13 March 2006

ENGLISH ONLY

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Consideration of carbon capture and storage as clean development mechanism project activities

Bonn, 22 May 2006

Workshop working paper

Submissions from Parties

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

2. The secretariat has received nine such submissions. 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.

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PAPER NO. 1: AUSTRALIA

Australian Comments on Carbon Dioxide Capture and Geological Storage under the Clean Development Mechanism

Purpose of paper

Carbon dioxide capture and geological storage (CCS) will play a vital part in mitigating the impact of climate change. Australia has a strong research and development program in this field and there are a number of medium and large-scale CCS projects currently under consideration in Australia. Australia consequently has significant technical expertise in this area.

The approach adopted by the Clean Development Mechanism (CDM) towards CCS will play an important role in fostering the uptake of this important method of abating greenhouse gas emissions.

Australia's submission covers the following technical elements of CCS:

- Challenges for addressing CCS;
- Guiding principles for the treatment of CCS under a baseline-credit scheme;
- Additionally assessments;
- The question of project boundaries; and
- Monitoring and verification (M&V).

The matters raised in this paper have general relevance to the application of CCS regardless of the source of the CO2.

Challenges for addressing CCS

The main challenge that confronts the Executive Board of the CDM (EB) is determining a standard methodology(s) to establish the emissions baseline from which the performance of a CCS project can be assessed (and potentially rewarded with credits). The modalities and procedures for CDM[1] identify three potential methodologies for estimating BAU emissions baselines:

1. Existing actual or historical emissions, as applicable; or
2. Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment; or
3. The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.

While these provide useful guidance, there remain many challenges for CCS activities including (respectively):

1. There is little actual emissions performance data for CO_2 captured from coal fired power stations and for permanent CO_2 geological storage (as most CO_2 injection is for enhance oil recovery or gas recovery in which the fate of the CO_2 is not considered);
2. Agreeing on plausible alternative technology scenarios to the proposed CCS project (given there are few if any regulations in regards to CO_2 emissions and there is no compulsion to undertake this activity) and defining mitigation performance (ie. point source emission reductions and/or CO_2 avoided or CO_2 captured); and
3. There are only four CO_2 storage projects globally and project performance depends on site (and to date there are no fossil fuel power plant projects).

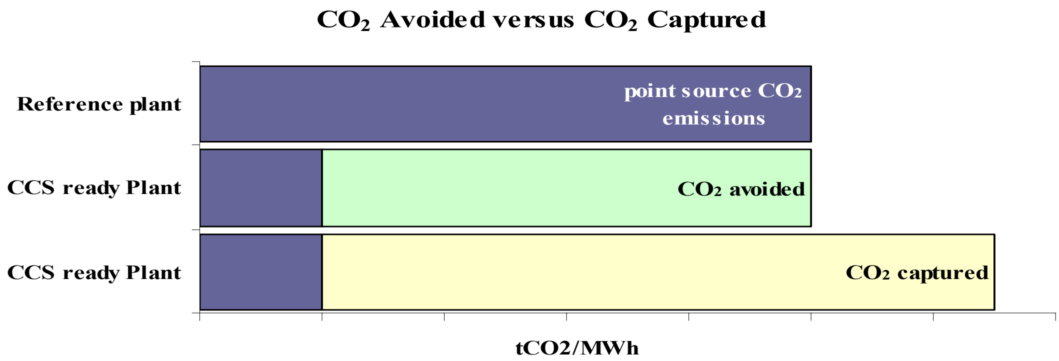
There is a broad range of possible CCS projects including (but not limited to) fossil fuel fired power plants (retrofitted or new), hydrocarbon processing plants (LNG, CNG, LPG) and industrial processes

[1] Decision 17/CP.7 (FCCC/CP/2001/13/Add.2)

(including ammonia, steel, cement and other chemical manufactures). While CO_2 separation and capture from current LNG projects could apply methodology one or three, emission baseline calculations for greenfield (ie non-retrofit) and electricity generation projects with CCS applications will be significantly more complex.

A greenfield project for example will have different technical specifications to any chosen alternative BAU technology scenario. An agreement on the assumptions made about current or best alternative options (as a basis for emission performance comparison) will likely include consideration of technology type (open cycle versus combined cycle), feedstock (coal versus gas versus biomass), power capacity and capacity factor (baseload versus peaking capacity) among many other considerations. To address this problem, the CDM EB could agree to a generic alternative technology 'reference case' corresponding with a particular type of greenfield CCS project.

Furthermore, projects that retrofit CCS technologies could potentially apply the first methodology, although an adjustment for the CO_2 capture and compression energy penalty would be required[2]. The choice of metric (CO_2 avoided or CO_2 captured) used for this adjustment will impact on any baseline estimate as the amount of CO_2 avoided (defined as the [average] point source emissions of the reference plant less the [expected] point source emissions of the CCS plant) is always less than the amount of CO_2 captured (see figure below). Therefore, to account for this energy penalty, CO_2 emissions avoided, rather than CO_2 captured, should be applied when calculating emission reductions.



For this reason, the cost of CO_2 avoided is always greater than the cost of CO_2 captured.

Other guiding comments for recognising CCS in baseline-credit schemes (such as CDM)

The following comments draw upon Mitsubishi's proposed methodology and an Australian industry paper – and reflect generally desirable characteristics of any CCS project baseline methodology(s), including:

1. Compliance with a set of clearly defined principles underpinning new CCS projects (to assist the management of long term leakage of emissions);
2. Establishment of clearly defined project boundaries (capture; transport; injection; operation; site closure);
3. Establishment of long term CCS enabling infrastructures (such as monitoring and verification regimes and accounting protocols for very long term emission storage performance criteria by storage site).

1. Guiding principles for new CCS projects

A major difference for the crediting of emission reductions from CCS projects to that of other projects is that the mitigation effort is rewarded upfront (at time of injection) while its environmental service (ie.

[2] The Intergovernmental Panel on Climate Change Special Report on CCS indicates that a power plant equipped with CCS would need approximately 10–40% more energy than a plant of equivalent output without CCS.

permanent avoidance of emissions to atmosphere) can only be verified over the very long term - typically extending outside of actual crediting periods. To *reasonably* address this issue, industry should expect to be required upfront to deliver on a set of guiding principles that facilitate a permitting or licensing approach to CCS under CDM. These principles could include:

- Adopting standard procedures for risk assessments (including the extent of any commitment to contingency planning) to allow for a consistent and informed regulatory approval decision processes;
- Adopting integrity criteria within a comprehensive project workplan that incorporates risk assessments and outlines injection, monitoring and verification, anticipatory modelling and contingency mitigation;
- delivery of sufficient data (and lend itself to independent verification) prior to injection to ensure geological stability; capacity; safety and integrity of storage site;
- Identifying transportation facilities (so as to allocate responsibility for CO2 monitoring and long term liabilities between entities and./or countries);
- Recognition that any CCS effort exceeds BAU activity in regards to emissions, regulatory and fiscal performance ('additionality assessment');
- Ensuring all project 'creditable' activity takes place within eligible national boundaries (noting that there may need to be a negotiation process to recognise eligible project emission reductions that extend across multiple non-Annex B national boundaries); and
- Allowing contingent emission liabilities to be hedged as much as possible through insurance products; indemnities; contingency funds; ring fenced credit reserves (eg. a tranche of CERs or fraction of CER sales for such matters); transfer of liabilities from private to public balance sheets.

2. Additionality assessment

The Kyoto Protocol[3] specifies that emission reductions resulting from a CDM project must be "additional to any that would occur in the absence of the certified project activity". Proving additionality for the majority of CCS projects will likely be relatively straight forward, as CCS is only implemented for emission reduction purposes.

However, it may be more difficult to prove additionality for Enhanced Hydrocarbon Recovery[4] (EHR) projects where CCS projects gain financial benefits from additional hydrocarbon production through injecting CO_2. While an EHR project may not be considered additional under a "financial" additionality test[5], there may be grounds for additionality under other barriers to implementation such as technological[6] barriers or barriers due to prevailing practices. It is clear that this question needs to be carefully addressed, as if the baseline against which CERs are allocated is miscalculated, there is a significant risk of creating "certified hot air" which could undermine real abatement opportunities in other sectors and undermine the environmental integrity of the CDM.

