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Item 5 of the provisional agenda
Issues relating to the clean development mechanism

Report on the workshop on carbon dioxide capture and storage as clean development mechanism project activities

Note by the secretariat

Summary

The UNFCCC workshop on carbon dioxide (CO_2) capture and storage as clean development mechanism (CDM) project activities was held on 22 May 2006, in Bonn, Germany, in conjunction with the twenty-fourth session of the Subsidiary Body for Scientific and Technological Advice. The participants discussed issues relating to the consideration of CO_2 capture and storage as CDM project activities under four main topics: project boundary, leakage, permanence and other issues. This report is to be considered by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its second session, together with submissions from Parties and recommendations by the CDM Executive Board on methodological issues.

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I. Introduction

A. Mandate

1. The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP), by its decision 7/CMP.1, requested the secretariat to organize, in conjunction with the twenty-fourth session of the Subsidiary Body for Scientific and Technological Advice (SBSTA), a workshop on considering carbon dioxide (CO_2) capture and storage as clean development mechanism (CDM) project activities, taking into account issues relating to project boundary, leakage and permanence. The COP/MOP also invited Parties to provide to the secretariat, by 13 February 2006, submissions on the consideration of carbon dioxide capture and storage (CCS) as CDM project activities, taking into account issues relating to project boundary, leakage and permanence, and on issues to be considered by the workshop.

2. The secretariat received nine submissions from Parties, which are contained in document FCCC/KP/CMP/2006/MISC.2. In addition, the Secretariat received five submissions from observer organizations, which have been posted on the UNFCCC website.[1]

3. The COP/MOP is to consider, at its second session, submissions from Parties, recommendations by the Executive Board of the CDM on methodological issues, based on submitted CDM methodologies, and this workshop report, with a view to adopting a decision on guidance to the Executive Board on CCS as CDM project activities, taking into account issues relating to project boundary, leakage and permanence.

B. Scope of the note

4. The workshop on CCS as CDM project activities was held on 22 May 2006 in Bonn, Germany. It was co-chaired by Mr. Hernán Carlino (Argentina) and Mr. Georg Børsting (Norway).[2]

5. The workshop consisted of two sessions. The first session included a short summary of the SBSTA in-session workshop on carbon dioxide capture and storage held on 20 May 2006 in Bonn, the *IPCC Special Report on Carbon Dioxide Capture and Storage*[3] published by the Intergovernmental Panel on Climate Change (IPCC) and the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.[4] This was followed by a presentation by the secretariat on common terms, an overview of the submissions made by Parties on the consideration of CCS as CDM project activities, and a summary of three proposed new methodologies for CCS as CDM project activities submitted to the Executive Board for its consideration.

6. The second session consisted of open discussions, guided by the co-chairs on topics identified from the submissions from Parties and observer organizations and on the issues of permanence, boundary and leakage as requested by the COP/MOP at its first session.

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[1] The submissions are available at <http://cdm.unfccc.int/workshops/ccs_cdm/index.html>.
[2] The workshop agenda is available at <http://cdm.unfccc.int/workshops/ccs_cdm/index.html>.
[3] Hereinafter referred to as the IPCC Special Report.
[4] Hereinafter referred to as 2006 IPCC Guidelines.

II. Session one

A. Summary of the in-session workshop on carbon capture and storage, the special report on carbon capture and storage, and the 2006 guidelines for national greenhouse gas inventories[5]

7. The presentations[6] highlighted the following salient points:

(a) Potential point sources of anthropogenic CO_2 emissions amenable to capture of CO_2 and sedimentary basins that may be suitable for geological storage of CO_2 exist all over the world;

(b) The capture and compression of CO_2 from emission sources requires a substantial amount of energy, which can be equivalent to 10–40 per cent of energy input per unit of output. For instance, in a power plant with CO_2 capture, this energy use could result in emissions due to reduced efficiency of the power plant and from production of fossil fuels used as fuel in the power plant;

