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Comments on the consideration of carbon dioxide capture and storage as clean development mechanism project activities

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1. Introduction

In response to the call for submissions on the topic titled above, we comment on the following issues which the CDM EB has asked the COP/MOP for guidance;

1. Can CO_2 capture and storage be eligible as CDM despite not being mentioned in the Marrakech Accords?
2. What level of permanence of the containment of CO_2 is required? This will be assessed using the analogy to biological sequestration (afforestation and reforestation). A particular focus will be on how to handle possible seepage[1] in the distant future.
3. What should be the boundary of a carbon capture and storage (CCS) project?

2. Can CO_2 storage be eligible as CDM when these projects are not mentioned in the Marrakech Accords?

First of all, it should be recognized that Article 1.8 of the UNFCCC defines a sink as "*any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere*." Since CCS usually refers to capture and storage of CO_2 from point sources and not the atmosphere, it should be regarded as an emission reduction, not an emission removal to be consistent with the UNFCCC definition. Therefore all CCS project activities with capture in non-Annex I countries[2] are considered not to be a sink and thus not to fall under the exclusion of sinks other than afforestation and reforestation.

[1] It should be noted that "leakage" is defined in the context of project-based mechanisms of the Kyoto Protocol as the emissions resulting from the project activity outside the project boundary. Since we recommend that emissions seeped out from a CO_2 reservoir should be included within a project boundary for the environmental integrity, such emissions are termed as "seepage" in this report (as done by other analysts, e.g. Bode, S. and Jung, M. (2004) "On the integration of CCS into the international climate regime." HWWA discussion paper 303).
[2] Note that storage can happen either in non-Annex I or Annex I countries under CDM.

While CCS is not mentioned in Decision 17/CP. 7, any technologies other than nuclear facilities should not be excluded from CDM as long as they fulfil all the requirements written in the Marrakech Accords. In case of CCS, a key question is whether it is considered as environmentally safe and sound technology or not.

Decision 17/CP.7 states "*clean development mechanism project activities should lead to the transfer of environmentally safe and sound technology and know-how in addition to that required under Article 4, paragraph 5, of the Convention and Article 10 of the Kyoto Protocol, ...*"[3] Therefore it should be ensured that CCS is an environmentally safe and sound technology before it becomes eligible for CDM.

As Decision 5/CP.7 "*encourages Parties to cooperate in the development, diffusion and transfer of less greenhouse gas-emitting advanced fossil-fuel technologies, and/or technologies relating to fossil fuels, that capture and store greenhouse gases, and requests Annex II Parties to facilitate the participation of the least developed countries and other non-Annex I Parties in this effort,*" we can assume that the COP endorses CCS as fulfilling the criteria of Decision 17/CP.7.

Due to the grave environmental risks of storage in the ocean, only ***geological*** storage should be eligible. Storage in movable matter (e.g. chemicals) should not be eligible.

3. What level of permanence of the containment of CO_2 is required?

There are no reliable experimental data available to accurately estimate the rate of CO_2 loss from storage into the atmosphere. Existing modelling (see IPCC Special Report on CCS, 2005) have suggested that a 1% seepage rate would not allow stabilisation of CO_2 concentrations; 0.1% would allow stabilisation but might involve large costs as escaped emissions from storage sites would need to be offset by deeper emission reductions elsewhere; 0.01% seepage rate, however, would appear compatible with stabilisation of concentration goals in all cases.[4] The precautionary principle would thus require safeguards to account for possible non-permanence of CCS.

In this respect, the safeguards for permanence agreed in the context of afforestation and reforestation are a good starting point to derive recommendations for CCS. Biological sequestration is similar to CCS in that i) both types of carbon storage can lead to other environmental consequences, ii) there are uncertainties about the permanence of the storage and actual seepage rates, and iii) many environmentalists argue that measures should focus on reducing fossil fuel consumption instead of "end of pipe" solutions.[5]

[3] UNFCCC (2001) "Decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol."
[4] Haefeli, S., Bosi, M., Philibert, C. (2004) "CCS – Accounting and baselines under the UNFCCC."
[5] Torvanger, A., Kallbekken, S., Rypdal, K. (2004) "Prerequisites for geological carbon storage as a climate policy option."

Paragraph 1 of the annex of Decision 19/CP.9 decides the use of temporary CERs (tCER) for afforestation and reforestation project activities.[6] The substantial difference between biological sequestration and CCS is that seepage is likely to be less obvious than destruction of a forest. Seepage is likely to be a long drawn-out process.

3.1. How to deal with non-permanence during crediting periods?

Theoretically, two approaches can be considered to deal with non-permanence of stored CO_2 in CERs issuance: i) use of discount factors, and ii) use of tCERs.