3. Project boundaries

The modalities and procedures for CDM[7] state that the project boundary encompasses all anthropogenic greenhouse gas emissions under the control of the project participants that are significant and reasonably attributable to the CDM project activity.

In addition, the consideration that CCS projects may operate over a large geographical area (with source and sink location potentially being some distance apart), analysis of the project boundary should also

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[3] Article 12 paragraph 5c

[4] Enhanced Hydrocarbon Recovery includes Enhanced Oil Recovery and Enhanced Coal Bed Methane.

[5] Financial additionality can be demonstrated through comparison of internal rate of return (IRR) with the non-CDM alternative. If the proposed CDM project is NOT the most economically attractive option then additionality is demonstrated.

[6] A technological barrier to investment would be present if a less technologically advanced alternative (with higher greenhouse gas emissions) to the CDM project activity existed and would be implemented in the absences of CDM incentives.

[7] Decision 17/CP.7 (FCCC/CP/2001/13/Add.2)

consider the long-term CO_2 storage aspect of CCS. However, defining the project boundary is unlikely to change the resulting emission reduction amount as emissions from both inside and outside the boundary of the project must be monitored[8]. Those EHR projects that rely on CDM related revenues to make them economically viable may present additional leakage issues if the additional hydrocarbon production is consumed outside the project boundary.

4. Monitoring and verification methodology

All CCS monitoring and verification methodologies need to adopt whole of process approach to CCS projects (capture, transport and operation and longer term storage), and require the identification of the following:

- key data variables (such as emissions from fuel consumption, electricity consumption, pipelines, wellheads, reservoirs etc);
- the appropriate enabling monitoring equipment and identification of how data is generated (directly or by proxy);
- monitoring and verification frequency (continuous or discrete) and how the data is disseminated;
- how the data should be interpreted; and
- data retrieval and archival systems.

For CCS projects, monitoring regimes, therefore, need to cover:

- Injected CO_2 (capable of defining the total amount of CO_2 and concentration of CO_2 in gas stream);
- Fuel/electricity consumption (emissions estimation);
- CCS project equipment (emissions estimation);
- All pipelines and injection wellheads (for pressure and emission leakage); and
- Reservoirs (emission behaviour and leakage and establish flow and shut-in pressures and temperatures).

At the end of the operational phase of any CCS project, it seems likely that future emissions associated with the project will need to be predicted using best available knowledge and methods (consistent with adherence to possible licensing arrangements) in order to facilitate potential licensing obligations.

Mitsubishi propose that very long term emissions should be discounted over time (future emissions deemed less important than near future emissions). While discounting future costs and benefits is a commonly used financial tool, the cost effectiveness of emission reduction actions would be highly dependent on how discounting is applied, over what period and at what rate is used – to both the financial costs and expected CO_2 reduction benefits of these actions.

Furthermore, benefits of current and future actions are uncertain as they will be dependent on largely unknown and volatile future opportunity costs of actions (ie. what future carbon prices may be). This is especially relevant given the large upfront costs of CCS projects and relatively low emissions reductions coupled over time with lowering costs and increasing emissions reductions.

Mitsubishi highlight the challenge of defining an environmentally appropriate timeframe for CO_2 storage (or permanency) stating that the "lifetime of CO_2 in the atmosphere is about 200 years in the global carbon cycle ... it is scientifically reasonable to recognise that the timeframe of over 1000 years is a sufficiently long storage period".

Ensuring long term monitoring will require the identification of responsible parties in addition to site abandonment procedures prior to the commencement of the project. Given the potential costs associated with leakage from reservoirs, there is no incentive for project proponents to voluntarily identify and report any such events.

[8] If the act of storage is considered as part of the project boundary then any seepage resulting from imperfect storage will need to be included. However, if long term storage is considered outside the project boundary, then seepage must be considered as CDM "leakage".

Migration of CO_2 within the reservoir into different jurisdictions also presents a challenge for monitoring responsibility and liability for CCS projects. CCS projects beneath international waters raise similar issues (in addition the issue of legality under international treaties).

Due to the heterogeneous nature of storage sites, an objective site by site assessment of monitoring requirements would avoid overly prescriptive approaches. Such assessments could extend to considering:

- Pre-injection monitoring of the site to determine baseline CO_2 concentrations at the site;
- Pre-injection modelling of CO_2 behaviour to determine the likely migration of the sequestered CO_2;
- Monitoring the geological reservoir during injection, and post-injection (eg seismic);
- Monitoring of injection well integrity;
- Sub-surface and near-surface soil monitoring to determine the sequestered CO2 is migrating as expected (eg. geochemical monitoring);
- Validating the models through comparing model results with the monitored (actual) migration of the CO_2, including the improvement of models through using monitoring data as model inputs; and
- Atmospheric monitoring through air sampling and/or satellite monitoring to determine if the sequestered CO_2 leaks into the atmosphere.

In addition to monitoring the behaviour of stored CO_2, it is important that a robust verification regime is in place to ensure that the CO_2 remains isolated from the atmosphere. This is a key issue for CO_2 accounting and for providing assurance to the investment community that any CERs created are legitimate reductions.

Conclusions

At present there are no global mandatory standards or guiding principles for CO_2 capture; transport; storage site selection; injection; project operation; decommissioning; stewardship; or remediation. Establishing standards to govern these components is made even more complex due to the significance of the site specificity of CCS projects.

It is important to realise that the overall value of these market mechanisms to CCS activities is to determine a threshold price for CCS activities. The Australian Government acknowledges that industry remain at the core of financing, developing and operating of CCS projects. As such, it is critical for agreed methodologies to avoid unnecessary cost imposts on CCS projects, possibly stifling what could otherwise be commercially attractive mitigation efforts.

Methodologies therefore need to minimise compliance costs and uncertainty while maximising efficiency and ensuring environmental integrity (ie. accurately determine the amount of emission reductions to be fiscally rewarded). They also need to be flexible enough to provide for advances in technological and regulatory developments over different CCS scenarios.

EU AT

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Austria 2006 ★ Presidency of the European Union
Autriche 2006 ★ Présidence de L'Union européenne

SUBMISSION BY AUSTRIA ON BEHALF OF THE EUROPEAN COMMUNITY AND ITS MEMBER STATES

This submission is supported by Bulgaria, Romania, Croatia, Albania and Serbia and Montenegro

Vienna, 6 March 2006

Subject: **Submission on the consideration of carbon dioxide capture and storage as clean development mechanism project activities, taking into account issues relating to project boundary, leakage and permanence and on issues to be considered at the workshop to be held in conjunction with SBSTA 24 (May 2006)**

Austria, on behalf of the European Community and its Member States, welcomes this opportunity to submit its initial views on the further consideration of CCS within the CDM.

The EU looks forward to considering the issues of CCS within the CDM in more depth with other Parties, relevant stakeholders and practitioners at the SBSTA workshop in May. The EU also looks forward to the prior publication of the IPCC 2006 guidelines and to the outcome of the workshop considering the IPCC Special Report on Carbon Dioxide Capture and Storage. The EU believes that the workshop on the Special Report should precede and inform considerations at the workshop on CCS under the CDM.

Background

Following referral by the Executive Board (EB) of the Clean Development Mechanism (CDM), the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP) adopted a decision[1] requesting the secretariat to organise, in conjunction with the 24th session of the Subsidiary Body for Scientific and Technological Advice (SBSTA24, May 2006), a workshop on considering CCS as CDM project activities, taking into account issues relating to project boundary, leakage and permanence. It also invited Parties to provide submissions by 13 February 2006 on this and on issues for consideration at the workshop.

The EB was requested to consider proposals for new methodologies for CCS under the CDM, with a view to making recommendations to COP/MOP2 on methodological issues. COP/MOP2 will consider Parties' submissions, the report of the workshop and recommendations by the EB with a view to adopting a decision on guidance to the EB on how to consider CCS as CDM project activities, taking into account issues of project boundary, leakage and permanence.