(c) The capture and storage of CO_2 from biomass-based processes could lead to a net removal of CO_2 from the atmosphere (or 'negative emissions') provided that the biomass is harvested at a sustainable rate;

(d) Potential seepage paths of CO_2 from a reservoir include faults, poorly plugged boreholes, and escape through migration in open reservoirs;

(e) Models to simulate movement of gases could be used for identifying possible seepage paths and for selecting monitoring techniques, provided sufficient data on the site and the surrounding area are available to quantify underground migration of CO_2;

(f) Though the knowledge of the general characteristics of reservoir types can provide valuable information, the suitability and potential of a reservoir for CO_2 storage can be determined only through detailed site characterization. Modelling results are dependent on the intrinsic qualities of the model and, in particular, on the quality of the data used;

(g) The CCS-specific monitoring strategy for emissions seepage and modelling should be updated when new information, data or scientific insights become available;

(h) According to the IPCC Special Report, monitoring costs for geological storage are USD 0.1–0.3 per tonne of CO_2 avoided, including costs for post-injection monitoring, over the lifetime of the project activity;

(i) The framework in the 2006 IPCC Guidelines for determining seepage from a storage site consists of the following steps:

(i) Identify the geological features of storage site, local and regional hydrology and seepage pathways;

(ii) Evaluate potential for seepage based on site characterization and realistic models that predict CO_2 movement;

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[5] See paragraph 5 above.
[6] The presentations given in this session are available at <http://cdm.unfccc.int/workshops/ccs_cdm/index.html>.

(iii) Develop a site-specific monitoring plan (for both during injection and post-injection monitoring) based on predetermined potential seepage paths. If the monitoring results indicate that the outcome of the models used in step 2 above may be improved, the models would then have to be validated, updated and rerun with any additional or new information;

(iv) Report amount of CO_2 injected and seepage from storage site.

B. Terms used, submissions received and carbon capture and storage methodologies submitted to the Executive Board

8. The secretariat provided an outline of the terms to be used during the workshop (see annex). Notably, the term “leakage”, as referred to in the CDM modalities and procedures[7] and the IPCC Special Report, was clarified. For the purpose of the workshop, the term “seepage” was defined as “the escape of injected CO_2 from a storage reservoir”. The secretariat also provided a brief summary of Party submissions, as contained in document FCCC/KP/CMP/2006/MISC.2.

9. The Executive Board has received three proposed new methodologies for CCS as CDM project activities: two large-scale geological storage methodologies (NM0167 and NM0168),[8] and one small-scale ocean storage methodology (SSC_049).[9] The main attributes of these methodologies were summarized by the secretariat.

III. Session two

A. Project boundary

10. Some of the issues raised in submissions from Parties and observers in relation to project boundary[10] are connected:

(a) To the various components of CCS (source of CO_2, capture, installation, transport facilities and storage site) that are defined within the project boundary;

(b) To defining project boundary when the reservoir storage spans international boundaries;

(c) To defining the project boundary for project activities that would use the same or overlapping reservoirs.

11. In discussion at the workshop, participants were of the view that the full CCS activity chain, i.e. capture, process, transport and storage, should be included within a CDM project boundary, although, for some sources of CO_2, this might differ from one project activity to another. One view expressed was that project boundary should not be restricted to the boundary of the reservoir, but extend to the zone of influence beyond the reservoir through which the emissions could escape (e.g. due to pressure build-up in the aquifer adjacent to the reservoir and possible seepage through the aquifer).

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[7] Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity (FCCC/KP/CMP/2005/8/Add.1, page 17, para. 51).

[8] Available at <http://cdm.unfccc.int/methodologies/PAmethodologies/publicview.html>.

[9] Available at <http://cdm.unfccc.int/methodologies/SSCmethodologies/Clarifications>.

[10] The project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the CDM project activity (FCCC/KP/CMP/2005/8/Add.1, page 17, para. 52).

