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Getting Science and Technology into International Climate Policy: Carbon Dioxide Capture and Storage in the UNFCCC

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Abstract

This paper describes how providing scientific information to negotiators assisted in achieving inclusion of carbon dioxide capture and storage (CCS) in the United Nations Framework Convention on Climate Change (UNFCCC) Clean Development Mechanism (CDM) during 2011. We provide specific examples of how scientific information from IEAGHG Research Networks in the areas of monitoring, modelling, environmental impacts and groundwater protection were used to address the issues of concern listed in the Cancun Decision (2010). Technical input was provided by members of IEAGHG Research Networks via the UNFCCC's technical workshop on Modalities and Procedures for CCS under the CDM, such that the negotiations in Durban (2011) were better informed by an understanding of the most recent technical information. The outcome was the agreement of CCS-specific modalities and procedures for including CCS in the CDM.

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1. Background

The CDM is the main policy tool under the UNFCCC's Kyoto Protocol for developing countries. It is a mechanism that encourages countries with emissions targets to implement low carbon projects in developing countries in order to earn tradable carbon credits (CERs – certified emissions reductions). To

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date, the CDM mechanism has stimulated over 4600 projects worldwide representing credits of over 1 billion tonnes of CO_2. In order for an activity to be eligible within the CDM, that activity must follow and meet a set of accepted modalities and procedures (i.e. rules) that guide the implementation of the project and define the method for deriving CERs.

Since 2005, the question of whether CCS should be eligible within the CDM has been debated and negotiated at great length and in detail, without progress. The negotiations have been characterised by a few countries having strong views against CCS in the CDM and by some with a positive view for it being included, but the UNFCCC process requires consensus to progress in any area. The main issues of concern have included; potential non-permanence of CO_2 storage, monitoring and verification, environmental impacts on ecosystems and climate (including "massive catastrophic release"), project boundaries and transboundary issues, liability, perverse outcomes (i.e. stimulating more use of fossil fuels), safety, and insurance and compensation for leakage.

In 2010, after years of debate, it was agreed at CMP6/COP16 in Cancun that CCS could be eligible providing this range of issues was addressed by specific modalities and procedures for CCS in the CDM (UNFCCC [1]). A work programme was put in place consisting of submissions (written information and views submitted formally), a technical and legal workshop in Abu Dhabi in September 2011, and the production of draft modalities and procedures by the UNFCCC for negotiation at CMP7/COP17.

2. Information into the UNFCCC

The usual routes for scientific information into the UNFCCC environment are threefold;

(1) Countries and their negotiators may undertake research and briefing before participating, however many lack the time and/or opportunity to cover the many different topics and issues being debated, and some countries have only small delegations.
(2) Negotiators may attend UNFCCC-hosted Side-events. These are seminars which the UNFCCC hosts alongside the negotiations, allowing organisations to present the latest work and results relating to climate change, mitigation and adaptation. There are many of these each day, however their effectiveness is reduced due to several factors. Firstly, audiences are self-selecting so they may not attend pertinent events. Secondly depending on conference logistics, Side-events can be some distance from the negotiations (although still within the UNFCCC area). Thirdly, Side-events may conflict with the timings of negotiations which are the priority activity at these meetings. Since 2006, there have been a small number of CCS-related side events at most of the main UNFCCC meetings (COP's).
(3) The third route for information is through booths. The UNFCCC makes available small stand areas for accredited observer organisations to provide information and literature to conference attendees. Again the effectiveness of these booths depends on people who are self-selecting and who may not have the time or awareness to seek out the information. Only since 2009 have there been one or two CCS-based booths at the 'COP's.

The work programme for CCS in the CDM included an additional avenue for information sharing, as proposed in Cancun, in the form of a dedicated workshop in Abu Dhabi. This workshop was free of the distractions of negotiation meetings and allowed negotiators the time and space to concentrate on and discuss issues on all aspects of CCS with technical and legal experts. The IEAGHG saw this opportunity, recognised that the technical issues of concern could be addressed from the expertise within its research networks, and took the initiative to contribute impartial and evidence-based information to the negotiators at the workshop, drawing upon the large amount of knowledge gained in the time since the IPCC Special Report on CCS) [2] was published. Since this IPCC report was published, many new technical developments had been gained through research and from real CCS project experience and developments.

3. IEAGHG Research Networks providing information

IEA Greenhouse Gas R&D Programme (IEAGHG) is an international research organisation active since 1991 which provides information on technologies to reduce greenhouse gas emissions from the use of fossil fuels, focussing mostly on CCS. One of its flagship activities is running Research Networks covering all aspects of CCS. These Research Networks meet annually and bring together the leading experts from around the world to share and discuss the latest work and results, and in so doing provide a resource that can be used to address particular issues, as well as to provide peer reviews of projects and programmes. (More information on these can be found on the IEAGHG website http://www.ieaghg.org/index.php?/networks.html).

IEAGHG used three of its International Research Network meetings in 2011, the Modelling Network, the Monitoring Network, and the Risk Assessment Network, as forums for the relevant international scientists and experts to address the relevant 'Cancun Decision' issues [1]. This was undertaken by introductory presentation and discussions at the Monitoring Network and Risk Assessment Network meetings, and by introductory presentation and questionnaire at the Modelling Network. Highlights of the outcomes and conclusions are illustrated below.

These 'Cancun Decision issues' included the following.

In the area of monitoring:

> *"Stringent monitoring plans shall be in place and be applied during and beyond the crediting period in order to reduce the risk to the environmental integrity of carbon dioxide capture and storage in geological formations;"* [1]

One conclusion from the Monitoring Network was that the IPCC GHG guidelines can provide robust and effective monitoring protocols, and that monitoring plans should be site specific and risk based [3].