[1] FCCC/KP/CMP/2005/L.7 (see paragraphs 5-8)

In this submission, the EU sets out its initial views in advance of discussions with other Parties at the planned workshop, and proposes some issues for discussion at that workshop.

Initial EU views

In general, the EU considers CCS involving geological storage as an acceptable mitigation option in the portfolio of actions for stabilising GHG concentrations in the atmosphere provided that it is in compliance with inter alia national regulations, international obligations including the relevant marine multilateral agreements and IPCC guidance. The IPCC special report on Carbon Dioxide Capture and Storage estimates that CCS could amount to 220-2200 Gt CO_2 mitigation in this century, which would mean that CCS could contribute 15–55% to the cumulative mitigation effort worldwide until 2100.

The EU also considers it important to distinguish between different methods of carbon storage. CCS can involve either geological storage or ocean storage. The EU has serious concerns over ocean storage (storage in the water column or at the sea floor), due to its potentially negative environmental impacts. Furthermore, the EU regards it incompatible with international marine conventions, and does not support it under the CDM or otherwise. The following deliberations therefore refer to geological storage only.

Offshore geological storage (in geological formations under the seabed) raises currently unresolved legal and liability issues, in particular in respect of international marine conventions, such as the London Convention. Current deliberations under those conventions are expected to clarify the legal status of offshore geological storage. It is important for the UNFCCC to be well informed about relevant decisions of marine multilateral agreements (e.g. London Convention, OSPAR).

The EU considers that the prospect of inclusion of CCS projects in the CDM raises a number of outstanding issues, including consistency with general principles of the CDM, environmental integrity, inventories and accounting issues including permanence and leakage, project boundary, as well as legal and regulatory aspects. Therefore, the EU believes that those issues need to be thoroughly addressed. Provided that appropriate procedures can be elaborated to address those outstanding issues, the EU believes that project activities involving carbon capture and geological storage could be considered under the CDM.

General principles

The EU believes that the following principles should guide the further consideration of inclusion of CCS projects under the CDM:

i) Any CCS project activity should contribute to the objectives of the CDM, including assisting non-Annex I Parties in achieving sustainable development, while recalling that it is in the host Party's prerogative to decide upon this objective;

ii) Any CCS project should be in accordance with the commitments under all relevant international law;

iii) Any CCS project should conform with appropriate site selection criteria, to minimise risk of leakage from storage sites – this should be conducted by an appropriately-qualified independent entity;

iv) Procedures and modalities for accounting of CO_2-storages should be established reflecting issues related to project boundaries, leakage and permanence.

Other Topics

The following items need to be addressed:

1. The Project Design Document (PDD) for such project activities should contain appropriate assessment of environmental impacts, including assessment of the risk of emission releases from the project and of impacts on the surrounding environment;

2. All significant sources of emission that are attributable to a CCS project activity should be taken into account in calculating emission reductions in baseline and monitoring methodologies;

3. Additionality should be demonstrated, in particular for Enhanced Oil Recovery and Enhanced Coal Bed Methane Recovery project activities;

4. Monitoring should be site-specific and cover pre-injection (including capture and transport), injection and site-operation, as well as post-injection, including monitoring after the end of the last crediting period, keeping in mind that monitoring regimes for geological storage sites need to be further developed;

5. Emissions from any CCS project activity, including emissions from the storage site, should be included in the greenhouse gas inventory of the host Party;

6. Issues, such as permanence and responsibility for remediation in the event of emission releases, both during the crediting period and subsequently, should be addressed;

7. Appropriate arrangements should be put in place in the case where geological formations used for storage cross national boundaries, including for monitoring.

Issues for discussion at workshop

The EU believes that the objective of the workshop should be to explore the outstanding issues, modalities and procedures for CCS projects under the CDM by reflecting the special characteristics of CCS projects and thus have a focus on the following issues:

a) Eligibility of CCS projects
b) Site selection criteria;
c) Assessment of project boundaries;
d) Monitoring, validation and verification;
e) Accounting for leakage and permanence;
f) Other issues;
g) Process.

Under these issues the EU believes the workshop should address the following questions:

a) Eligibility of CCS projects under CDM

The following questions need further consideration:

- Which modalities and procedures for CCS projects are to be applied or need to be developed reflecting the special characteristics of CCS project activities?
- How could CCS projects contribute to the general objectives of the CDM?

b) Site selection criteria

- Which methods of storage should be allowed under the CDM?
- What might be addressed in guidelines on site selection?
- What should be taken into account in the development of guidelines?
- Who might prepare these guidelines?

c) Assessment of project boundaries

- What should be included in the project boundary?
- What factors need to be taken into account in addressing project boundary issues?

- How should the energy penalty from carbon capture and storage be factored in?

d) Validation, monitoring and verification

- How could additionality of CCS activities in particular for Enhanced Oil Recovery and Enhanced Coal Bed Methane Recovery project activities, effectively be demonstrated?
- What are the particular validation, monitoring and verification requirements of CCS project activities?
- How long the monitoring period should be extended beyond the lifetime of the emission reduction activity?
- What monitoring arrangements are there already which might be used?

e) Accounting for leakage and permanence

- What are possible accounting arrangements to deal with permanence and leakage issues and what are their advantages and disadvantages?
- How should issues of permanence and possibly resulting liability be addressed, especially beyond crediting periods?

f) Other issues

- How should transboundary issues be addressed?
- How should storage in international territory be considered? [2]
- What are additional legal issues, if any?

g) Process

- What should be the next steps?

Many of the above issues are closely interlinked and cannot be considered in isolation. For instance, consideration of monitoring and verification requirements relates closely to site selection criteria.

[2] As far as geological storage of CO_2 in sub seabed reservoirs is concerned, the questionnaire that has been elaborated in the framework of the London Convention should be taken into account

PAPER NO. 3: BANGLADESH

Carbon dioxide capture and storage as
Clean Development Mechanism project activities
Revised updated Submission from Bangladesh

(Decision FCCC/KP/CMP/2005/L.7)

Bangladesh, welcomes this opportunity to provide input into the process, and wishes to submit the following views.

Activities under CDM should give full consideration to the special needs of the Least Developed Countries, in particular to the identification of their special technology needs and capacity building.

Bangladesh recognizes the potential for reducing atmospheric greenhouse gas emissions through Carbon Capture and Storage. However, there is lack of available knowledge and understanding are some concerns regarding the process and method of CCS if it is to be considered CDM-able. These need to be addressed before these technologies can be accepted for CDM project activities. At this point, geological storage of CO_2 seems to be safer and therefore more feasible than ocean storage.

We suggest that SBSTA develop a process for further research into the safety of CCS technologies.. Bangladesh is prepared to contribute to such a process . Bangladesh has experience in gas exploration and potential carbon storage reservoirs are available in the country.

Bangladesh further urges the SBSTA to involve developing countries such as Bangladesh and others having potential sectors for Carbon Capture and Storage in its future research activities to develop proven methodologies on CCS.

SBSTA should also identify the necessary steps for developing appropriate accounting and reporting methodologies for CCS technologies that address issues related to project boundaries, leakage and permanence.

The SBSTA workshop on Carbon Capture and Storage to be held in conjunction with the twenty-fourth session of the Subsidiary Body for Scientific and Technological Advice (May 2006) could be used to develop these processes. At the same time we suggest that the workshop could be used for presentations on existing CCS technologies and methodologies for the long-term monitoring of carbon capture and storage sites

PAPER NO. 4: BRAZIL

Consideration of Carbon Dioxide Capture and Storage as Clean Development Mechanism Project Activities

Submission by the Government of Brazil

The Conference of the Parties serving as meeting of the Parties to the Kyoto Protocol at its first session, invited Parties to provide submissions on the consideration of carbon dioxide capture and storage as clean development mechanism (CDM) project activities, taking into account issues relating to project boundary, leakage and permanence, and on issues to be considered at the workshop to be held on May 2006.

