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Item 8 (b) of the provisional agenda
Methodological issues under the Kyoto Protocol
Carbon dioxide capture and storage in geological formations as clean development mechanism project activities

Views related to carbon dioxide capture and storage in geological formations as a possible mitigation technology

Submissions from Parties

1. The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, invited Parties to submit to the secretariat, by 22 March 2010, their views on the issues listed in decision 2/CMP.5, paragraph 29, related to carbon dioxide capture and storage in geological formations as a possible mitigation technology (decision 2/CMP.5, para. 31).

2. The secretariat has received four submissions from Parties. In accordance with the procedure for miscellaneous documents, these submissions are attached and reproduced* in the language in which they were received and without formal editing.

* These submissions have been electronically imported in order to make them available on electronic systems, including the World Wide Web. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

FCCC/SBSTA/2010/MISC.2

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Inclusion of Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities

Submission to SBSTA 32

March 2010

As requested in Decision -/CMP.5 on '*Further guidance relating to the Clean Development Mechanism'* (hereafter referred to as "Decision -/CMP.5"), Australia is pleased to submit its views relating to the inclusion of carbon dioxide (CO_2) capture and storage (CCS) in geological formations as a clean development mechanism (CDM) project activity. This submission builds on Australia's previous submissions to SBSTA at its twenty-ninth1 and thirty-first sessions.[2]

Australia welcomes Decision -/CMP.5 that 'recognizes the importance of carbon dioxide capture and storage in geological formations as a possible mitigation technology'. Australia also notes that the UNFCCC, Intergovernmental Panel on Climate Change (IPCC), Carbon Sequestration Leadership Forum (CSLF), G8, Major Economies Forum, International Energy Agency (IEA) and the Global Carbon Capture and Storage Institute (GCCSI) all recognise CCS as a mitigation technology. Australia looks forward to working constructively with Parties to progress the inclusion of CCS in the CDM.

Australia notes analysis in the IEA '*Energy Perspectives Report*[3]*'* which concluded that CCS will need to contribute one-fifth of the necessary emissions reductions to achieve stabilisation in the most cost-effective manner. Australia also notes the IEA '*Technology Roadmap: Carbon Capture and Storage'*[4] which found that for the deployment of CCS in developing countries, CCS projects in these countries will need to be eligible for carbon market funding, either via inclusion in the CDM or through a new mechanism.

Australia is one of 23 countries plus the European Commission which supported the CSLF[5] communiqué of 13 October 2009 which states that CCS should be appropriately recognised in any mitigation and technology incentive arrangements that are part of any agreement under the UNFCCC[6].

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[1] http://www.climatechange.gov.au/en/government/initiatives/unfccc/~/media/submissions/international/ccs-as-cdm-project-activities.ashx

[2] http://unfccc.int/resource/docs/2009/sbsta/eng/misc11.pdf

[3] IEA 'Energy Technology Perspectives 2008', http://www.iea.org/techno/etp/index.asp

[4] http://www.iea.org/papers/2009/CCS_Roadmap.pdf, p35.

[5] CSLF Members: http://www.cslforum.net/aboutus/index.html

[6] CSLF Communiqué: http://www.cslforum.org/publications/documents/London2009/final_approved_communique101309.pdf

Inclusion of CCS projects in the CDM would provide an important financial incentive that would assist in offsetting the incremental cost for those developing countries that may wish to deploy this technology. While large scale deployment in developing countries is still expected to be some time away, an early signal on inclusion is critical to provide markets with improved investment certainty for investments in long-lived and large-scale CCS projects.

Inclusion in the CDM and/or other crediting mechanisms would also provide a rigorous project approval process which would support best practice global deployment of CCS technologies.

The CDM should remain technology-neutral and the inclusion of CCS as an eligible CDM project activity would support developing countries' access to technologies consistent with their preferred development path. It would also provide developing countries access to the economic incentives that are available for other emission abatement technologies.

Australia believes there are sufficient established technical and scientific data and analysis, methods and expert advice to address the concerns raised on the outstanding issues in Decision -/CMP.5, paragraph 29. This body of work shows that with the addition of some CCS specific modalities and procedures, CCS can be accommodated within the CDM. Further information on addressing the outstanding issues is available in **Attachment A** to this submission.

In particular, Australia acknowledges the report to the CDM Executive Board on '*Implications of the Inclusion of Geological Carbon Dioxide Capture and Storage as CDM Project Activities'*[7] *(referred to hereafter as* 'EB 49 Report'*)*; the IEA Greenhouse Gas R&D Programme (*referred to hereafter as* 'IEA GHG') report *'ERM-Carbon Dioxide Capture and Storage in the clean development mechanism'*[8] (*referred to hereafter as the IEA GHG report)*; the 2006 IPCC Guidelines for National Greenhouse Gas Inventories[9] (*referred to hereafter as the 2006 IPCC Guidelines)* and the IPCC Special Report on '*Carbon Dioxide Capture and Storage'*[10] *(referred to hereafter as the IPCC SRCCS)* which offer guidance on the way forward for the inclusion of CCS projects in the CDM.

Australia considers that based on the information, sources and expert bodies cited in this submission and elsewhere, the CMP should request SBSTA to prepare modalities and procedures for CDM project activities relating to CCS. The development of CCS modalities and procedures would allow options to address the outstanding issues could be identified, assessed and resolved. To assist in developing such a request, Australia has prepared core elements of a possible decision text for consideration at CMP 6 at **Attachment B**.

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[7] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf
[8] http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf
[9] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf
[10] http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf

Attachment A

Addressing issues highlighted in Decision-/CMP.5 '*Further guidance relating to the Clean Development Mechanism',* paragraph 29.

Australia considers that there exists sufficient established methods and expert advice to address the following nine concerns outlined in Decision-/CMP.5, paragraph 29, relating to the inclusion of CCS projects in the CDM:

a) Non-permanence, including long-term permanence;

b) Measuring, reporting and verification;

c) Environmental impacts;

d) Project activity boundaries;

e) International law;

f) Liability;

g) The potential for perverse outcomes;

h) Safety; and

i) Insurance coverage and compensation for damages caused due to seepage or leakage.

Key to the deployment of CCS projects that effectively address these issues will be the establishment of relevant governance arrangements in each Host Country. Australia notes the recommendation in the EB 49 Report that regulation of CCS in the host country for CCS project activities, with an appropriate regulatory body to administer it, is highly important. The report also recommends that a role of the Designated Operational Entity (DOE) would be to assess whether there is a regulatory framework in place in the host country to control the project, and whether the appropriate regulatory approval has been or can be given to the particular project.

Australia further recognises the need to develop regulatory capacities in developing countries interested in deploying CCS. There is a significant body of work underway through bodies such as the GCCSI and the CSLF which can provide support for developing countries that are developing national CCS regimes. Further information on capacity building activities throughout the world is available in Australia's submission to SBSTA 31.[11]

Australia considers modalities and procedures for CCS CDM projects should require Host Countries to establish governance arrangements for the deployment of CCS.

[11] http://unfccc.int/resource/docs/2009/sbsta/eng/misc11.pdf#page=10

Non-permanence, including long-term permanence

Some Parties have raised concerns over: the risk of seepage from CCS projects over the crediting period and the long-term; the risk of emission from abandoned and unmonitored wells; the risk of sudden, massive release of CO_2; and the implications these risks may have for inclusion in the CDM.[12]

The IPCC offers guidance on seepage (or permanence) in CCS projects. Based on observations and analysis of current carbon dioxide storage sites, natural systems, engineering systems and modelling, the IPCC SRCCS concluded that the fraction of injected CO_2 retained is very likely to exceed 99 per cent over 100 years (a very unlikely chance of more than 1 per cent seepage over 100 years).[13]

In terms of long-term permanence, the IPCC further concluded that the fraction of injected CO_2 retained is likely to exceed 99 per cent over 1000 years (an unlikely chance of more than 1 per cent seepage over 1000 years). It further concludes that, for well-selected designed and managed geological storage sites, the vast majority of the CO_2 will gradually be immobilised by various trapping mechanisms and, in that case, could be retained for up to millions of years.

The risk of non-permanence or seepage is a manageable risk. As indicated in the IEA GHG report, permanence is 'a function of good site selection, risk management and appropriate closure, and not an inherent feature of all projects'[14].

The IEA GHG '*Geological Storage of Carbon Dioxide: Staying Safely Underground'* report offers guidance on the risk of seepage. It explains: 'Most geologic storage projects are expected to take advantage of multiple trapping mechanisms. As a result of a combination of stratigraphic, structural, residual, solubility and mineral trapping, any CO_2 movement out of the formations is unlikely. Evidence shows that these kinds of movements are very slow for appropriately selected and designed sites that are operated and monitored properly. Moreover, the CO_2 will typically be stored in rock formations that have proven their ability to retain fluids, some for millions of years. Injected CO_2 would not exist as an underground gas bubble that could rapidly burst forth to the surface'. The report further advises that 'best estimates of leakage rates by geologists are well below levels that would cause any significant increase in atmospheric CO_2 or risk to public safety'[15].

The only realistic avenues for releases of CO_2 are well bores (the injection well, for example), or faults that reach the surface or near-surface. The risk of a seepage event from a well bore would only likely present in the injection phase, where there is a driver for CO_2 movement, and before significant amounts of CO_2 had migrated over a larger area or otherwise stabilised or immobilised in the subsurface. Technology safety features are used at the injection point to prevent blowout, and backflow of injected fluids, in the event of equipment failure. Techniques also exist to monitor and assess the integrity of the well and equipment. Should unintended

[12] FCCC/SBSTA/2008/INF.3, http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[13] http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf, p246.
[14] http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf
[15] http://www.co2crc.com.au/dls/external/geostoragesafe-IEA.pdf, p22.

migration occur, remediation techniques are available such as adjusting pressure in the reservoir, and intercepting and sealing the seepage pathway. These methods are based on extensive experience in oil and gas fields.