12. On the issue of a reservoir extending over more than one country, one view was that the reservoir should be within the jurisdiction of Parties not included in Annex I to the Convention (non-Annex I Parties). Another viewpoint was that the extension of a reservoir across national borders should not be a barrier to undertaking CCS as a CDM project activity and it should be left to the countries under whose jurisdictions the reservoir falls to address the issue.

13. No views were expressed on implications of the overlap or co-use of CO_2 storage reservoirs by two or more different project participants.

B. Leakage

14. Parties and observers in their submissions focused on issues such as how to account for emissions resulting from the use of additional hydrocarbons recovered in, for example, enhanced oil recovery (EOR) operations, and how to account for leakage due to upstream and downstream emissions.

15. The workshop discussion addressed the issue of accounting for emissions resulting from EOR, as summarized below:

(a) One point of view was that emissions from oil produced due to EOR should not be accounted for because there is no evidence that EOR will result in significant increase of oil production; the extracted oil might replace more-carbon-intensive fossil fuels, thus reduce emissions; emissions from oil produced through EOR should be accounted for at the consumption location and, therefore, accounting for them in the CDM project would result in double counting of emissions; and the assessment of an increase in emissions would require a detailed analysis, taking into account market price of fossil fuels and technology improvement aspects, whereas, the impact might be insignificant;

(b) Another view was that such emissions should be treated as leakage and accounted for, because EOR will result in increased oil production, consumption and resultant emissions in non-Annex I Parties, which do not have emission reduction targets under the Kyoto Protocol;

(c) Several participants expressed the view that a general guideline for assessing EOR should be developed, but that the specific outcome of its application should be based on a case-by-case assessment;

(d) It was pointed out that approved methodology AM0009 may provide a precedent for addressing leakage from consumption and emissions from hydrocarbons resulting from EOR, as AM0009 determines that emissions from the use of methane recovered in reducing/preventing gas flaring should not be accounted for as leakage. In response it was pointed out that AM0009 is related to the use of methane which is co-produced in oil extraction and would otherwise be flared. Whereas the oil produced in an EOR operation results from the injection of CO_2. According to this view, the operations are therefore not comparable and the methodology is not applicable;

(e) Some participants were of the view that EOR may raise some issues relevant to the demonstration of additionality of project activities (see paragraph 33 below).

16. As regards the issue of leakage resulting from the energy required to capture CO_2, the general view was that, if the source of CO_2 is not within the project boundary, emissions from energy required to capture CO_2 should be accounted for as leakage and on a case-by-case basis.

17. The issue of upstream and downstream emissions resulting from CCS as CDM project activities was also discussed. Some participants pointed out that the additional energy requirement for CCS results

in a significant overall loss in conversion efficiency of the power plant. This loss in conversion efficiency implies a greater use of fossil fuel by the power plant to supply the same output. The resulting increased use of fossil fuel also results in upstream emissions from the production, processing and transportation of fossil fuel. It was argued that these emissions should therefore be estimated as leakage and taken into account.

C. Permanence[11]

18. Participants broadly recognized that permanence is an important issue when considering CCS as a CDM project activity.

19. Issues raised in submissions from Parties and observers in relation to permanence have, inter alia, been connected:

(a) To the methodological aspects of seepage;

(b) To the definition of the storage site selection criteria;

(c) To suitable reservoirs and methods of storage

(d) To monitoring techniques and requirements;

(e) To implications of force majeure and accidents;

(f) To accountability and responsibility for seepage during and after the crediting period(s).

20. One view expressed in discussion at the workshop was that permanence and reducing the risk of seepage could be addressed through clearly defined site selection criteria and their implementation. Criteria defined in the IPCC Special Report were mentioned as a possible starting point. Another view was that proper site management principles should be defined and implemented to minimize the risk of seepage and limit through remediation measures the consequences of potential seepage.