Brazil understands that carbon dioxide capture and storage may an option, in the portfolio of mitigation options for stabilization of atmospheric greenhouse gas concentrations, among others, as noted in the IPCC Special Report on Carbon Dioxide Capture and Storage (CCS). Brazil also is aware that the widespread application of CCS will depend on the technical maturity, costs, diffusion and transfer of the technology to developing countries and assessment of environmental issues. In particular, Brazil supports the acceleration of research, development, deployment and diffusion of carbon dioxide capture and storage technologies.

While acknowledging that carbon dioxide capture and storage may an option for mitigation, particularly for Annex I Parties in their effort to reduce their emissions, Brazil remarks that the correct assessment of the issues of leakage, permanence and monitoring are essential for the accounting of the net emissions over time in their inventories of anthropogenic emissions and removals of GHG.

Moreover, regarding the consideration of CCS as CDM project activities, the issues of leakage and permanence have many additional implications that should be examined, together with the necessary consideration of the issues of project boundaries and liability. The importance of considering the environmental issues is also amplified, taking in consideration the objective of sustainable development of the CDM. Brazil is concerned with the acceptance of CCS as CDM project activities without careful consideration of these issues and development of convenient modalities, if appropriate. As so, Brazil welcomes the workshop to be held in May 2006 as an opportunity to open discussion of this matter and the issues highlighted here.

Furthermore, when analyzing these issues, a clear differentiation should be made between the different options of storage covered by the IPCC report(geological storage, ocean storage, mineral carbonation and industrial uses of $CO2$), taking in consideration the different stages of scientific and technical knowledge, environmental impacts and expected leakage levels.

Special consideration should be given at the workshop to the assessment of the implication of non-permanence and liability consequences, taking in consideration that a removal of $CO2$ in a Party not included in Annex I, would be used by an Annex I Party to meet its commitments.

Brazil looks forward to discuss these issues in the workshop with a view to fully assess the implications of considering CCS as CDM project activities to the environmental integrity of the CDM and the Kyoto Protocol.

PAPER NO. 5: CANADA

Submission by Canada

Consideration of Carbon Dioxide Capture and Storage as Clean Development Mechanism Project Activities

Decision –/CMP.1 (*Further Guidance relating to the Clean Development Mechanism*) contained in document FCCC/KP/CMP/2005/L.7 invites Parties to provide submissions on the consideration of carbon dioxide capture and storage (CCS) as clean development mechanism (CDM) project activities, taking into account issues relating to project boundary, leakage and permanence, and on issues to be considered at a workshop on CCS in the context of CDM to be held in conjunction with the twenty-fourth session of the Subsidiary Body on Scientific and Technological Advice (SBSTA-24). Canada recalls that decision -/CMP.1 also requests the CDM Executive Board to consider proposals for new methodologies for CCS as CDM project activities with a view to making recommendations to COP/MOP2 on methodological issues. In Canada's view it can be demonstrated that concerns regarding CCS technology can be addressed through the CDM methodology process and that application of CCS technology within the CDM is, indeed, similar to that of other technologies being deployed under the CDM.

CCS is a technology that captures and stores carbon dioxide (CO_2) in geological formations for thousands of years. This technology can serve as a critical bridge towards a low-carbon world, given the forecasted global growth in fossil fuel use. Applying CCS technology in both developed and developing economies with rapidly growing GHG emissions could have significant positive impacts on reducing global GHG emissions thus confronting the challenge of climate change. Deploying CCS technology through the CDM is critical to maximizing GHG mitigation opportunities worldwide, and is also an important element in furthering the transfer of CCS technology and expertise to developing countries.

Canada notes that all Parties to the United Nations Framework Convention on Climate Change (UNFCCC) welcomed the findings of the Intergovernmental Panel on Climate Change (IPCC) in its Special Report on Carbon Dioxide Capture and Storage (SRCCS) at SBSTA23 in December, 2005. This exhaustive scientific review contributes greatly to our understanding of this technology, and also helps address considerations on deploying this technology through the CDM. The IPCC's *Carbon Dioxide Capture and Storage Summary for Policy Makers (SPM)* notes that fossil fuels will be the primary source of energy for both developed and developing countries into the mid 21^{st} century resulting in a significant increase in global GHG emissions. The International Energy Agency also estimates that world primary energy demand is set to rise by 59% from now to 2030 and 85% of this increase will be derived from fossil fuels.

The IPCC estimates that CCS could yield 15% to 55% of the cumulative mitigation efforts required worldwide up to the year 2100 (roughly 220 to 2200 GtCO2). The IPCC's SRCCS notes that CCS as "… an option in the portfolio of mitigation actions for stabilization of atmospheric greenhouse gas concentrations…CCS has the potential to reduce overall mitigation costs and increase flexibility in achieving greenhouse gas emission reductions …"

The IPCC SRCCS (Table SPM.2) concludes that CCS system components are at varying levels of maturity and development. With minor exceptions, capture, geological storage and CO_2 pipeline transport are listed as mature and economically feasible technologies. The SRCCS notes that other storage techniques, such as ocean storage and mineral carbonation, require more study. While the IPCC SRCCS highlights the relative economic feasibility of the capture and geological storage option, it also cites the need for compatible legal and regulatory frameworks to assist in its widespread deployment.

The need for this institutional structure can be addressed through appropriate CDM methodologies for CCS projects. Studies of naturally occurring CO_2 systems, in addition to experience from on-going projects, provide confidence that CO_2 can be safely contained in appropriately selected geological formations.

The Canadian Experience

Canada has a resource-based, energy producing economy that has provided it with decades of experience in developing and deploying technologies applicable to CCS, as well as monitoring geologically stored CO_2. We have established world-renowned expertise on the injection into, and detection of, various fluids within the geological subsurface as a result of enhanced petroleum extraction and other CO_2 geological storage-related activities. The processes used in these operations are very similar in nature to those used for the storage of CO2 in geological formations.

Given its potential, the Canadian government, in cooperation with its provincial governments, industry, academia, foreign governments and international organizations, has invested heavily in the development and scientific understanding of CCS technology in a way that balances the need for emission reductions and strong environmental practices. Canada has also developed strong scientific understanding on the fate and migration of stored CO_2 in the subsurface (in part through modelling expertise), the critical establishment of site selection criteria, and criteria for short-term and long-term monitoring programs. Canada recognizes that all of these elements are crucial to ensure the long-term integrity of safely storing CO_2 in geological formations.

Canada has developed a comprehensive CO_2 storage and monitoring project, known as the International Energy Agency (IEA) GHG Weyburn/Midale CO_2 Storage and Monitoring Project, that have operated since 2000. The success of this pilot demonstrates substantial opportunities for both Canada and countries around the world. During the last four years, five million tonnes of CO_2 have been safely stored at this secure location. This is roughly equivalent to taking one million cars off the road for a one-year period. It is expected that over the next 25 years, 20 million tonnes of GHG emissions will be removed from the atmosphere and stored at the Weyburn/Midale site.

In addition to the extensive, ongoing work in Canada on CCS, we are along with many countries and international organizations, actively engaged in CCS activities worldwide that contribute to the breadth of knowledge and understanding on this issue.

Methodological Issues

In keeping with the breadth of scientific information on CCS, Canada believes that methodological issues, including permanence, project boundary, and leakage, for CCS CDM projects can be addressed through appropriate methodologies under the CDM.

As a caution, the definitions of "project boundary[1]" and "leakage[2]" have different meanings in the CDM context versus the CCS context. It will be important that all Parties clearly understand how these terms are applied in the CCS context to avoid any misinterpretation and in developing a rigorous yet flexible means to determine net emission reductions in a CCS CDM activity.

[1] For the purpose of this submission, 'project boundary' refers to the definition contained in the CDM Glossary http://cdm.unfccc.int/Reference/Documents/Guidel_Pdd/English/Guidelines_CDMPDD_NMB_NMM.pdf "…all anthropogenic emissions by sources of greenhouse gases (GHG) under the control of the project participants that are significant and reasonably attributable to the CDM project activity.