Any risks of seepage, for instance from an abandoned well or fault, would be identified in a risk assessment. For example, risk assessments would identify an abandoned well, which would need to be properly sealed so as to prevent a seepage pathway. The risk assessment could even identify the likelihood of an earthquake event, the likely consequent volume of CO_2 loss should an earthquake occur, and the planned remediation16[16]. However, it should be noted that seismic activity in itself would not automatically result in CO_2 seepage. This is demonstrated in Nagaoka, Japan, where a large earthquake occurred in the vicinity of the CO_2 storage site, and the C02 was unaffected. This is further demonstrated in existing oil and gas fields in seismically active areas around the world[17].

There is extensive expert guidance available on measures and practices designed to identify, address, and prevent the risk of seepage from CCS projects. Such measures include: appropriate site selection and characterisation; comprehensive risk assessments to assess all potential seepage pathways; modelling of CO_2 behaviour; monitoring CO_2 behaviour; monitoring to detect any seepage; remediation planning and practices; safe seal and abandonment planning and practices; and post-closure monitoring and management planning and practices. Many practices have been adopted or adapted from the petroleum industry, which has over 100 years of experience in extracting oil and gas (and CO_2) and injecting fluids (such as water) safely and securely underground, including over 30 years experience of producing, transporting and injecting CO_2 for enhanced oil recovery.

The 2006 IPCC Guidelines address permanence in CCS projects, using a Tier 3 approach. They identify methodologies for estimating emissions (seepage) from CO_2 storage sites, even at low levels, should it occur[18]. Measures to redress certified emission reductions (CERs) in the event of seepage are explained in the section on ‘Liability’ below.

Australia believes CCS projects can and should be designed with the expectation of permanent CO_2 storage. Australia recommends modalities and procedures for CCS CDM projects approval procedures should require project participants, *inter alia*: to undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths; and to identify procedures for addressing any identified risks, including for safe sealing and abandonment of the reservoir and for monitoring and accounting seepage of CO_2 emissions.

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[16] Jürgen E. Streit and Maxwell N. Watson, ‘*Estimating rates of potential CO2 loss from geological storage sites for risk and uncertainty analysis*’, CRC for Greenhouse Gas Technologies, https://extra.co2crc.com.au/modules/pts2/download.php?file_id=569&rec_id=68

[17] http://www.co2crc.com.au/dls/external/geostoragesafe-IEA.pdf

[18] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf

Liability

Some Parties have raised concerns relating to the assignment of liability to account for emissions associated with seepage (or liability for non-permanence). Ensuring appropriate arrangements for liability to account for these emissions is essential in order to maintain the environmental integrity of the CDM.

Some parties have also raised concerns relating to broader project liabilities. Australia considers that these would be determined and assigned by national regulatory frameworks. Australia considers that the modalities and procedures should require that proposed projects are in compliance with all relevant national laws and regulations for the deployment of CCS.

Australia notes that some Parties consider that project proponents should assume liability for emissions, at least during the crediting period of the project. Other Parties consider that the host government should assume liability, while others consider that the host government may not be in a position to manage this liability[19].

There are a number of potential options that have been canvassed for addressing liability for non-permanence[20], including that:

i. CERs equal to the quantity of seepage CO_2 could be cancelled by an entity responsible for the project to remediate any seepage amount, as recommended by the EB 49 Report. The liability could be placed on either the project participant, or the host Party, or a combination, with project participants responsible during the crediting period and host Parties over the longer-term.

ii. During the crediting period, emissions could be monitored and reported as „project emissions‟, and accounted for by deducting the amount from the project baseline, as the IEA GHG report concluded.

iii. Temporary or time-bound units could be created, similar to those that already exist for afforestation and reforestation. These would require replacement in the event that seepage did occur. The liability for any seepage would be passed on to the buyer, providing little ongoing incentive for the project participant or host Party to take measures to avoid seepage. Given the potential for non-permanence is low, temporary units are likely to add unnecessary complexity. Also temporary units have already been shown to have reduced desirability in the market.

iv. A discount factor could be applied so that a proportion of CERs are not issued to account for potential future seepage. This option would require the likelihood of seepage or non-permanence to be assessed and potentially adjusted over time, as the monitoring results provide confidence of permanence. In establishing modalities to this effect, models of risk

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[19] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf

[20] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf, pp32-33 and p48, citing the IEA GHG Report.

assessment such as those used in the insurance industry could be considered.

v. Similarly, a proportion of CERs could be put aside into a ‘confidence buffer’ at the time of issuance, to account for any future seepage. The ‘confidence buffer’ would provide a pool of credits that could be cancelled to take account of emissions associated with any seepage event. As with the previous option, the likelihood of seepage or non-permanence would need to be assessed. The proportion of CERs set aside could be adjusted over time to reflect changes to the assessed risk of seepage and taking account of the number of units already in the confidence buffer.

Australia considers that modalities and procedures for CCS in the CDM should establish arrangements to address liability for non-permanence. Host Parties would need to establish measures as defined in these modalities and procedures. In determining arrangements, options that promote the environmental effectiveness of the CDM, can be adequately implemented, and are attractive to the market, should be favoured. Australia would be open to further consideration of all options canvassed and to any other proposals from Parties that could achieve our stated objectives.

Some Parties have raised concerns surrounding liability arrangements for non-permanence where a CCS project crosses national borders[21] (also referred to as “trans-boundary” issues). Australia notes that guidance on cross-border CCS operations is available in the 2006 IPCC Guidelines[22], and that these provide an appropriate basis for considering liability arrangements. However, where trans-boundary issues arise that are not resolved to the satisfaction of the countries concerned, these projects could be excluded from qualifying for CDM registration until resolution is achieved. Projects that cross national borders may also raise issues of international law. Australia’s preference for the treatment of cross border and international issues are contained in the section on ‘International Law’, below.

Measuring, reporting and verification (MRV)

The following concerns have been raised over measurement, reporting and verification:

i. that CO_2 stored in sub-surface reservoirs is not measured, only modelled;

ii. that monitoring would add unmanageable complexity to the CDM; and

iii. that the CDM institutional structures would need to be modified to accommodate CCS, such as modification of the roles of DOEs[23].

[21] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[22] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf, pp5.20-5.21.
[23] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf

CCS projects can and should meet robust MRV requirements. Australia notes that the technology and processes to provide accurate MRV for CCS already exists. The amount of CO_2 injected into a geological formation can be measured by equipment at the wellhead (meter) before it enters the injection well. The storage site is then monitored, and any subsequent emissions reported. The monitoring validates measurement. The 2006 IPCC Guidelines provides further guidance on sophisticated monitoring techniques.

The 2006 IPCC Guidelines can contribute to a framework for measuring, monitoring, reporting and verification for carbon capture, transport, injection and storage which could be used as the basis for CCS CDM MRV requirements. Australia further notes the finding of the EB 49 Report that the 2006 IPCC Guidelines methodology can be applied to CCS project activities under the CDM.

Australia also notes the EB 49 Report recommendation that monitoring methodologies should set overall objectives while leaving flexibility in the monitoring programme details, so as to allow the most appropriate monitoring techniques to be selected given specific geological situations.

Australia notes that MRV is already required of other CDM projects under existing CDM modalities and procedures via Project Design Documents (PDD) and the verification and certification process undertaken by DOEs. Australia considers that the additional measures specific to CCS projects are practical and manageable.

Australia recommends development of CCS CDM modalities and procedures in relation to measurement, monitoring, reporting and verification, consistent with the 2006 IPCC Guidelines.

Australia further recommends the development of procedures for the accreditation of DOEs incorporating the requirement that such entities possess the technical expertise necessary to discharge their validation and verification functions with respect to project activities relating to CCS in geological formations. The EB 49 Report also recommends CCS-specific DOE accreditation.

Environmental Impacts

The following concerns have been raised relating to environmental impacts:

i. the risk of catastrophic seepage event resulting in damage to the environment or human health/safety;[24]

ii. the lack of experience with CCS compared to current eligible CDM projects and the uncertainty surrounding risk of seepage make Environmental Impact Assessments (EIAs) challenging;[25] and

[24] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[25] Issues raised under points (ii) and (iii) are noted in '*Possible implications of the inclusion of CCS as CDM project activities*', Report of the 50th meeting of the CDM Executive Board, 13-16 October 2009, Annex 11, http://cdm.unfccc.int/EB/050/eb50_repan11.pdf

iii. that the Terms of Reference and review process for EIAs are currently solely within the purview of the host country. A substandard EIA could have regional or international implications, if it leads to poor site selection or operating practices that result in seepage; and

iv. the potential for ‘impurities in the CO_2 stream’[26].

As mentioned above, CCS project management measures and practices are designed to identify, address, and prevent the risk of seepage from CCS projects. Such measures include: appropriate site selection and characterisation; comprehensive risk assessments to assess all potential seepage pathways; and modelling of CO_2 behaviour. Risk assessments and modelling would indicate that it is extremely unlikely that catastrophic seepage could occur due to the geological trapping mechanisms which prevent CO_2 movement and release (as in natural systems). Further CCS project management also involves: monitoring to detect any seepage; remediation planning and practices in the event of any seepage; safe seal and abandonment of the site; as well as post-closure monitoring and management planning and practices.

The issue of environmental impact has also been considered in the EB 49 Report which recommends that an EIA be carried out for each CCS CDM project, governed by national host government regulations and based on the risk assessment procedure that should be outlined in any CCS CDM methodology and PDD. The requirement for assessment of environmental impact during the project approval process, similar to existing modalities and procedures for other CDM projects, would allow for concerns relating to the environmental impact of CCS activities to be considered during CCS CDM project validation and registration. Further, stakeholder consultation, including with any affected local and indigenous communities, should be described as a requirement in the CCS project approval process, as is required under current PDD guidelines.