21. Participants recognized that a list of conditions for low-risk storage of CO_2 could be useful in finding appropriate storage sites. Other necessary elements mentioned included a rigorous monitoring programme, a regulatory system and follow-up remediation in the event of seepage. A question was raised about how to ensure that these elements are implemented.

22. There was general agreement that reservoirs are not uniform in character and that some types of reservoirs might be less suitable as CO_2 storage sites than others. The general view was that only project activities using storage reservoirs with a high expected permanence should be accepted under the CDM, and that site selection criteria should be developed with the aim of minimizing potential seepage risks, by incorporating the outcomes of available scientific studies.

23. A general view was that monitoring is essential in order to account for seepage and that monitoring techniques should be appropriate, site-specific, flexible and cost-effective. One view was that the existing knowledge of underground monitoring should be used in CCS project activities.

24. In relation to the question of how long a storage site should be monitored, some participants responded that the time frame should be based on cost minimization, whereas others said that it should be based on risk minimization. It was argued that monitoring should extend beyond the injection and crediting period of the project activity and that there should be a defined time frame over which the project participants should monitor the site after its closure.

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[11] See annex.

25. Other views expressed were that monitoring should be based on a transparent process taking into account costs and risk of seepage; the monitoring requirements could be based on the performance of the reservoir; and the monitoring time frame should not pose a cost burden to society.[12] It was argued that monitoring time frames and technologies should be treated with a degree of flexibility so that they can be adapted to reflect new findings.

26. Another issue raised in connection with the topic of permanence was the question of liability for seepage. A general view was that clear and transparent licensing and regulatory arrangements, which should include proper site closure procedures, are needed for CCS as CDM project activities. While many of the participants felt that liability beyond the crediting period should be clearly defined, there were differing views on who should be held liable. One view was that the project participants should be held liable up until the closure of the site, beyond which liability should be transferred to the national government (i.e. the host country). One participant said that this is the norm for mining activities in most countries, in particular as the lifetime of the environmental impact (i.e. seepage) could exceed the lifetime of the operating or mining company.

27. It was mentioned that seepage should be accounted for in the year in which it occurs. Some participants pointed out that accounting for seepage in the year in which the seepage occurs is not sufficient, as project participants could not be held liable if it occurs beyond the crediting period or beyond the lifetime of the project participant's existence. For this reason, some argued that the liability of the project activity beyond the crediting period might have to be limited. Other participants highlighted that the importance of accounting requirements should not be played down, as they are required for public acceptance, transparency and clarity on legal requirements. It was also pointed out by some participants that project implementers might be able to insure themselves against post-closure seepage, although insurance is based on detailed knowledge of risks, which could be a challenge for CCS project activities. Another remark was that shifting the liability to the host country after the crediting period might be too much of a burden for the host country.

28. There was general agreement that the accounting system beyond the crediting period should be appropriate, transparent and simple. Suggestions on accounting for seepage beyond the crediting period were: discounting by a set rate of potential seepage; cancellation or replacement of certified emission reductions (CERs) should seepage occur; issuance of temporary CERs; through insurance; and the creation of a remediation fund for any seepage. One view was that the holder of the CERs should be held liable, but that there should be a possibility for the transfer of this liability. One participant suggested creating storage bonds[13] to provide an incentive for permanence.

D. Other issues

29. The issue of whether CCS should be treated as an emission reduction or a sink project activity was discussed. Most participants were of the view that CCS should be treated as an emissions reduction project activity, in line with the 2006 IPCC Guidelines. One participant mentioned that the current modalities and procedures do not provide a basis for inclusion of CCS under the CDM, as CCS cannot be considered an emission reduction project activity as per the CDM modalities and procedures (e.g. because these do not address the issue of permanence) and, in addition, that it cannot be considered a

[12] According to the IPCC Special Report the costs of monitoring are considered to be low (see paragraph 7 (h) above).