[2] For the purpose of this submission, 'Leakage' refers to the definition contained in the CDM Glossary http://cdm.unfccc.int/Reference/Documents/Guidel_Pdd/English/Guidelines_CDMPDD_NMB_NMM.pdf "Net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the CDM project boundary, and which is measurable and attributable to the project activity."

Accounting

A comprehensive list of emission sources and a methodology for accounting and estimating emissions for CCS projects is expected in the IPCC Guidelines for National Greenhouse Gas Inventories to be released in April, 2006. These guidelines will provide valuable guidance on developing and applying CCS methodologies in the context of CDM projects.

Permanence and Storage Risk

The issue of permanence – referring to the long-term secure storage of CO_2 – is critical when discussing the application of CCS technology. As previously stated in this submission, there has been considerable work by Canada and other countries over many years that concludes that geological storage of CO_2 is secure. The IPCC's SRCCS notes, in its comprehensive review of the science, that the fraction of stored CO_2 retained in appropriately selected and managed geological reservoirs is very likely (a probability of 90-99%) to exceed 99% over 100 years, and is likely (a probability of 66-90%) to exceed 99% over 1000 years. The IPCC SRCCS notes as well that the scientific effectiveness of geological storage depends on a combination of naturally occurring physical and geochemical trapping mechanisms. These include:

- Structural trapping;
- Hydrodynamic trapping whereby CO_2 eventually dissolves into the water of the geological formation, and;
- Geochemical trapping whereby CO_2 undergoes a sequence of interactions with the rock and formation water.

These natural trapping mechanisms further enhance storage capacity and security over time. Modelling research is continuing to enhance our understanding of these chemical processes.

Operational experience of the Sleipner (Norway), In-Salah (Algeria), Weyburn (Canada) and Frio Brine (Texas, United States) projects has demonstrated the capability to track the geochemical behaviour and migration of CO_2 in the subsurface. This experience increases certainty that CO_2 can be safely stored and monitored in geological formations.

The proper management of CO_2 storage sites is a critical factor in minimizing potential migration of CO_2 to the surface. A variety of approaches are in use to stop fugitive emissions during the pipeline transport, injection or containment phases. From a methodological perspective, these approaches include:

- The establishment of pressure differences to stop the flow of fluids;
- Plume interception and;
- In the unlikely event of a breakthrough of stored CO_2, plugging the locations with low permeability materials.

In terms of transboundary issues such as the off-site migration of carbon dioxide, the IPCC's *SRCC*S notes that legal and regulatory issues for implementing geological storage of CO_2 could draw from existing experience regarding *inter alia* mining, oil and gas operations, pollution control, waste disposal, subsurface property rights, etc. Again, these existing experiences could be built into CCS-CDM project methodologies.

Site Selection to Address Permanence

Bearing in mind the statistical certainty of storage identified in the IPCC SRCCS, it is nonetheless acknowledged that CO_2 could migrate to the surface over time at very low rates. This dictates the importance of due diligence and detailed *ex-ante* risk assessments to minimize potential migration.

A CCS project under the CDM should demonstrate careful site selection, which should include but not be limited to:

- Conducting detailed site characterization that encompasses an assessment of the geological characteristics of the storage reservoir and caprock;
- Understanding the hydrogeology, geochemistry and geomechanics at the site;
- Assessing the volume and permeability of the storage formation;
- Understanding the site's geological trapping mechanisms; and
- Assessing whether abandoned or active oil/gas wells will compromise the integrity of the seal.

Measurement and Monitoring

Addressing the issues of project boundary, permanence, and leakage for CCS CDM projects requires effective application of available measurement and monitoring techniques.

Monitoring protocols for CCS sites recognize the need for different technologies, depths, measurements and timeframes for monitoring at the various stages of a project. These monitoring protocols were recently used to develop the monitoring programme at PennWest's Pembina project in Canada and will be used in the development of monitoring programmes associated with enhanced coalbed methane and other projects associated with geological natural resources extraction. The protocols identify three critical types of monitoring:

- *Operational monitoring*: focused on movement of fluids between wells for a specific oil or gas reservoir;
- *Verification monitoring*: measurements to track the migration of fluid or a plume in the reservoir or to determine if it is migrating out of the reservoir, and;
- *Environmental monitoring*: aimed at safeguarding against health, safety and environmental risks at the surface and shallow subsurface.

Within the different project stages, there are a wide variety of tools to monitor all phases of CO_2 injection into the subsurface and its behaviour underground. Within the CDM context, methodologies can incorporate either direct or indirect monitoring tools that are available and currently used at commercial CCS sites. The choice of type of monitoring tool depends on the size and other physical characteristics of the project (type of reservoir/storage container, type of injection scheme, etc.) along with the costs of monitoring relative to total project costs. Combining direct and indirect monitoring techniques may be appropriate in many cases. Best practices should be used in the selection of monitoring tools appropriate to the size and characteristics of a specific CCS project activity and site.

A monitoring methodology under the CDM could therefore include the following:

- Direct techniques such as measurements taken in wells located at a storage site.
- Indirect methods such as seismic surveys and remote sensing techniques.

Site-specific monitoring programmes can be designed to track the potential migration of CO_2 at CCS sites, based on the initial risk characterization and subsurface modeling. In the unlikely event of a surface breakthrough, ongoing monitoring should focus on the breakthrough by identifying its location and quantifying the gas release rate that will help the project developer mitigate the emissions seepage.

Project Boundary and Leakage

A conception of project boundary for CCS projects under the CDM should accommodate full life cycle analysis of the CCS project. Project boundary should be broad enough to encompass GHG emissions during CO_2 capture, transport and injection. Moreover, a conception of project boundary for CCS CDM projects should be flexible to accommodate disparate storage types (e.g. Enhanced Oil Recovery, Enhanced Coalbed Methane, Enhanced Gas Recovery), each of which has specific characteristics.

In terms of leakage, it is important that CCS project methodologies under the CDM adequately account for potential significant, attributable sources of emissions outside the project boundary. For example, the loss in efficiency of a power facility, which results from CO_2 capture, will likely require additional make-up power from another source. The emissions from the make-up power source, if beyond the project boundary, should be factored in when calculating net emission reductions from the project activity. A methodology that incorporates a full-life cycle analysis of the CDM project within the project boundary will serve to minimize potential leakage.

In summary, methodologies for CCS CDM projects should include, but not be limited to the following:

- Inclusion of a comprehensive list of the project's emissions sources and an accounting methodology.
- Application of updated and appropriate modeling and monitoring techniques to track and assess movement of CO_2 stored underground.
- Appropriate site selection.
- Proper management of storage sites.
- Application of a concept of project boundary that accommodates full life cycle analysis.

<u>Views on the SB24 CDM-CCS Workshop</u>

Canada suggests the workshop:

- Be scheduled immediately after the related workshop on the SRCCS at SB24 as this would facilitate a more informed discussion amongst Parties and interested experts;

- Accommodate attendance by members of the CDM Executive Board and its Methodology Panel;

- Draw on the highlights of discussion during the IPCC-CCS workshop in introducing the key issues of site selection, monitoring, project boundary, leakage, and permanence as they relate to deploying CCS under the CDM;

- Include Party experiences through presentations;

- Include a series of presentations by experts related to how CCS projects could be considered under the CDM, followed by a panel discussion and questions from the floor. This would help maximize information exchange and promote dialogue to address issues in further detail or help raise issues not discussed in the presentations;

- Ensure that presenters and panel members in the workshop encompass experts from industry, academia, and governments; and

- Conclude with perspectives on the workshop from the workshop's Chair.

Canada requests an opportunity within the workshop to share our perspectives and extensive experiences on these issues by participating in a panel discussion and providing a presentation on our views on how a CDM methodology for CCS projects could address the key issues of project boundary, leakage, and permanence.