Australia notes the recommendation in the EB 49 Report that no waste or other matter should be added to a CO_2 stream of a CCS CDM project activity for the purpose of discarding that waste or other matter, and that acceptable levels of impurities in CO_2 streams should be determined based on their potential impacts on transport and storage integrity. It is furthermore recommended that operators of potential CCS projects under the CDM prove that their CO_2 streams are sufficiently pure and that they have adequately considered the relationship between CO_2 stream purity and the surrounding cap rock, including environmental and other risks of CO_2 storage.

Australia considers that modalities and procedures for CCS CDM project should require that the project participants, *inter alia*, undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths, and environmental, health and safety impacts; and undertake and report on public and stakeholder consultation, including with any affected local and indigenous communities.

[26] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf, pp35-36.

Project activity boundaries

The following concerns relating to project boundaries have been raised[27]:

i. the need to ensure all relevant project-related emissions are captured;

ii. that a reservoir may cover different countries or international waters, and that after storage the plume may migrate without regard for plans or political borders;

iii. that ‘there are difficulties in defining the project boundaries if there are several different injection points from different project activities in different time frames’; and

iv. the project boundary ‘is difficult to define in a situation in which potential leakage or seepage may result in international impacts’.

Australia considers that project boundaries for CCS activities under the CDM should encompass all GHG emissions under the control of the operator including: the capture, transport, intermediate storage facilities, and injection systems; and the storage reservoir. Project boundaries for the storage reservoir would be defined by the site characterisation, including any potential seepage pathway, modelled CO_2 migration path, and any potential secondary containment formations.

The 2006 IPCC Guidelines provide methodologies for estimating CCS project-related emissions. CCS CDM project methodologies should be consistent with these. We note that emissions resulting from fossil fuels used for capture, compression, transport, and injection of CO_2 are addressed in the energy chapter of the 2006 IPCC Guidelines.

Guidance on how to report on cross-border CCS operations is also available in the 2006 IPCC Guidelines[28]. The 2006 IPCC Guidelines also offer guidance on instances where more than one country utilises a common storage site, and in the case where a storage site occurs in more than one country. These guidelines could be followed for defining project boundaries. However, where trans-boundary issues arise that are not resolved to the satisfaction of the countries concerned, these projects could be excluded from qualifying for CDM registration until resolution is achieved.

Australia considers that modalities and procedures for CCS CDM projects should require project participants to, *inter alia*, define physical and operational project boundaries as outlined above.

[27] http://cdm.unfccc.int/EB/050/eb50_repan11.pdf
[28] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_5_Ch5_CCS.pdf, pp5.20-5.21.

International law

The following issues have been raised relating to international legal obligations:

i. 'an international regulatory and institutional framework may be required to deal with the international implications[29]'; and

ii. cross-boundary or trans-boundary issues.[30]

Currently, CO_2 storage in areas of national jurisdiction is generally regulated under national systems of law. It is expected that the regulation of CCS CDM projects would reside with an appropriate regulatory body in the host country.

Australia notes the recommendation in the EB 49 Report that 'regulation of CCS in the host country, with an appropriate regulatory body to administer it, is highly important for CCS CDM projects. ...An objective of any DOE validating a CCS CDM project activity would be to assess whether there is a regulatory framework that could be considered sufficient in place in the host country to control the project, and whether the appropriate regulatory approval has been or can be given to the particular project'.[31]

Australia acknowledges that the need to develop regulatory capacities in developing countries interested in deploying CCS is well recognised and there is a significant body of work underway through bodies such as the GCCSI and the CSLF. Further information on capacity building activities is available in Australia‟ s previous submission to SBSTA 31.[32]

Where domestic regulatory regimes are adequate, there would not appear to be an issue with CCS projects within national jurisdictions. There may however be concerns related to the legal implications of storage and seepage which occurs in international waters, or crosses national boundaries[33].

Existing international legal obligations are relevant to these concerns and CCS projects need to comply with applicable international legal obligations. For example, the United Nations Convention on the Law of the Sea (UNCLOS) divides the sea into jurisdictional zones and the sovereign rights and obligations that apply in those areas[34]. UNCLOS is relevant to implementation of States' legal obligations concerning the marine environment by establishing what areas are within and beyond national jurisdiction.

[29] http://cdm.unfccc.int/EB/050/eb50_repan11.pdf
[30] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf, p12.
[31] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf, pp10-11.
[32] http://unfccc.int/resource/docs/2009/sbsta/eng/misc11.pdf#page=10
[33] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[34] http://www.un.org/Depts/los/convention_agreements/texts/unclos/UNCLOS-TOC.htm

The London Protocol[35] and the OSPAR Convention[36] permit, and regulate, the long-term safe storage of carbon dioxide streams in geological formations. The London Protocol requires Parties to take effective measures to prevent, reduce and, where practicable, eliminate pollution caused by dumping at sea. The Protocol limits the types of materials that may be considered for dumping to those listed in Annex I of the Protocol. The Protocol was amended by Contracting Parties at their first meeting held in London from 30 October to 3 November 2006. Annex I of the Protocol – Wastes or other matter that may be considered for dumping – includes in the category of 'wastes or other matter', carbon-dioxide streams sequestered in sub-seabed geological formations (otherwise known as offshore geosequestration). Only CO_2 and incidental associated substances derived from the source material may be considered for geosequestration purposes. No wastes or other matter may be added to the CO_2 stream for the purposes of disposal. The amendment took effect on 10 February 2007.

This means that States Parties can regulate CCS in sub-seabed geological formations, for permanent isolation.

A '*Risk Assessment and Management Framework for CO_2 Sequestration'* has been developed under the London Protocol, and *'Guidelines for Risk Assessment and Management of Storage of CO_2 Streams in Geological Formations'* have been developed under the OSPAR Convention.

The London Protocol (as further amended in 2009) allows for the export of CO_2 streams for disposal, provided an agreement or arrangement has been entered into by the countries concerned[37]. Australia further notes that the 2006 IPCC Guidelines address the treatment of cross-boundary CCS projects, including where the reporting responsibilities lie where more than one country is involved.

The London Protocol and OSPAR Convention, and the 2006 IPCC Guidelines provide guidance when considering any trans-boundary issues that need to be addressed for CCS CDM projects.

In the event that trans-boundary issues arising from a project are not resolved to the satisfaction of the countries concerned, the project could be excluded from qualifying for CDM registration until resolution is achieved.

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[35] 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972. http://www.imo.org/includes/blastDataOnly.asp/data_id%3D16925/LC1972.pdf

[36] The OSPAR Convention is a regional convention which applies in the north-east Atlantic. The full title of the convention is the Convention for the Protection of the Marine Environment of the North East Atlantic. http://www.ospar.org/content/content.asp?menu=00310108000007_000000_000000

[37] Note that in adopting the amendment to Article 6 of the London Protocol, Contracting Parties **noted**: "that the transboundary movement of carbon dioxide after injection (migration) is not export for dumping and therefore not prohibited by Article 6;" and **stressed** that management of shared formations is an important issue that should be addressed to ensure appropriate environmental protection. The amendment will enter into force for those Parties which have accepted it, after two-thirds of the Parties have deposited their instruments of acceptance with IMO. The amendment has not yet entered into force.

Australia also notes the recommendation in the EB 49 Report that „[d]ue to additional legal implications for cross-border storage it is suggested that CCS projects in the first and a second commitment period would be limited to take place within national boundaries and with no risk of migration across national boundaries‟.

In order to address any possible international legal issues, Australia recommends modalities and procedures for CCS CDM projects approval procedures should require host countries, *inter alia* to:

i. establish governance arrangements for the deployment of carbon dioxide capture and storage;

ii. establish measures to identify and address any trans-boundary seepage paths and/or potential impacts; and

iii. declare that, where trans-boundaries issues exist, the measures to address the issues have been agreed with all countries concerned consistent with applicable international obligations.

Modalities and procedures for CCS CDM project approval procedures should also require project participants to undertake comprehensive risk assessment and rigorous identification of project boundaries, and declare that the proposed project will comply with all applicable national laws and regulations for the deployment of CCS.

The potential for perverse outcomes

Concerns have been raised over perverse outcomes of inclusion of CCS in the CDM relating to:

i. CDM market implications;

ii. the increase of fossil energy production; and

iii. subsidisation of Enhanced Oil Recovery projects (EOR).[38]

Analysis contained in the EB 49 Report (including analysis in the UNFCCC‟s technical paper on '*Investment and financial flows to address climate change*'[39]) shows that inclusion of CCS is not expected to significantly impact on CER markets in the short to medium term, with uptake in developing countries being gradual over time.

Analysis by expert organisations such as the IPCC and the IEA unambiguously demonstrates that achieving an ambitious long-term global goal that would hold the increase in global temperature below 2 degrees Celsius will require deployment of the full range of low emission technologies across developed and developing countries. This analysis shows that fossil fuels will continue to supply a large share of global energy needs, particularly in rapidly industrialising developing countries.

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[38] http://unfccc.int/resource/docs/2008/sbsta/eng/inf03.pdf
[39] FCCC/TP/2008/7, Investment and financial flows to address climate change, November 2008.

Deployment of CCS technologies under the CDM would mean that a proportion of this fossil fuel use is low emissions and climate friendly.

In its assessment of energy technologies for reducing GHG emissions by half in 2050, the IEA projected that CCS will need to contribute one-fifth of the necessary emissions reductions to achieve stabilisation, which equates to global deployment of CCS capture of over 10 gigatonnes of carbon dioxide in 2050, with a cumulative storage of around 145 GtC02 from 2010 to 2050[40]. It also found that under this scenario developing countries would account for a growing proportion of CCS over time.