[13] Storage bonds are certificates bought by the project participant(s) at the project start. The number of bonds bought is based on the amount of CO_2 stored and the reliability of the reservoir. They are depreciated should seepage occur. Because the project developers will want to prevent this depreciation, and therefore the loss of value of the bonds, the project participants have an incentive to prevent seepage from the reservoir.

sink activity as per decision 5/CMP.1.[14] Others felt that existing modalities and procedures were sufficient and that the particular characteristics of the CCS technology can be dealt with.

30. One participant stated that, because the emission reductions of CCS activities under the CDM would allow for increased emissions in Parties included in Annex I to the Convention, permanence of the project activity is important. Another issue that was raised in this context was whether CCS project activities contribute to sustainable development in host countries. In this context, one participant said that if CCS results in the enhancement of the use of fossil fuels, this may contradict the objective of the UNFCCC.

31. The issue of specific CCS knowledge and competence of designated operational entities (DOEs) was also raised. It was pointed out that the current level of expertise on CCS may be insufficient to select DOEs able to evaluate CCS project activities effectively. It was suggested that CCS should be considered as a separate scope for the accreditation of DOEs.

32. On the issue of the objective of CDM to address technology transfer, some participants stated that CCS technology is not yet fully developed and that the CDM was not intended as a platform to introduce immature technologies in developing countries. Others, however, emphasized that the technology is not new, that it should be transferred and that CDM is currently the only incentive for this. The relevance of CCS for developing countries that will rely on fossil fuels for their economic development was also emphasized by some participants. One participant pointed out that partnerships between developed and developing countries to develop CCS as CDM projects would allow developing countries to leapfrog technology and be exporters of this technology in the future.

33. Another issue discussed was whether projects could be regarded as consistent with the additionality provisions under the CDM. One view was that the current price of CERs is too low for making CCS projects profitable and, therefore, the revenues from EOR are required to make projects viable. An opposing view was that the CDM should not support project activities that are aimed mainly at enabling private companies to deploy EOR that improves profitability of oil production. One participant was of the view that to prove additionality a comparison should be made between the profitability of the CCS project activity with the benefit of EOR and the profitability of the CCS project activity without the benefit of EOR, and a comparison should be made between the profitability of the CCS project activity with the benefit of CERs and the profitability of the CCS project activity without the benefit of CERs.

34. One participant pointed out that a substantial opportunity to reduce or prevent CO_2 emissions globally in the gas processing industry would be lost if CCS is excluded from the CDM, as such project activities could be implemented at current CER prices because of very low capture costs.

IV. Further steps

35. In their closing comments, the co-chairs stated that the secretariat will prepare a report on the workshop, in collaboration with the co-chairs, to be submitted to the COP/MOP for consideration at its second session.

[14] Decision 5/CMP.1 confirmed decision 19/CP.9.

Annex

Terms introduced by the secretariat for use in the workshop

1. Monitoring: The collection and archiving of all relevant data necessary for determining the baseline, measuring anthropogenic emissions by sources of greenhouse gases within the project boundary of a clean development mechanism (CDM) project activity and leakage, as applicable.

2. Leakage: The net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity.

3. Permanence: A qualitative term to characterize whether a reservoir is able to store carbon dioxide (CO_2) for a long time. Decision 5/CMP.1 accounts for non-permanence in afforestation and reforestation and decision 3/CMP.1 deals with emission reductions.

4. Project boundary: All anthropogenic emissions by sources of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the CDM project activity.

5. Sink: Any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere (UNFCCC Article 1, paragraph 8).

6. Seepage: The escape of injected CO_2 from a storage reservoir. This seepage from a reservoir during the crediting period is accounted for either as project emissions (from the part of a reservoir that is within the project boundary) or as leakage (from the part of a reservoir that is outside the project boundary). Seepage beyond the crediting period is not accounted for under the present modalities and procedures.

7. Seepage rate: The percentage of stored CO_2 released per year.

8. Site characterization: The assessment to determine whether the geological storage reservoir has adequate capacity and injectivity, satisfactory sealing caprock or confining unit, and a stable geological environment.

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