<u>Conclusion</u>

There is strong support globally for the use of CO_2 capture and storage technology as one option within a portfolio of mitigation activities to help stabilize atmospheric greenhouse gas concentrations. Given the continued use of fossil fuels and the significant economic growth of emerging economies in coming decades, the role of CCS as a bridging technology will be critically important to assist in managing global GHG emissions growth. Deploying this technology through the CDM will be crucial to the global mitigation effort. In particular, deploying the technology and expertise for CCS to developing countries will be key.

CCS technology has evolved significantly over the past number of decades. Research, development and innovation are continuing to close the remaining knowledge gaps. As the IPCC SRCCS concludes, there are significant benefits currently waiting to be exploited for mitigating global GHG emissions through deploying CCS technology (estimated at 15-55% of global GHG reduction efforts up to the year 2100). Harnessing the global benefits of this technology through the CDM is a crucial element of reducing emissions worldwide.

PAPER NO. 7: JAPAN

Submission by the Government of Japan (GOJ)

On the consideration of carbon dioxide capture and storage (CCS) as clean development mechanism project activities, taking into account issues relating to project boundary, leakage and permanence, and on issues to be considered at the workshop

The GOJ is pleased to have this opportunity to submit its views on the issues of CCS as CDM projects. The GOJ is looking forward to exchanging views and information with other Parties as well as various stake holders for further deliberation on the three issues as identified at COP/MOP 1 with a view to finding feasible and effective solutions for the issues.

I. Mandate of the CDM Executive Board Dictated by the Decision of COP/MOP 1

The GOJ is of the opinion that the three issues identified as the main issues to be addressed, i.e., project boundary, leakage and permanence, are all related to methodologies of CDM. Thus, they should and can be addressed by devising CDM methodologies in such a way that they establish appropriate applicability conditions and stipulate adequate requirements for monitoring methodologies. From this point of view, it is essential, in accordance with the mandate of the CDM Executive Board agreed on at the COP/MOP 1, to consider the proposed new methodologies which have been submitted to the CDM Executive Board. In fact, paragraph 7 of the COP/MOP 1 decision ("consider proposals for new methodologies for carbon dioxide capture and storage as clean development mechanism project activities with a view to making recommendations to the COP/MOP 2 on methodological issues, in particular with regard to project boundary, leakage and permanence") clearly so requires. The CDM Executive Board and the Methodology Panel, therefore, should immediately commence consideration of the submitted new methodologies for carbon capture and storage (CCS) projects, which have been put on hold by the CDM Executive Board. Similarly, new methodologies that will be submitted in the future should be analyzed and considered without delay once submitted to the CDM Executive Board.

As for possible contents of the recommendations by the CDM Executive Board to COP/MOP 2, they should include methodological issues identified as per the CDM Modalities and Procedures for emissions reduction projects (CDM M&P) as well as concrete means to resolve them.

Apart from the process of consideration of new methodologies by the CDM Executive Board, it is also necessary to assess and demonstrate whether the submitted new methodologies will be operational and practical, and will effectively address the three issues as identified at COP/MOP 1. For this purpose, other initiatives by Parties and international organizations to this end should be encouraged, and the outcomes of such initiatives should, as appropriate, be inputted and reflected into the consideration by the CDM Executive Board and the workshop to be held in conjunction with SBSTA 24.

II. Introduction of Representative CCS Projects

The two representative types of CCS projects are briefly introduced below in order to facilitate understanding and discussion of the issues related to CCS projects. The descriptions below were derived from the PDD and NMB/NMM submitted to the CDM Executive Board and made available to the public by the project proponents on a voluntary basis.

1) Recovery of CO_2 and its storage in an oil reservoir[1]

Emission gas from power plants is directed into a CO2 recovery plant. CO2 gas is stripped from the emission gas using a chemical absorption technique. A solution containing KS-1 absorbs Co2 gas which is released after being heated in a regenerator.

Moisture is removed from the CO2 gas and it is pressurized for transport to the injection well via pipeline. CO2 gas is introduced into the injection well under high pressure and sent directly to the oil zone of the reservoir. The CO2 is dissolved into the oil and decreases the viscosity to facilitate enhanced oil recovery. After recovery via the production well, the oil is directed into a separator which separates liquids (crude oil) and gases (mainly CO2 and CH4). The separated gas is then sent to the CO2 recycle

[1] The descriptions are based on the project, "The White Tiger Oil Field Carbon Capture and Storage (CCS) project in Vietnam".

plant which extracts the CO2 from the other gases. The extracted CO2 is dehydrated and once again pressurized for re-injection into the oil reservoir. Natural gas and NGL, which are both byproducts extracted in the CO2 recycle plants, along with the crude oil that has passed through the separator, are collected in separate tanks (see Figure 1).

2) Recovery of CO2 and its storage in an aquifer[2]

The natural gas produced from underground gas fields contains some acid gas components, such as CO_2, H_2S, and water. In natural gas processing plants and liquefied natural gas (LNG) plants, the acid gas components are removed from the natural gas using amine solvents to meet the acid gas content limitations for products (e.g., sales gas, natural gas liquid (NGL) and LNG) and to avoid possible plugging of equipment by CO_2 freezing in the liquefaction process. At most plants, the acid gas containing CO_2 is released to the atmosphere either directly or after processing in the acid gas incinerators.

The project activity comprises compression of the non-processed acid gas containing CO_2 into supercritical form, its transportation through pipelines, and the injection of the supercritical CO_2 through injection wells into secure aquifers or abandoned oil and gas reservoirs where it is stored.

A project has been developed to recover CO_2 from the LNG complex located at Bintulu, Malaysia and inject it into an aquifer (see Figure 2).

III. Proposed Key Ideas for CCS Methodologies

The followings are proposed key ideas to be included in methodologies for CCS projects to address the identified three issues. These should be reflected in possible guidance by COP/MOP 2 to the CDM Executive Board.

In addition, it goes without saying that CCS projects should strictly adhere to relevant international treaties or domestic laws/regulations where CCS projects are carried out.

It is also suggested that CCS methodologies make use of the 2006 IPCC Inventory Guideline, as appropriate, since it will provide methods to identify the emissions sources and options to measure/estimate the amount of emissions therefrom, if any, in the whole process of CCS projects. In particular, it will provide guidelines to ascertain whether emission from the storage ("leakage") is expected and to approximate the amount of the leakage, including use of models. Although the IPCC guideline is for the purpose of preparation of national inventories and are not intended for CDM projects directly, the guidelines will nevertheless have useful implications for CDM, especially in the context of monitoring methodologies for storage. It should be noted, indeed, that there are many cases where IPCC methods to estimate emissions or its default values are applied or referred to in approved CDM methodologies.

1) Project boundary

In order to avoid complicated legal and technical problems, it is proposed, for the time being, to exclude the case (in the applicability conditions of methodologies) where project boundary involves more than one host country in the process of CCS projects, covering capture, transport, injection and storage. Otherwise, there would not be any problems associated with project boundary.

In the future, however, the applicability conditions should extend to the cases that involve cross-border project boundaries. In this regard, it should be noted that the issue related to project boundary is not specific to CCS projects, but rather a general issue for CDM as seen, for instance, in the case of renewable power generation projects undertaken in one country and replacing grid electricity in other countries. Thus, it is suggested to request the CDM Executive Board to consider and come up with a measure to address such cases as a general matter.

2) Leakage and permanence

It is proposed to include the following elements in CCS methodologies:

[2] The descriptions are based on the project, "The capture of CO2 from Liquefied Natural Gas (LNG) complex and its geological storage in the aquifer located in Malaysia".

- Cover the whole project cycle of CCS projects, including capture, transport, injection and storage, in the project boundary (in other words, put the whole project cycle under the control and responsibility of project proponents);
- (Especially in the case of aquifer storage projects,) identify and estimate expected path, timing and amounts of leakage through adopting appropriate model related to leakage, such as forward model and reservoir simulations;
- Apply appropriate monitoring technologies, such as 3D seismic surveys[3], to grasp the storage situation, to verify the amount of injected CO2 being stored, and to detect leakage, as happen;
- Select geological reservoirs in a site where sudden and large release of injected CO2 through earthquake and other crustal disturbance is reasonably unforeseen;
- Plan a measure to prevent and address future leakage after injections of CCS in the long term.