Based on these expert views, CCS deployment offers an important opportunity to make a significant contribution to the UNFCCC objective of stabilising atmospheric GHG concentrations, and particularly in reducing ‘peak’ greenhouse gas emission levels given many Parties will remain highly dependent on fossil fuels in the near-term.

The inclusion of CCS projects in the CDM would provide an important incentive for potential investments in projects for those developing countries that may wish to deploy this technology. This incentive can offset the incremental cost of the technology and provide markets with improved investment certainty, which would aid business planning for investment in long-lived and generally large-scale CCS projects.

Ultimately, the CDM should be technology-neutral and not prescribe or proscribe particular technologies. The inclusion of CCS as an eligible CDM project activity would support developing countries’ access to technologies consistent with their preferred development path and would provide developing countries access to the economic incentives that are available for other emission abatement technologies.

Australia also considers that the perceived encouragement of projects such as EOR is not a reason for the exclusion of CCS from the CDM, as this issue is adequately addressed in the current CDM requirements to prove additionality.

Safety

Some Parties have raised safety concerns related to the inclusion of CCS in the CDM, notably in relation to the risk of catastrophic release of sequestered and stored CO_2.

As previously noted, CCS geological storage sites take advantage of trapping systems which prevent CO_2 movement and release, as in natural systems. As previously noted, the IPCC concludes that the fraction of injected CO_2 retained is very likely to exceed 99 per cent over 1000 years. Further, experts advise that best estimates of seepage rates by geologists are well below levels that would cause any significant increase in atmospheric CO_2 or risk to public safety[41].

[40] http://www.iea.org/techno/etp/index.asp
[41] http://www.co2crc.com.au/dls/external/geostoragesafe-IEA.pdf

The IPCC also found that with 'appropriate site selection based on available subsurface information, a monitoring programme to detect problems, a regulatory system and the appropriate use of remediation methods to stop or control CO_2 releases if they arise, the local health, safety and environment risks of geological storage would be comparable to the risks of current activities such as natural gas storage, EOR and deep underground disposal of acid gas'[42]. As previously stated, many CCS practices have been adopted or adapted from the petroleum industry, which has over 100 years of experience in extracting oil and gas (and CO_2), and injecting fluids (water, gas, etc.) safely and securely underground, including over 30 years of producing, transporting and injecting CO_2 for enhanced oil recovery. It should also be noted that CO_2 is neither explosive nor flammable (unlike natural gas) and that people live near and literally on natural gas storage sites worldwide.

Safety risks should be assessed and addressed in each project. Australia considers that modalities and procedures for CCS CDM project approvals should require that the project participants, *inter alia*, undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths, and environmental, health and safety impacts.

Insurance coverage and compensation for damages caused due to seepage or leakage.

The use of insurance coverage and compensation for damages caused due to seepage or leakage has been raised in regard to CCS CDM projects.

Australia notes the finding in the EB 49 Report that liability risk can be reduced or removed from host countries with the use of instruments such as long-term financial bonds or insurance or contractual arrangements with the project operator. This is also explored in the IEA GHG report which considered that the management of contingent liability for seepage could be achieved through the establishment of *inter alia*: insurance, indemnities, escrow or contingency funds, and/or credit reserves. These measures should be considered.

[42] http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf, p12.

Attachment B

Core elements of draft text for CCS in the CDM

The CMP:

1. *Notes* the final report to the Clean Development Mechanism Executive Board on "Implications of the Inclusion of Geological Carbon Dioxide Capture and Storage as CDM project activities".[43]

2. *Decides* that activities relating to carbon dioxide capture and storage in geological formations, including saline aquifers and excluding ocean sequestration, should be eligible as project activities under the Clean Development Mechanism.

3. *Requests* the Subsidiary Body for Scientific and Technological Advice to recommend modalities and procedures for Clean Development Mechanism project activities relating to carbon dioxide capture and storage in geological formations, with a view to forwarding a draft decision on this matter to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol for adoption at its seventh session, including modalities and procedures in relation to:

a) Definitions;

b) Role of Conference of the Parties serving as the meeting of the Parties;

c) Role of the Executive Board;

d) Accreditation and designation of operational entities;

e) Role of designated operational entities;

f) Participation requirements;

g) Validation and project registration;

h) Monitoring during project operation and following project closure;

i) Verification and certification;

j) Addressing non-permanence of carbon dioxide capture and storage project activities.

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[43] http://cdm.unfccc.int/EB/049/eb49annagan4.pdf

4. *Requests also* the Subsidiary Body for Scientific and Technological Advice, in preparing its recommendations pursuant to paragraph 3, to incorporate in the Clean Development Mechanism approval procedures and the project design document, as appropriate, requirements that the project participants, inter alia:

a) Define physical and operational project boundaries;

b) Undertake and report on the comprehensive risk assessment conducted of the storage site and operation, including an assessment of all potential seepage paths, and environmental, health and safety impacts;

c) Identify procedures for addressing the risks identified in subparagraph 4 (b) including for safe sealing and abandonment of the reservoir and for monitoring and accounting seepage of CO_2 emissions;

d) Declare that the proposed project will comply with all applicable national laws and regulations for the deployment of carbon dioxide capture and storage; and

e) Undertake and report on public and stakeholder consultation, including with any affected local and indigenous communities.

5. Further requests the Subsidiary Body for Scientific and Technological Advice, in preparing its recommendations pursuant to paragraph 3, to incorporate requirements that the host countries, inter alia:

a) Establish governance arrangements for the deployment of carbon dioxide capture and storage;

b) Establish measures to identify and address any trans-boundary seepage paths and potential impacts in accordance with applicable international obligations;

c) Declare that measures identified pursuant to subparagraph 5(b) above have been agreed with the countries concerned consistent with applicable international obligations; and

d) Affirm the declaration of the project participants pursuant to subparagraph 4 (d) of this decision.

6. *Requests also* the Subsidiary Body for Scientific and Technological Advice, in preparing its recommendations pursuant to paragraph 3, to incorporate in the Clean Development Mechanism procedures for the accreditation of designated operational entities (DOE) the requirement that such entities possess the technical expertise necessary to discharge their validation and verification functions with respect to project activities relating to carbon dioxide capture and storage in geological formations.

PAPER NO. 2: INDONESIA

SUBMISSION BY INDONESIA

Views on the inclusion of Carbon dioxide Capture and Storage in Geological Formations (CCS) in Clean Development Mechanism (CDM)

The AWG-KP, through paragraph 31 of FCCC/KP/CMP/2009/L.10, has invited parties to submit views to the Secretariat on the issue of the inclusion of carbon dioxide capture and storage in geological formations (CCS) in Clean Development Mechanism (CDM).

In this regard, the Government of Indonesia has submitted its initial ideas of the proposal during a contact group of SBSTA on December 9th 2009. This document elaborate in more details Indonesia's proposal for the inclusion of CCS in CDM.

Indonesia wishes to kindly request the Secretariat to communicate and make it available to all Parties.

1. Indonesia recognizes the potential of CCS as one of the key options to mitigate greenhouse gas emissions at a large scale. It is in our view, that the deployment of CCS in both developed and developing countries is important in efforts to avoid the adverse impacts of climate change.

2. Indonesia would like to highlight that CCS is a particularly major greenhouse gas mitigation option for developing countries whose economies are dependent on fossil fuels, as stipulated in Article 4 paragraphs 8(h) and Article 4.10 of the Convention.

3. Indonesia also recognizes that CCS is high cost measure. In this regard, we believe that project-based mechanism is the most appropriate means to support the finance of CCS projects in developing countries through provision of incentives.

4. As a project-based mechanism with an established infrastructure, CDM is suitable to facilitate prompt deployment of CCS projects in developing countries. Given the urgency to have mitigation at a large scale, it is critical to utilize the established institutions and infrastructure.

5. To this end, Indonesia supports the principle of having CCS projects as activity under the CDM with the objectives to establish CCS projects in due course and in the safest possible manner.

6. Indonesia acknowledges the concerns listed in paragraph 29 of FCCC/KP/CMP/2009/L.10 and supports efforts to address them thoroughly and promptly. Indonesia views the concerns listed as

also relevant for any future project-based mechanism and other potential financial support mechanism currently considered under the Convention.

7. Indonesia observes that during recent years, discussions on the inclusion of CCS under CDM methodologies have evolved significantly, partly due to the inclusion of CCS in the European Union Emissions Trading Scheme (EU ETS) and a series of workshops involving many competent stakeholders. The discussions have culminated into the release of two CCS New Methodologies that address potential concerns in a manner that safeguards climate effectiveness and are to the benefit of the host country.