In the area of modelling:

> *"Further consideration is required as regards the suitability of the use of modelling, taking into account the scientific uncertainties surrounding existing models, in meeting the stringency requirements of such monitoring plans;"* [1]

The Modelling Network concluded that current characterisation and modeling techniques can provide sufficient confidence to select storage sites that can store CO_2 securely, assuming selection, characterisation and predictive modelling of CO_2 geological storage sites is undertaken according to relevant best practice guidance [4].

In the area of risk assessment:

> *"A thorough risk and safety assessment using a methodology specified in the modalities and procedures, as well as a comprehensive socio-environmental impacts assessment, shall be undertaken;*
>
> *The risk and safety assessment shall include, inter alia, the assessment of risk and proposal of mitigation actions related to emissions from injection points, emissions from above-ground and underground installations and reservoirs, seepage, lateral flows, migrating plumes, including carbon dioxide dissolved in aqueous medium migrating outside the project boundary, massive and catastrophic release of stored carbon dioxide, and impacts on human health and ecosystems, as well as an assessment of the consequences of such a release for the climate"* [1]

The conclusions of the Risk Assessment Network included the need to specify the objectives of risk assessment rather than the methodology. Various methodologies or techniques can be applied for different aspects of risk assessment, and risk assessment techniques are developing and improving. Risk assessment is iterative process throughout the project lifetime [5].

IEAGHG then ensured that these outcomes and conclusions were shared in the UNFCCC workshop in Abu Dhabi. This workshop brought CCS negotiators into contact with some 28 technical and legal experts, Presentations and discussions at the workshop by technical expert members of the IEAGHG networks included the latest on monitoring, modelling, risk assessment, environmental impacts and groundwater protection [6]. There have been significant developments in all these areas since the IPCC Special Report on CCS [2] which before the workshop tended to serve as the main source of information for negotiators. Because the Abu Dhabi workshop environment was conducive to good and open discussion among negotiators and experts, a number of important technical points were successfully conveyed, including:

- The key longer-term trapping process of CO_2 dissolution accompanied by gravitational sinking of CO_2 saturated formation water can be demonstrated from downhole resistivity logging at the Nagaoka site (Mito et al [7]).
- History-matching of simulated CO_2 plume movement with actual observations is challenging, but has been achieved at Sleipner to a degree sufficient to provide confidence in the understanding of the processes controlling CO_2 plume behaviour (e.g. Chadwick et al [8]).
- The processes and scale of potential environmental impacts from leakage events is better understood than is generally appreciated and can be monitored, including in groundwater, using a range of practical techniques and also by using studies on natural CO_2 leakage analogues as examples (eg Keating [9], Romanak [10], IEAGHG [11]).
- The scale and extent of any environmental impacts would be relatively modest, the concept of "massive catastrophic release" being without any scientific basis (e.g. IEAGHG [11], Dixon et al [12]).

Elements from the Abu Dhabi workshop were repeated in an official UNFCCC Side-event organised by the Carbon Capture and Storage Association at the CMP7/COP17 (2011) in Durban.

4. The need to inform

Although technical information provided to negotiators through the efforts of IEAGHG and others produced observable results, these results were variable, illustrating the difficulty of, and on-going need for informing policy makers on scientific issues. This point is illustrated by the following statements

which are illustrative of those made during negotiations on including CCS in the CDM during the CMP7/COP17 meeting in Durban:

"What is this carbon capture?"

"Do we have technology to monitor groundwater impacts?"

"Definition of seepage should include CO_2 dissolved in groundwater migrating to ocean or atmosphere"

These illustrative statements reflect different degrees to which negotiators in Durban were informed on CCS science, even with the significant information provided from submissions, the Abu Dhabi technical workshop, and the side event in Durban. The first quote reflects an uninformed negotiator. The second is from a concerned negotiator who was not at the technical workshop to learn more on the topic. The third reflects a negotiator who attended and benefitted from the technical workshop thus enabling him to be more scientifically-articulate and influential in reflecting his concerns in the modalities and procedures while still facilitating negotiations.

Such better-informed negotiators raised the quality of discussion and negotiation in Durban as the modalities and procedures document was debated and agreed word by word, line by line, to the satisfaction of all negotiators concerned. This took some 32 hours of negotiations, which also achieved agreement on what was possibly the largest amount of new text yet within a single UNFCCC meeting (some twenty pages of the draft modalities and procedures).

5. Results

The end result of the Durban negotiations was the agreement and acceptance of a set of CCS-specific modalities and procedures for including CCS in the CDM to ensure environmental integrity whilst also being workable by projects [13]. This was recognition by the UNFCCC that CCS is a viable technology for use in developing countries. It also sets an important precedent for the inclusion of CCS into other global financial and support mechanisms. This is particularly relevant given the other achievements at Durban that provide for a future agreement on binding targets for both developed and developing countries from 2020, and a second commitment period for the Kyoto Protocol which will continue 'project-based mechanisms' such as the CDM, and also a Technology Mechanism and the Green Climate Fund into the future.

6. Conclusions

At CMP6/COP16 in Cancun CCS became eligible to be included in the CDM providing a range of technical issues was addressed. IEAGHG used three of its International Research Network meetings as forums for international scientists and experts to address and discuss the relevant 'Cancun Decision' issues. These outcomes were shared in the UNFCCC workshop in Abu Dhabi. This provision of technical information in such a way ensured that science was able to reach and inform some negotiators, significantly assisting in achieving inclusion of CCS in the CDM. Some negotiators who were not able to attend the technical information events remained uninformed illustrating the difficulty of, and ongoing need for, informing policy makers on scientific issues.

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