In addition, it is proposed to consider the possibility to apply the following rules for calculating emission reductions and issuing CERs:

- Based on a quite conservative assumption that 0.1% of injected CO2 is released to the atmosphere annually[4], 0.1% times storage years for the crediting period of verified emission reductions are set aside (CERs are not issued) during the crediting period (each crediting period if the project selects a renewable crediting period)[5][6].
- In the case where no leakage is detected or estimated during the crediting period through monitoring, the CERs corresponding to the total emission reductions set aside are issued at the end of the crediting period.
- On the contrary, in the case that leakage is detected and estimated, the estimated amount of leakage through monitoring is deducted from the previously calculated emissions reductions set aside, and if the estimated amount exceeds the emissions reductions set aside, then the exceeding amount is further deducted from future emissions reductions[7].

Furthermore, it is important to consider, as elements for CCS methodologies, possible means to take into account future leakages after crediting periods, including further discounts of CERs issued for CCS projects.

IV. Organization of the Workshop

The GOJ suggests the Secretariat invite members of the CDM Executive Board and the Methodology Panel, other methodology experts, key persons involved in preparing IPCC inventory guidelines, DOEs, and project proponents of CCS projects including experts familiar with technologies of capture and sequestrations, transport and injection and storage to the workshop to be held in conjunction with SBSTA 24 (”a workshop on considering carbon dioxide capture and storage as clean development mechanism project activities, taking into account issues relating to project boundary, leakage and permanence”).

Concerning the programs of the workshop, the following items are proposed:

- Presentation of real on-going or planned CCS projects;

[3] 2006 IPCC Inventory Guideline is expected to introduce various monitoring technologies applicable to detection and estimation of leakage.

[4] IPCC Special Report on CCS estimates, in the case of well selected and managed geological reservoirs, the possible leakage of injected CO2 is less than 1% over 1000 years with a possibility of more than 66%, and the same proportion over 100 years with a possibility of more than 90%. (see SPM, para.25) This indicates only 0.001% to 0.01% of injected CO2, if any, will be released to the atmosphere per annum.

[5] Under this rule, for instance, 0.1% of the amount of issued CERs in the first year of the crediting period is set aside, and the same amount of CERs is similarly aside from the issuance for the second year of the crediting period while 0.1% of the verified emissions reductions in the second year is separately set aside.

[6] For reference as an analogy, a similar approach is taken in the consolidate methodology for CBM□CMM projects (ACM0008), where 10% of default cut off rate of emissions reductions are applied to avoid possible manipulated mining that attempts to capture more methane than necessary under normal business circumstances.

[7] For reference as an analogy, the CDM Executive Board, at its 21st meeting, adopted the guidance that, in the case of temporary minus emissions reductions (project emissions exceeds baseline emissions), the minus amount should be deducted from the future emissions reductions. (see EB21 report, para.18)

- Presentation of proposed new methodologies for CCS projects as applied to real CCS projects, focusing on key ideas to address the three issues (This could include introductions of the activities by other initiatives);
- Presentation on methods for estimating emissions in relation to CCS projects indicated in 2006 IPCC Inventory Guidelines, as applicable to CDM projects
- Expression of views by invited Parties (both investor and host Parties) and relevant experts
- Invitation of views and questions from the floor

The date of the workshop should be arranged so as to encourage the members of the CDM Executive Board and the Methodology Panel to attend the workshop. On this ground, it is proposed to set the date, for instance, for Saturday, 13th May, just following the meeting of the CDM Executive Board.

In this respect, it is noted that another workshop related to IPCC Special Report on CCS will take place during SBSTA 24 as requested by the conclusion of SBSTA 23. Given a close relationship and overlapping issues to be taken up between these two workshops, it is suggested to integrate the two workshops as a joint workshop to enhance synergy effects. It is further proposed that the former part of the workshop be assigned for IPCC Special Report focusing on general matters with an aim of developing common understanding on scientific aspects of CCS, followed by the latter part focusing more on specific issues related to CCS in the context of the CDM.

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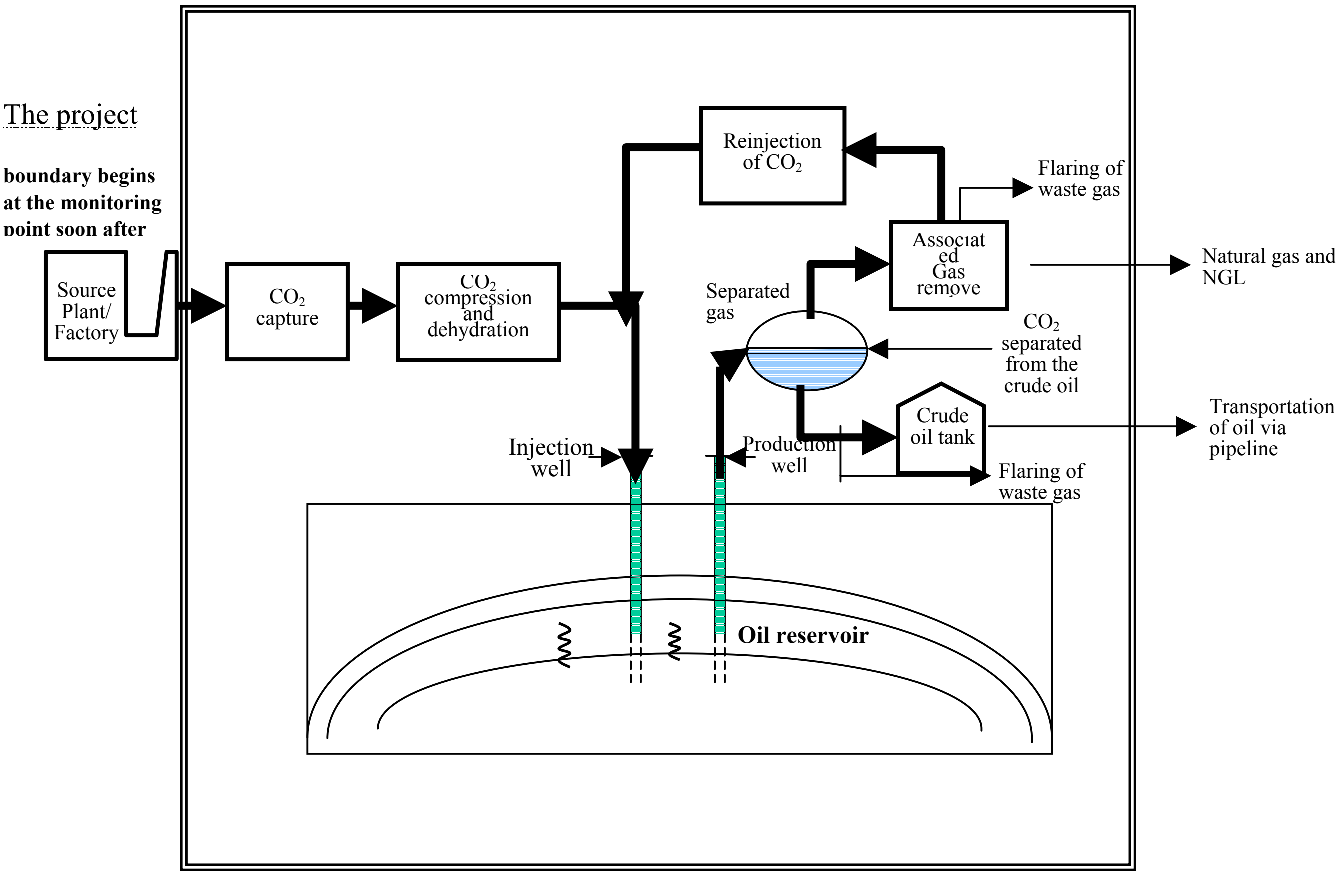
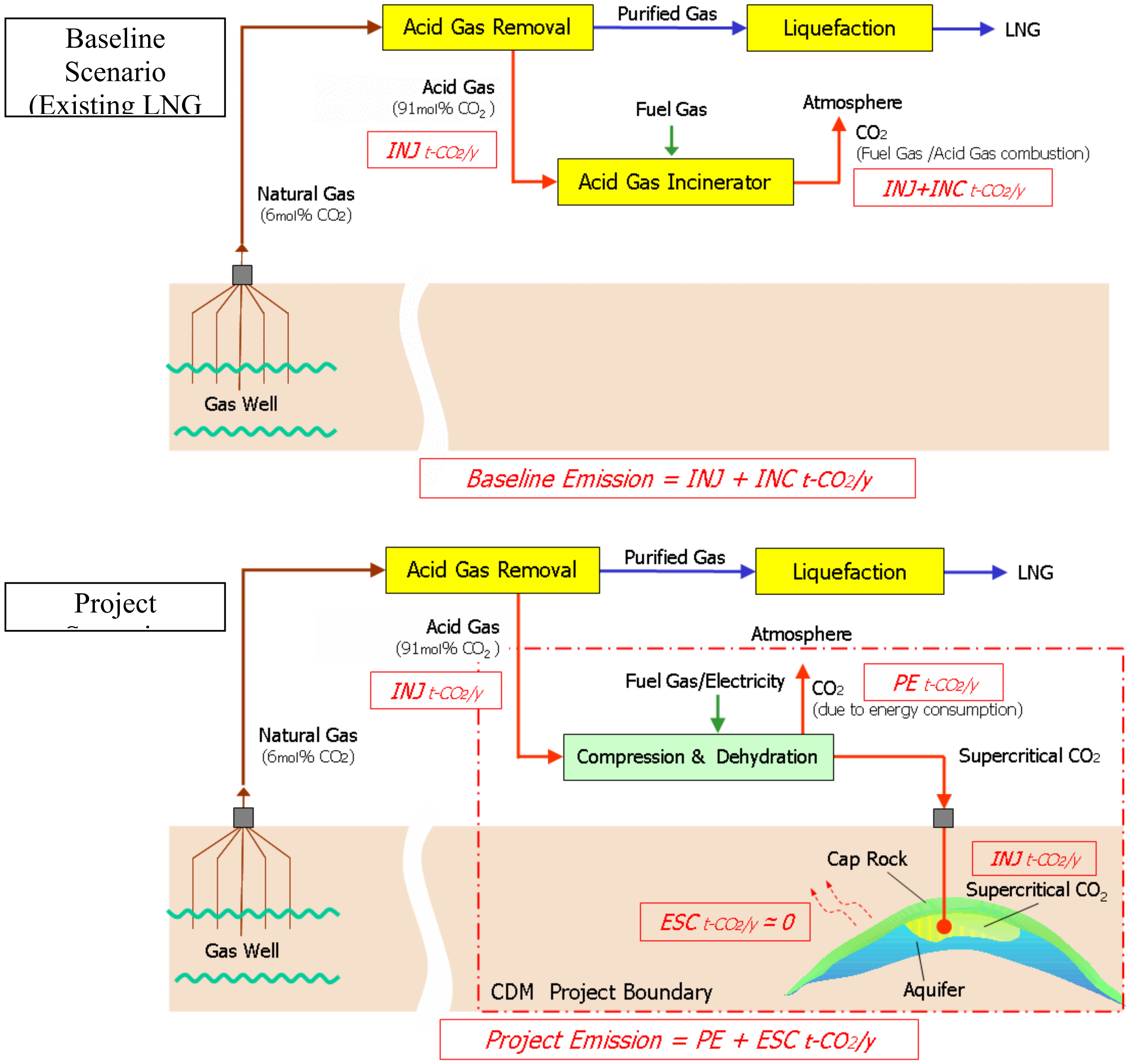
(Figure 1) Oil-reservoir storage projects