8. In this context, Indonesia is in the view that most of the concerns listed in paragraph 29 of FCCC/KP/CMP/2009/L.10 falls under the autonomy of individual host country governments that will approve specific CCS projects in its jurisdiction after due consideration. In this regard Indonesia would like to address individual items listed in paragraph 29 of FCCC/KP/CMP/2009/L.10 as follows:

(a) *Non permanence, including long-term permanence* -
The issue could be addressed through careful storage site characterization, selection, design and operation together with methods for early detection of seepage, hence project developers must demonstrate a thorough process is undertaken in its Methodology;

(b) *Measuring, reporting and verification (MRV)* -
The issue would be addressed through the implementation of the accounting framework for monitoring geological CO_2 storage projects as provided in the 2006 IPCC Guidelines, namely the Tier 3 methodology;

(c) *Environmental impacts* -
These important elements should be properly assessed in the same manner as any other CDM projects. It is also important to incorporate a thorough risk assessment using detailed site characterization and simulation techniques that are subject to relevant national regulations;

(d) *Project activity boundaries* -
It is important to ensure that all CO_2 associated with the project at any point in time under the temporal project boundary that remains within the spatial boundary, including in case of irregularities which means the subsurface boundary may need to be updated;

(e) *International law* -

This issue may be resolved through the limitation of type of CCS projects that may be applied under the CDM to only those that are within national boundaries and not trans-boundary;

(f) *Liability* -

This can be addressed through the application of a regulation that implied that the liability lies within the temporal boundary of the project is fully rests with the project developer, i.e. any seepage during the crediting period should be treated as project emissions. The transfer of liability to the host country will be decided on a case-by-case basis based on the agreed requirement at project initiation phase between the host country and project developer;

(g) Potential for perverse outcomes -

This should take into account the need of developing countries that are dependent on fossil fuel as stipulated in Article 4 paragraphs 8(h) and Article 10 of the Convention;

(h) Safety -

This important element should be properly assessed in the same manner as any other CDM projects, subject to national regulations and relevant industry safety standards;

(i) Insurance coverage and compensation for damages caused due to seepage or leakage is compulsory in reducing financial risks of host countries. This shall be clearly articulated in the project initiation phase and form part of the PDD.

9. Indonesia reiterates that inclusion of CCS in the CDM does not imply any new obligation to developing countries in deploying CCS project; however it may provides options and financial support for those developing countries that wish to do so according to their own national circumstances.

10. Indonesia also recognizes that since 2006, significant progress on defining role of "CCS in the CDM" has been made through many technical discussions. Therefore, Indonesia believes that it is an added value for SBSTA to host an inter-sessional workshop to address such matters in order to help COP in its 16th session to decide a possible decision. Such initiative will also encourage Parties to share their best practices on applying CCS in various forums.

PAPER NO. 3: NORWAY

Submission from Norway on the inclusion of carbon capture and storage in geological formations as project activities under the Clean Development Mechanism

At the fifth session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol, the draft Decision 1/CMP.5 invited Parties to submit their views related to carbon dioxide capture and storage in geological formations as a possible mitigation technology.

Norway welcomes the opportunity to present its views on this important issue. We refer to our previous submissions as well as the documents FCCC/SBSTA/2008/INF.1 and FCCC/SBSTA/2008/INF.3 where the secretariat has provided a synthesis of previous submissions by Parties on this issue.

General comments

The Intergovernmental Panel on Climate Change (IPCC) defines carbon capture and storage (CCS) as a process consisting of the separation of CO_2 from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere. CCS in general should not be viewed as a distinct technology, but rather as a vital mitigation option, consisting of various technological options, many of which are already individually commercially viable and proven.

According to the IPCC, CCS has, after energy efficiency, the second largest potential for global emission reductions. An enhanced effort to stimulate development, deployment and dissemination of CCS technologies at a global scale will in our view be necessary to keep the increase in global average temperature within 2˚C, and vital if we want to keep the increase within a lower average temperature range.

For a number of large emission sources, in various sectors, CCS is a key mitigation option. The IEA Energy Technology Perspectives (2008) suggests that CCS would contribute 19% of the total global mitigation that is needed for halving global GHG emissions by 2050. This can be split into a 10% contribution from the power sector and 9% from the manufacturing industry and fuel transformation (refineries, etc.). IEA concludes that 25-30% of the industrial CO_2 reduction needs to be achieved through CCS. It could provide 1.7 to 2.4 Gt CO_2-reduction in 2050.

Due to the importance of the energy sector as source of GHG emissions, most attention has so far been paid to capturing CO_2 from power generations. However, the most attractive conditions for capturing would be in gas streams with high concentrations of CO_2. Such streams are found in the chemical processes used to produce ammonia of hydrogen, in coal-to-liquids and gas-to-liquids processes, in blast furnaces and cement kilns and in the processing of natural gas. For dominating industrial sectors, such as cement, iron and steel production, ammonia production and refineries, a mechanism for CO_2 storage could therefore contribute to significant emission reductions. In contrast to the power- sector, few other alternatives exist for emissions mitigation in the manufacturing industry sector.

CCS is already a mitigation option available to Annex I countries. Norway has stored CO_2 for the last 14 years, and several Annex I countries plan to use CCS in their national mitigating strategies.

The technology should also be a part of a comprehensive portfolio of mitigation action options available to non-Annex I countries. In order to mobilise the financial resources needed to enable this technology to reach its full potential, we must create financial incentives for private investments in CCS. The inclusion of CCS project activities under the CDM will give one important contribution to the dissemination and deployment of this technology in non-Annex I countries.

Fully fungible Certified Emission Reductions

Guidance provided by the COP/MOP to the EB must ensure the maximum environmental integrity of the projects.

For Norway it is important that Certified Emission Reductions (CER) resulting from environmentally sound CCS project activities under the CDM be considered as solid and viable as CERs from other CDM project activities. To obtain this, it is of utmost importance that the geological storage sites are carefully selected, and that the selection is based on thorough and well-documented analyses. Furthermore, proper and long-term monitoring of the reservoir after the CO_2 has been injected should be required, so that potential seepage from the site will be detected, and the seepage properly handled.

To ensure confidence in the CERs, the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (2006 IPCC GHG Guidelines) should be used as a basis for CCS project activities under the CDM. The 2006 Guidelines contain a chapter on CCS, and describe agreed methods for estimation of emissions from the capture, transport and injection processes as well as for possible seepage from the reservoirs.

The present modalities and procedures for the CDM cover most issues related to CCS project activities.

International regulations, guidelines etc.

Relevant marine environment conventions have addressed the issues and adopted regulation which already applies to carbon dioxide storage in sub-seabed geological formations.- Importantly, this includes the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter 1972 (London Convention) and the Protocol of 1996 thereto (London Protocol), which both have a global scope, as well as the regional Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR).

The London Convention currently has 86 contracting parties from across the globe, while the more modern London Protocol has replaced the Convention between its 37 contracting parties. The objective of both instruments is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter. In 2006 amendments were adopted to the London Protocol, adding CO_2 streams for sequestration to a list of wastes and other matter that may be considered for disposal, thus removing legal barriers for and at the same time regulating important forms of CO_2 storage.

In 2007 the London Protocol adopted “Specific Guidelines for Assessment of Carbon Dioxide Streams for Disposal into Sub-seabed Geological Formations”. Although adopted under the auspices of the Protocol, the guidelines were also considered relevant for parties to the London Convention 1972. While not directly related to CDM project activities, these guidelines cover many areas of concern listed in FCCC/KP/CMP/2009/L.10. Importantly, the guidelines include criteria for site selection, ensuring that only storage sites that will safely and permanently sequester the CO_2 stream are selected, as well as requirements as to characterisation of the CO_2 stream, environmental impact assessment, monitoring, remediation plan etc. A format for the reporting of such storage was adopted in 2008.

The OSPAR Convention, which is the Regional Seas convention applicable to the North-East Atlantic, has 16 contracting parties (15 countries and the European Community represented by the European Commission). In 2007 amendments to the Convention equivalent to those of the London Protocol were adopted. At the same time, a legally binding decision containing permitting and reporting requirements, as well as “Guidelines for Risk Assessment and Management of Storage of CO_2 Streams in Geological Formations” were adopted. Similar to the London Protocol guidelines, the OSPAR guidelines also contain criteria for site selection, characterisation of the CO_2 stream, environmental impact assessment, monitoring and remediation.

In 2009 the EU adopted a new Directive on the Geological Storage of Carbon Dioxide (Directive 2009/31/EC). Building on the London Protocol and OSPAR frameworks, this Directive similarly addresses issues of site selection, permitting, contents of CO_2 stream, review, measuring, monitoring, remediation, inspections etc. in legally binding form. The Directive further addresses the issue of liability and the eventual transfer of responsibility to the state.

National legal framework

Legal and regulatory frameworks should be developed by each host country as a pre-requisite to hosting CO2 storage project activities. Based on the host country’s capacities and capabilities, extensive capacity-building activities may be needed. This may be combined with broader capacity building for planning and advancing nationally appropriate mitigation actions.

Project boundary

According to the modalities and procedures for the CDM, “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”. The definition of CCS in the IPCC Special Report is “a process consisting of the separation of CO2 from industrial and energy-related sources, transport to a storage location and long-term isolation from the atmosphere”. The project boundary of the CDM project activity should comprise these three separate processes; capture, transport and injection/storage of CO_2.

Specific components that will need to be properly addressed in the CDM project boundary include:

i. The subsurface components, e.g., the installation where the CO_2 is generated, the capture plant, any additional CO_2 treatment facilities, the compression facility, the transportation equipment and booster stations along a pipeline, any reception facilities or holding tanks at the injection site, and the injection facility. These components present similar technical elements to any CDM project. Emissions from these components can therefore be calculated using techniques and approaches applied in other CDM project activities.

ii. Wells and other potential direct seepage pathways, e.g., injection, observation of abandoned wells, mineshafts and boreholes. These potential seepage pathways will need to be monitored as part of the overall project monitoring plan.

iii. The reservoir where the CO_2 is stored. Site characterisation and storage performance assessment studies carried out as part of the feasibility study in advance of CO_2 injection operations will define the project boundary for the reservoir.

iv. The locations around the reservoir such as the cap-rock or spill points at the lateral edges of a geological structural trap.

v. Emissions associated with enhanced hydrocarbon recovery using CO_2, which may include breakthrough of injected anthropogenic CO_2 at extraction wells, additional energy use for hydrocarbon recovery and for CO_2 stripping and recovery, and any flare or venting emissions.