Use of discount factors is problematic since credible values for discounting are not available. It is difficult to account for seepage due to unforeseeable events or wilful releases based on ex-ante estimation. It should be noted that depending on the rule for liability, there might be incentives for reservoir operators in non-Annex I countries to release CO_2 after "permanent" CERs have been issued and to subsequently refill the reservoir and to receive CERs again for the same reservoir.[7]

Use of tCERs is a better option for the environmental integrity because it can make sure that the amount of seepage monitored ex-post will be subtracted at the time of renewal.[8] We thus suggest that CCS can only generate tCERs. Unless monitoring and verification prove the continued existence of the carbon stock stored, the tCERs will expire. Monitoring rules should ensure conservativeness, e.g. by requiring 95% confidence levels. Monitoring and verification has to be done in the last year of each commitment period. The amount of tCERs remaining at the end of the crediting period[9] should be ***converted into permanent CERs*** subject to a special liability rule proposed below.

3.2. How to deal with non-permanence beyond crediting periods?

Due to the long time horizon relevant for CCS, it is problematic to leave the full responsibility for potential future seepage with project proponents. For example, project proponents might not exist in the distant future.[10] Ideally, countries where the storage takes place should take responsibility for monitoring, verification, and reporting. However, these countries have no incentives to do this as long as they do not have emission reduction targets and thus no liability for emissions on their territory. Thus, an incentive-compatible option has to be used.

Countries that have ***used the CERs remaining at the end of the crediting period*** should be ***liable for all seepage occurring beyond the crediting period***. They are responsible for monitoring and independent verification at intervals not longer than a commitment period. Failure to monitor leads to immediate treatment of the entire

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[6] UNFCCC (2003) "Decision 19/CP.9 – Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol."
[7] Bode, S., Jung., M. (2005) "CCS – liability for non-permanence under the UNFCCC." HWWA discussion paper 325.
[8] Ibid.
[9] Defined as the economic lifetime of the facility whose emissions are captured (see section five).
[10] See Torvanger, A., Kallbekken, S., Rypdal, K. (2004)

volume of stored carbon as an emission in the country's emissions inventory. Likewise, carbon losses that have been shown through monitoring and have been verified are treated as an emission at the time of verification.

4. What should be the boundary of a CCS project?

A project boundary must encompass the entire chain from capture to storage in order to make sure that emission reductions are properly accounted for. This means project proponents have to account for emissions from capture, transportation, storage of CO_2 and usage of stored CO_2. In particular, the energy penalty of a capture process, fugitive emissions during transportation and seepage from a CO_2 reservoir are of importance.

It is also important to account for CO_2 emissions increase due to enhanced production of fossil fuel, e.g. enhanced oil recovery (EOR), enhanced gas recovery (EGR), and enhanced coal bed methane recovery (ECBM).[11] It should be recognized that the Weyburn EOR project in Canada has been essentially increasing CO_2 emissions as more oil is made available.[12] Since it is not practical to account for such emissions within a project boundary, they must be taken into consideration as leakage.

5. Other issues

CDM projects shall be in compliance with relevant laws and regulations both on the national and international level. In case of CCS, several relevant international laws and regulations exist that prohibit CCS in the ocean, e.g. notably the London Protocol and the OSPAR Convention, whose legal frameworks were established before CCS became a potential mitigation option.

Crediting periods should be limited to the economic lifetime of the facility whose emissions are captured. For large industrial facilities, this is usually less than 30 years. Crediting periods should last 10 years, with two possibilities for renewal. Maximum duration of the crediting period should thus be 30 years.

6. Conclusion

CCS CDM project activities should fulfil the following requirements;

1. Storage in ocean water is not eligible;
2. The crediting period should be a maximum of 30 years (10 years with two options of renewal);
3. During their crediting period CCS will only generate temporary CERs (tCERs)

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[11] This is in line with argument on the "rebound effect" having been discussed in the CDM Meth Panel. Emissions from increased outputs due to energy efficiency improvement, better service offers, etc. should be taken into account as leakage. See, for example, the Meth Panel recommendations to the EB on NM0052 and NM0100.

[12] Michaelowa, A. (2005) "Carbon capture and geological storage research – a capture by fossil fuel interests?" in Governing Climate – the struggle for a global framework beyond Kyoto.

4. Monitoring and verification of carbon stocks has to be done at least in the last year of each commitment period;
5. At the end of the last crediting period, the remaining tCERs are converted into permanent CERs. The countries that have used these CERs are liable for any seepage. Monitoring and verification of carbon stocks has to be done at least in the last year of each commitment period; carbon losses are treated as emission in the countries' inventories in the year of monitoring. Failure of monitoring will be treated as an immediate emission of the total stored carbon;
6. Increased production of fossil fuel (e.g. oil, gas, methane) that would have remained in the reservoir under business-as-usual has to be treated as leakage;
7. Project boundaries encompass the entire chain from capture to storage and emissions increase due to enhanced production of fossil fuel is accounted for; and
8. Project activities are in compliance with relevant national and international laws and regulations.