures under the CDM, and with the IEA on various aspects of CCS. Paul has worked on several initiatives relating to CCS deployment and implementation in Europe, the US, Middle East, South Africa, China, India and South East Asia. He is currently working with the World Bank and South African Government to develop CCS regulations in the country, and reviewing the scope for implementing a CCS CDM project in South Africa on the Pilot CO₂ Storage Project run by SACCS.



Paul Zakkour