It is Norway´s view that the CERs from the project should be calculated on the basis of the amount of CO_2 produced by the plant (the baseline), minus CO_2 released in relation to the separation (un-captured CO_2), transport and injection processes. In addition, indirect emissions from energy produced to perform the three processes should be subtracted. If the monitoring of the storage site reveals seepage of CO_2, this must also be subtracted from the CERs. Another way of expressing this is that the emission reductions could be calculated on the basis of the amount stored, minus emissions from producing energy needed for the capturing, transport and injection processes as well as detected seepage from the storage site.

Cross-border projects do not pose any additional challenges from a project boundary perspective, with respect to shared reservoirs. It does, however, pose the question of determining the responsible host country, and would entail resolving legal responsibility between involved countries.

Norway would not recommend projects using storage reservoirs in international waters due to the legal complexities associated to such storage reservoirs.

Permanence, including long-term permanence

The careful selection of storage sites for CCS projects is of vital importance to prevent seepage and ensure the environmental integrity of the projects. The long-term risk for seepage has to be minimised and only projects designed with a high expectation of no seepage should be approved.

The IPCC Special Report on Carbon Dioxide Capture and Storage states that “the proportion of CO2 retained in appropriately selected and managed sites is […] likely to exceed 99% over 1,000 years”. Over time, it is also possible that the CO2 will be immobilised by various trapping mechanisms.

The regulatory regime should have a special focus on the appropriate selection and management of geological storage sites. A well selected and managed CO2 storage site will have a diminishingly small risk of seepage and the job of the EB will be to permit projects whose maximum assessed risk is acceptable.

A key element is therefore to ensure that the storage sites proposed for CCS projects in the CDM have been thoroughly characterised and analysed, and that the documentation is a part of the Product Design Document (PDD). The analysis should include a characterisation of the reservoir, the cap-rock/trapping mechanisms, geological stability as well as possible seepage pathways. The methodologies addressed in the PDD should require a thorough risk assessment of the storage site and operation, including an assessment of all potential seepage paths and environmental impacts, using detailed site characterisation and simulation based on the methodology and requirements of the 2006 IPCC GHG Guidelines, on the general advice on site selection in the IPCC Special Report on CCS, available industry best practice and where applicable, the London Protocol and OSPAR guidelines.

Possible seepage from the storage site should be accounted for. “Seepage” here refers to leakage of CO2 from the storage site, and not leakage as defined by Decision 3/CMP.1, paragraph 51.

Leakage and seepage

In the modalities and procedures for the CDM, 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”. Our understanding is that leakage is not different for CCS projects compared to other CDM project activities, and thus, will not require new guidance.

One of the options for CDM projects is a crediting period of 7 years, which may be renewed twice, according to the modalities and procedures for CDM. If this option is chosen, a thorough analysis of the storage site is required before a renewal is granted. If the analysis shows that direct or indirect seepage has taken place, it could be decided to deny renewal of the project as a CDM project. The rationale is that this could indicate that the reservoir is not safe and that the seepage may continue.

Monitoring

The modalities and procedures for the CDM requires that the monitoring plan for a project activity provides for e.g. the collection and archiving of all relevant data necessary for estimating greenhouse gas emissions and determination of baselines. This should include monitoring of the amount of CO2 injected in the reservoir and the relevant data from the injection project. Identification of all potential sources of increased emissions outside the project boundary, that are significant and attributable to the project activity during the crediting period, should also be included.

A proposed monitoring plan is to be developed by the project participants and included in the PDD. The PDD should also demonstrate the responsibilities for monitoring of any seepage from the reservoir in the long term. The monitoring plan should be consistent with the requirements of the 2006 IPCC GHG Guidelines, relevant parts of the IPCC Special Report, available best industry practice and where applicable, the London Protocol and OSPAR guidelines.

The following items should be monitored

- injection rate
- injection and reservoir pressure
- properties of the injected CO2-fluid including temperature, phase solid contents
- mechanical integrity seals
- containment of CO2 plume
- effectiveness of control measures (e.g. emergency shut-down systems)

Norway is of the view that proper and long-term monitoring of the reservoir is required to ensure that any seepage from the site will be detected, accounted for and brought under control. It is important that the monitoring program covers the CO2 storage and addresses possible seepage pathways in an appropriate way. These possible pathways would have been identified during the analysis of the storage site. Monitoring technology and methodology for environmentally sound storage of CO2 are available and in use by the petroleum industry. This includes known seismic as well as gravimetric techniques.

The monitoring should go far beyond the crediting period (10 years or 7 years, with the possibility to be renewed twice). It should be decided who is responsible for the monitoring after the crediting period, the project participants or the host country, and the length of this period.

Measuring, reporting and verification

As part of the PDD a potential project participant should acquire baseline monitoring data and perform an initial quantified risk assessment outlining the most-likely seepage scenarios and developing an expected risk profile over time. The risk profile will be specific to each project, and is likely to change through time as the risk assessment and measuring, reporting and verification are updated during storage operations. The risk of seepage is expected to increase during the operation phase, decrease as the primary seepage paths are decommissioned and become diminishingly small as the trapping mechanisms take effect.

At appropriate intervals during the project, the fate of the CO2 plume should be monitored, verified, accounted for and reported and the quantified risk assessment updated. This will require robust baseline data and the quantification of associated uncertainty ranges for the appropriate monitoring technologies to be established prior to CO2 injection and a quantified risk assessment performed to provide assurance that the maximum risk during operation is acceptable. During the Closure phase, a final quantified risk assessment should be carried out to establish that the risk levels are acceptable before storage reservoir is relinquished to the State.

The London Protocol and OSPAR guidelines address and provide useful starting points for regulation of these aspects.

Liability

The emission reductions resulting from each project activity under the CDM shall, according to the modalities and procedures for the CDM, contribute to real, measurable and long-term benefits to the mitigation of climate change. As stated earlier, it is vital for Norway that CERs from CCS projects are considered as solid as CERs from other CDM emission reduction projects. On this basis we see a need for a clearly defined long-term liability, which extends the crediting and project period.

In the PDD, the participants should demonstrate procedures for the proper and safe sealing and abandonment of the reservoir. It should also demonstrate that CO2 within the reservoir will reach a stable distribution in the long term, entailing no seepage to the atmosphere. Furthermore the PDD should show how binding regulatory provisions will be in place to permit, regulate and control the CCS project, including in the longer-term after the CDM crediting period. Thus the PDD must clearly define: short-term, medium-term, and long-term liabilities; accounts for any seepage and the remediation required in the different periods.

The short to medium-term liability should as a rule rest with the project participants. Post-closure/ medium-term and long-term liability should be agreed upon between the host country and the project participants.

The EB should ensure that the issue of liability is appropriately addressed in the PDD.

Safety

All CCS project activities should demonstrate in the PDD that the project is environmentally sound and minimize both the risk of the environment and human health.

The potential for perverse outcomes

There have been concerns raised about the possibility that emissions reductions from CCS activities would overflow the global CDM market. To our knowledge this argument is not based on factual figures as far as the near and mid-term is concerned.

It is unlikely that potential CCS-projects will have a large crowding-out effect on other CDM project activities, because of the long lead times for implementation and high technology costs. The potential market effect of any specific technology or project activity in subsequent commitment periods under the Kyoto Protocol will depend on the ambition level and content of these commitments, and should not have any impact on rules and modalities for CDM projects.

CCS an integrated part of the Norwegian domestic mitigation policy

Article 2 (a) (iv) of the Kyoto Protocol encourages Annex I Parties to "implement and/or further elaborate policies and measures in accordance with its national circumstances, such as [...] research on, and promotion, development and increased use of [...]carbon dioxide sequestration technologies and innovative environmentally sound technologies". Norway has made CCS an integrated part of our national climate change mitigation policy. In our Fifth National Communication under the Framework Convention on Climate Change we give a broad description of our national CCS policy and projects:
http://www.regjeringen.no/upload/MD/Vedlegg/Rapporter/T-1482E.pdf

PAPER NO. 4: SPAIN AND THE EUROPEAN COMMISSION ON BEHALF OF THE EUROPEAN UNION AND ITS MEMBER STATES

SUBMISSION BY SPAIN AND THE EUROPEAN COMMISSION ON BEHALF OF THE EUROPEAN UNION AND ITS MEMBER STATES

This submission is supported by Croatia, the Former Yugoslav Republic of Macedonia, Serbia and Turkey.

Madrid, 5 March 2010

Subject: **Carbon dioxide capture and storage in geological formations (SBSTA)**

Submission from Parties - on views related to carbon dioxide capture and storage in geological formations as a possible mitigation technology, bearing in mind the concerns related to the following outstanding issues, inter alia:

(a) Non-permanence, including long-term permanence;
(b) Measuring, reporting and verification;
(c) Environmental impacts;
(d) Project activity boundaries;
(e) International law;
(f) Liability;
(g) The potential for perverse outcomes;
(h) Safety;
(i) Insurance coverage and compensation for damages caused due to seepage or leakage;

I. Introduction

1. At COP/MOP 5 in Copenhagen, draft Decision -/CMP.5 invited Parties to make submissions to the secretariat, by 22 March 2010, on carbon dioxide capture and storage (CCS) in geological formations as clean development mechanism (CDM) project activities, bearing in mind a number of different issues. The EU welcomes the opportunity to submit its views on this important issue and looks forward to discussions at SBSTA 32 and COP/MOP 6.

2. This submission should be considered in conjunction with our previous submissions, most recently that of September 2007 and June 2008.

3. For the purposes of this particular submission, CCS refers to the technologies for capturing emissions of CO_2 from large point sources (such as power stations and energy-intensive industrial processes), transporting it to suitable sites, and injecting it into geological formations. The EU does not support CCS projects involving the direct injection of CO_2 into the water column because of high levels of uncertainty about levels of CO_2 retention and the negative effects on ecosystems. For these reasons, such projects are not discussed in this submission.

4. **CCS technology should not serve as an incentive to increase the share of fossil fuel power plants. Its development should not lead to a reduction of efforts to support energy saving policies, renewable energies and other safe and sustainable low carbon technologies, both in research and financial terms.** At this condition, the EU considers CCS involving geological storage as a possible mitigation option in the portfolio of actions for stabilising GHG concentrations in the atmosphere, provided that the necessary technical, economic and regulatory framework exists to provide maximum environmental integrity, ensure that any seepage is avoided and that it is done safely and responsibly, with no consequences for health or environment.

5. Industrialised countries can take the lead in developing and deploying CCS. However, in view of the size of the challenge ahead and the projected increase in fossil fuel-powered generation in developing countries, it is important that in the next decade developing countries build capacity to deploy low carbon technologies, including CCS**,** on a commercial scale. The CDM could provide an opportunity to support the deployment of CCS in these countries.

6. While some CCS components are already deployed in mature markets, there is still relatively little experience with the combination of CO_2 capture, transport and storage in a fully integrated CCS system. In addition, there are many potential barriers that could inhibit deployment in developing countries, even of technologies that are mature in industrialized countries. At the same time, appropriate regulation should be put in place and financing incentives should primarily come from the market. As such, CDM could provide an additional incentive to further develop and deploy CCS. As noted in our previous EU submissions on this issue, it is important that any CCS project activity should contribute to all of the objectives of the CDM, including assisting non-Annex I Parties in achieving sustainable development.

7. **Basic conditions for the inclusion of CCS in the CDM are that the necessary technical, economic and regulatory framework for stored CO_2 exists to secure the overall environmental integrity. On a project level, this requires not only a sound CDM methodology, but also regulatory measures in host countries. In April 2009 the EU adopted a legal framework for the geological storage of carbon dioxide, with the aim of ensuring that the geological storage of carbon dioxide is implemented in an environmentally safe way by preventing and, where this is not possible, eliminating as far as possible negative effects and any risk to the environment and human health. Although the EU CCS Directive was developed for application in Europe, it may serve as a useful example for enabling CCS in**

other jurisdictions, respecting legal, cultural, social and administrative differences.

8. **The following sections could form the basis of a set of comprehensive criteria against which the Executive Board (EB) assesses that proposals for CDM project activities involving CCS adequately address issues of: non-permanence, measuring, monitoring and verification, - project activity boundaries – environmental impacts, safety, potential for perverse outcomes – liability, international law -, insurance coverage and compensation for damages caused due to seepage or leakage**.

II. Non-permanence, MMV, Boundaries

(a) Non-permanence, including long-term permanence

9. Addressing risks and preventing long-term seepage from storage sites is crucial to ensuring the integrity and efficiency of CCS as a mitigation option and its use under the CDM. It is therefore important to assess site-specific risks of potential long-term seepage and to ensure the long-term CO_2 storage integrity.

10. The geological characteristics of reservoirs differ and their suitability and long-term storage capacity is widely recognised to be heavily dependent on their individual characteristics. For this reason**,** only projects designed in the most secure sites, allowing sufficient trapping mechanisms to ensure stored CO_2 is fully and permanently retained in the long term, could be approved. **Those projects should employ sound and suitable rigorous site-selection criteria** to ensure long-term integrity of storage, proper risk management, good site maintenance, and put in place appropriate measures to deal both with long-term liability for the site (including any necessary remediation in the event of any seepage). This must be done prior to starting the storage operation and requires **monitoring and remediation programmes**.

11. To put the EB in the position to assess each individual project, Project Design Documents (PDDs) should contain clear and detailed information on storage site characterization, the identification of potential seepage paths and the potential impacts in case of seepage, site operation procedures to minimise the risk of seepage, as well as on risk assessments and management, and on remediation measures to deal with any seepage.

12. In the case of CDM project activities it will be important to ensure that criteria are suitably rigorous and applied consistently whatever the location of projects. Should host countries not yet have a suitable national regulatory regime in place, such a regime has to be developed and implemented before the project could be authorised. There is also an international function for increasing the common knowledge-base. There is a need to develop clear principles and criteria for site-selection, risk management systems, as well as long-term liability (see section IV.a). Moreover, it

will be necessary to develop a detailed step-wise procedure to enable consistent and sound development and assessment of individual projects.

13. As a general principle, **the EU believes that accounting rules for CCS project activities under the CDM should be consistent with the current approach under the Kyoto Protocol,** which ensures that the actual effect on the atmosphere is reflected in the quantity of Kyoto units issued and accounted over time.

14. The EU believes that the best way to avoid very complex accounting schemes for long-term seepage is to ensure that there is full assurance of permanent storage of CO_2.

15. Geological storage of CO_2 for long time intervals is different to GHG removals by sinks. The EU therefore does not consider the use of temporary Certified Emission Reduction Units (tCERs) or long-term Certified Emission Reduction Units (lCERs) for CCS project activities as a suitable option to address permanence concerns. These units were specifically developed for afforestation and reforestation project activities to account for the non-permanence of removals by afforestation or reforestation project activities. The problem of potential non-permanence could be more successfully addressed via, inter alia: credit buffer or new type of credits that solves the long-term permanence issue.

(b) Measuring, monitoring and verification

16. Attention must be given to potential seepage during the pre-injection (CO_2 capture and transportation), injection, and post-injection (operation, closure, post-closure) phases of a CCS project.

17. In the operation and monitoring of reservoirs, the key issue is the availability of reliable, trustworthy and reproducible methodologies used to determine and verify the efficacy of storage mechanisms and ensure storage integrity. In approving CCS methodologies, the EB must be in a position to assess that the development of a comprehensive monitoring programme, based on appropriate storage site characterisation and risk assessment, have been conducted in order to prevent and to manage the risk of CO_2 seepage (and implement remediation measures in case of seepage).

18. **Monitoring is essential to assess whether injected CO_2 is behaving as expected, whether any migration or leakage occurs, and whether any identified leakage is damaging the environment or human health**. To that end, the DOE should ensure that during the operational phase, the operator monitors the storage complex and the injection facilities on the basis of a monitoring plan designed pursuant to specific monitoring requirements. The plan should be submitted to and approved by the DOE. In the case of geological storage under the seabed, monitoring should further be adapted to the specific conditions for the management of CCS in the marine environment. Operational procedures and monitoring methodologies should be

determined in accordance with industry best practice and the recommendations of the IPCC.

19. **The project operator should report, inter alia, the results of the monitoring to the Designated Operational Entity (DOE) at least once a year**. In addition, the DOE should establish a system of inspections to ensure that the storage site is operated in compliance with the requirements.

20. **Maintenance regulations** for injection wells are essential to avoid seepage during project operation and post-closure phases. Monitoring of the sealing performance of wells is necessary after storage operations are completed.

21. **Appropriate quality control and quality assurance regulations** are fundamental to ensure sustainable operation of storage sites.

22. **The DOEs responsible for validation and verification of CCS project activities should have proper geological and engineering experience relevant to CCS; the EB should draw on appropriate expertise in defining criteria and standards for accrediting such DOEs.**

(c) Project activity boundaries

23. **Project boundaries should clearly cover all emissions that are significant and reasonably attributable to any aspects of the project activity**, including capture, transport, intermediate storage, injection and storage, and should factor in increased energy use and loss of efficiency resulting from the CCS project activity.

24. One particular issue is how to deal with the case where several projects use the same reservoir for storage. This raises the question of who should be responsible for monitoring and avoiding any seepage. In the EU's view **each storage site should only be under the responsibility**, for monitoring, preparedness, response, and remediation measures, for instance, via insurance coverage, **of one entity**.

25. If a project boundary encompasses territory in more than one country, the project is only eligible as long as there is clear assignment of liabilities, and adequate accounting for emission reductions and any seepage according to solutions for reporting of cross border CCS projects put forward in the 2006 IPCC Guidelines; notwithstanding that the objective should be to avoid any seepage.

26. A predictive modelling and simulation of CO_2 migration to determine a larger 'storage complex' would ensure that the project boundary can be defined so as to ensure that the CO_2 plume will stay within the project boundary.

III. Environmental impacts, safety, potential for perverse outcomes

(a) Environmental impacts

27. **For all CCS project, a comprehensive socio-environmental impacts assessment should be conducted** and adequate measures for mitigation and compensation foreseen.

28. While CO_2 is drastically reduced, the use of a CCS project, requiring generally substantial more energy, should not have perverse environmental consequence such as significantly increasing absolute quantities of air pollutants (e.g.: NO_X, SOx, dust, Hg, PAHs, etc.) by comparison with the baseline. Moreover, a CCS project must not lead to clean air technologies being neglected or not applied anymore.

29. In all cases, **best available techniques should be applied in order to achieve a high level of protection for the environment as a whole**.

30. Provisions are required concerning liability for damage to the local environment and the climate, resulting from any failure of permanent containment of CO_2.

31. Competent authorities and project operators should ensure that sufficient information is made available to the public and stakeholders are adequately involved in the decision making process.

(b) Safety

32. **For all storage projects, a risk assessment should be required, along with the development and implementation of a risk management and risk communication plan**. At a minimum, risk assessments should examine the potential for leakage of injected or displaced fluids via wells, faults, fractures, and seismic events, and the fluids' potential impacts on the integrity of the confining zone and endangerment to human health and the environment. Risk assessments should address the potential for leakage during operations as well as over the long term. The risk assessment should be conducted by a private or public institution, independent from the CCS implementing company/institution.

33. In countries where CO_2 is stored, an independent/public expertise should be maintained or developed in order to have an independent controlling expertise.

34. Good design, completion and operation of CO_2 injection wells are fundamental for the environmentally safe operation of CO_2 storage formations. Construction materials that can resist CO_2 degradation will be needed, and appropriate regulations would assist in that respect.

35. Pipelines located in vulnerable areas (populated, ecologically sensitive, or seismically active areas) require extra due diligence by operators to ensure safe pipeline operations. Options for increasing due diligence include among other things: decreased spacing of mainline valves, greater depths of burial, increased frequency of pipeline integrity assessments and monitoring for leaks.

36. **It is necessary to impose on the composition of the CO_2 stream constraints that are consistent with the primary purpose of geological storage**, which is to isolate CO_2 emissions from the atmosphere, and that are based on the risks that contamination may pose to the safety and security of the transport and storage network and to the environment and human health. To this end, prior to injection and storage, the composition of the CO_2 stream should be verified and operators should prove that their CO_2 streams are sufficiently pure and that they have adequately considered the relationship between stream purity and the surrounding cap rock including environmental and other risks of CO_2 storage. The composition of the CO_2 stream is the result of the processes at the capture installations. The operator of the storage site should only accept and inject CO_2 streams if an analysis of the composition, including corrosive substances, of the streams, and a risk assessment has been carried out, and if the risk assessment has shown that the contamination levels of the CO_2 stream are in line with the composition criteria required. In all cases, acceptable concentration of substances should be related to their potential impacts on the integrity of the storage site and relevant transport infrastructure, the risk to the environment, and to requirements of the applicable regulations.

(c) Potential for perverse outcomes

37. The only market technology for geological storage listed by the IPCC in its Special Report on CCS is enhanced oil recovery (EOR)/enhanced gas recovery (EGR), and this type of project activity may not depend on CDM incentives and/or may not be additional.

38. **For the inclusion of CCS in the CDM the necessary economic and regulatory framework for stored CO_2 should exist to avoid generation of windfall profits.**

IV. Liability, international law, insurance

(a) Liability

39. **PDDs and monitoring plans should include clear assignment of long-term liability for monitoring and site-management, including remediation (covering a period as long as is necessary in accordance with guidance in the 2006 IPCC GHG Guidelines); they should clearly specify details of any transfer of liabilities (between project participants and Parties involved), including evidence of agreements on such transfers; PDDs and Monitoring Reports/Verification**

Reports should also include clear evidences of the compliance with financial and organizational provisions to ensure the continuing viability of the storage operation and monitoring beyond the crediting period.

40. The accounting of Certified Emission Reduction Units (CERs) from CCS project activities requires the clear assignment of long-term liability and insurance coverage for the risk of emission from a reservoir.

41. **After the operator's liability ends, the ultimate legal long-term (indefinite) liability for any seepage emissions needs to be with the host country**. The EU recommends that the EB be tasked to survey existing rules and principles on international liability as embodied in international treaties and conventions and the preparatory work on international liability (being) carried out by various international bodies and, based upon this study, to come with proposals best suited to deal with international liability in the context of CCS.

42. The host country should be legally responsible for ensuring that the project operator is liable. The host country and the project operator have control over the reservoir and any seepage emissions, as the reservoir is under their control, enabling them to manage and mitigate the risk of seepage.

(b) International law

43. **Project activities must comply with all relevant rules and regulations of national and international law including, where applicable, the London Convention and Protocol, the OSPAR Convention and the Barcelona Convention for the Protection Of The Mediterranean Sea, Against Pollution.**

(c) Insurance coverage and compensation for damages caused due to seepage or leakage

44. Project operators must demonstrate financial security for all of the activities required for site closure and for liability after closure. For during project operation, specific insurance is now available from commercial providers.

45. Although the ultimate liability for any seepage emissions in the long term needs to be with the host country, the development of a common insurance scheme (e.g. based on a share of proceeds on CCS project's CER) among all CCS projects can be an option to make sure that every host country is able to comply with this duty even decades after the closure of the storage site/project.

V. Conclusions

46. **The EU believes that the above mentioned points are some of the key issues that need to be addressed before CCS projects are considered to be carried out under the CDM. The EU considers that the IPCC Special Report and the 2006 Inventory Guidelines provide a good basis for further addressing these issues. In a number of cases, further work will need to be done, drawing on this material to provide sufficiently clear guidance for the consideration of CCS projects under the CDM.**

47. **We believe that COP/MOP should instruct the Executive Board to proceed with this work. The assessment and the discussion of the methodologies submitted on the basis of real cases may contribute to solve the open questions raised above and to enable the possibility for a safe and sustainable inclusion of CCS in the CDM.**

48. **The EU moreover recommends that COP/MOP tasks the Executive Board with liaising with a number of governmental and non-governmental bodies with suitable knowledge, and identifying experts, to draw up guidance and recommendations for the necessary regulatory framework to secure the overall environmental integrity and long-term liability for CCS project activities and their contribution to guarantee sustainable development in the host country.**

49. **Guidance and recommendations should draw on the existing work of the IPCC, on national and regional experience, such as that of the EU, on work undertaken under the London and OSPAR Conventions, the IEAGHG, the ILC and the CSLF, and on growing industry experience, and should be updated as new knowledge becomes available.**

50. The possible development of sub-seabed storage CCS projects under the CDM should be subject to the establishment of specific procedures and regulations. Such procedures would need to be assessed under the SBSTA process.

Annex A: Rationale for large-scale deployment of CCS

51. CCS has been identified by the IEA as one of the top three most important GHG emission reduction solutions to tackle climate change globally, after energy efficiency and renewables. CCS is not a substitute for energy efficiency and renewables, but may offer an additional share to reduce emissions of carbon dioxide during a transition period to a low carbon economy.

52. Following the IEA, without CCS the overall costs to halve CO_2 emissions levels by 2050 increases by 70% and according to the EU funded ADAM work "The availability of CCS is crucially important for achieving low stabilisation levels". However, the current capital and operational costs of CCS make its uptake expensive.

53. There are still concerns around environmental integrity, safety of storage, storage potential and liability, increased energy use and its impacts, cost effectiveness, high costs of deployment and lack of access to the carbon market. Demonstration and sharing of knowledge of a range of technologies and storage sites could help resolve the concerns and tackle the barriers for CCS deployment.

54. R&D, demonstration projects and sharing of knowledge of a range of technologies and storage sites should be used to find answers to open questions and to improve the public awareness for CCS. Successful R&D and large scale demonstration projects are a condition for the commercial deployment.

55. Given the current trajectory of growing fossil fuel electricity generation and industrial growth in key developing countries, it is crucial that they explore emission reduction technologies in parallel with industrialized countries. Therefore, it is important to establish demonstration projects – as part of a range of mitigation technologies - not only in our own countries but also in developing countries provided that the necessary technical, economic and regulatory framework exists to secure environmental integrity.

56. 2008 G8 committed (and reaffirmed in 2009) to support the launch of 20 CCS demonstration plants by 2010. The IEA was tasked with tracking progress towards this commitment, and produced in 2009 a Technology Roadmap for CCS, largely exploited by the MEF Global Partnership initiative to build the CCS Technology Action Plans presented in December 2009.

Annex B: EU actions

57. There has been a sharp rise in interest in CCS within some EU Member States. Many EU companies are developing plans to demonstrate the full CCS chain of capture, transport and storage for the power generation sector.

58. The EU recognises that full scale deployment of CCS requires strengthened R&D and a regulatory framework that ensures long-term storage integrity, full liability and investment certainty that takes into account all relevant environmental, health, economic, technical and legal aspects.

59. In January 2007 EU Heads of State and government affirmed the need for Member States and the Commission to work towards strengthening R&D and developing the necessary technical, economic and regulatory framework to bring forward environmentally safe CCS to deployment in all new coal power plants, if possible by 2020. They called for a strengthening of partnership and cooperation building with emerging economies, including low-emission energy technologies, notably CCS.

60. In April 2009, the EU has adopted a legal framework for the geological storage of carbon dioxide. It includes provisions on managing the risks of CCS, covering site-selection criteria, operation, closure and post-closure obligations including CO_2 stream acceptance criteria, monitoring, corrective measures in case of leakage as well as criteria for the transfer of responsibility and financial liability. Monitoring, reporting and verification are based on the IPCC Inventory Guidelines. The EU regulatory framework may provide a suitable basis for regulatory provisions in other jurisdictions to establish requirements to ensure environmentally safe CCS projects.

61. The European Council of June 2008 called for a mechanism to incentivise Member State and private sector investments to ensure the construction and operation of up to 12 CCS demonstration plants by 2015. For this purpose the revised EU Emissions Trading Scheme establishes a mechanism for the financing of up to 12 commercial CCS demonstration projects. In addition, the European Energy Programme for Recovery provides funding of EUR 1 billion for 6 CCS demonstration projects.

62. The EU is ready to support capacity building exercise to help developing countries to integrate this technology in NAMAs and LEDSs and engage in collaborative R&D and exchange of views on policy issues including legal framework. Some European Member States, as well as the European Commission, are also active members of the Carbon Sequestration Leadership Forum (CSLF).

63. In this regard, the EU has a political agreement with China to develop and demonstrate near zero emissions coal (NZEC) technology through carbon capture and storage by 2020 and is exploring further cooperation with other key emerging economies. The first phase of the China-EU Cooperation has been finalized, and four projects on research and development, financed by the EC and UK, involving Chinese and European public and private partners have made significant progress in improving

understanding of this technology. On June 2009, the Commission adopted a Communication on financing the construction and operation of an NZEC demonstration plant in China, and the October Environment Council invited the Commission to cooperate with EU and EEA member states, international stockholders and financial institution to find the way to finance demonstration. At the last EU-China Summit on November 2009 the EC and the Chinese Ministry of Science and Technology signed a Memorandum of Understanding (MoU) for the following phases of the NZEC project, and the project identification is currently on going.

64. Under the European Commission's 7th Framework Programme for Research, opportunities exist for scientific collaboration between European and non-European researchers on CCS.

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