Project operation and project boundary



(Figure 2) Aquifer storage projects



PAPER NO. 8: NEW ZEALAND

Carbon Capture and Storage and the Clean Development Mechanism

Submission by New Zealand

In response to a solicitation for comments, New Zealand wishes to remit the following submission in response to the following decision: FCCC/KP/CMP/2005/L.7, paragraph 6.

New Zealand would like to acknowledge its interest in following the discussions related to carbon capture and storage under the CDM. Recognizing the significance of this mitigation approach, we remain committed to adequate discussions as they relate to due diligence and the project approval process. As such we look forward to participating in the workshop scheduled for May 2006.

PAPER NO. 9: NORWAY

Views on Carbon capture and storage in the clean development mechanism

SUBMISSION FROM NORWAY, FEBRUARY 2006

The COP/MOP 1 Decision on further guidance relating to the CDM invites Parties to submit their views on consideration of CO_2 capture and storage (CCS) as clean development mechanism (CDM) project activities by 13 February 2006. Norway welcomes this opportunity to provide initial views and proposals on these issues.

Introduction

In the following are presented some views and proposals related to project boundary, leakage and permanence. In addition we provide some views on the methodology for estimating emission reductions and monitoring. We have limited our comments to storage of CO_2 in geological structures. With the present knowledge of ocean storage, including the potential for negative impacts to the marine environment, we are of the view that such projects should not be considered now.

Norway looks forward to taking part in constructive discussions on how to obtain sound solutions on outstanding issues in the agreed process towards COP/MOP 2 in November 2006. Our aim is that a decision should be adopted at that session, including guidance to the EB on how to consider CO_2 capture and storage as CDM project activities.

General

Based on the findings and conclusions of the IPCC Special Report on CCS we are convinced that CO_2 capture and storage in geological reservoirs is a viable option for project activities under the CDM. We realise, however, that might be a need for some specific procedures and guidance for such projects to ensure that issues such as leakage and liability are properly addressed.

For Norway it is important to ensure that CERs resulting from CCS project activities under the CDM are 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 for CDM projects be 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 leakage from the site will be detected and accounted for.

To ensure confidence in the CERs from the project activities, we are of the view that the coming 2006 IPCC Guidelines for National Greenhouse Gas Inventories should be used as a basis for CCS projects under CDM. The current IPCC Guidelines (1996) do not include methods specific to estimating emissions associated with CCS. The 2006 Guidelines will contain a chapter on CO_2 capture and storage, and are expected to describe agreed methods for estimation of emissions from the capture, transport and injection processes as well as for possible leakage from the reservoirs.

We find that the present modalities and procedures for the CDM cover most issues related to CCS project activities. However, we see that there are some questions that need to be discussed and clarified by the COP/MOP to provide guidance to the Executive Board of the CDM (EB), because of the storage component of such projects. In our opinion these questions primarily relate to selection of storage sites, prevention of leakage, some issues related to the monitoring plan and to liability with regard to the stored CO_2 after the crediting period.

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 CO_2 capture and storage in the IPCC Special Report on CCS is "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". The project boundary of the CDM project activity should hence comprise these three separate processes; capture, transport and injection/storage of CO_2.

It is our 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 (uncaptured CO_2), transport and injection processes. In addition, indirect emissions from energy produced to perform the three processes should be taken into account. If the monitoring of the storage site reveals leakage 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 leakage from the storage site.

Leakage and permanence

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". We suggest that the project boundary encompasses the storage site, and that possible leakage from the storage site should be accounted for. "Leakage" then refers to leakage of CO_2 from the storage site, and not leakage as defined in the COP/MOP-decision. The latter type of leakage is not different for CCS projects compared to other CDM project activities, and thus, will not require new guidance.

The selection of storage sites for CCS projects is of vital importance to prevent leakage. It should be ensured that the storage sites proposed for CCS CDM projects have been thoroughly characterized and analysed, and that the documentation is a part of the Project Design Document (PDD). The analyses should include a characterisation of the reservoir, the cap rock/trapping mechanisms, geological stability as well as possible leakage pathways. The examination of possible reservoirs and quality storage should be based on e.g. knowledge obtained by industry and research communities.

The EB should be encouraged to develop guidelines for the assessment of potential storage sites and criteria for the selection of storage sites. The use of the coming 2006 IPCC Guidelines could be considered in this regard. The aim would be to avoid projects involving a potential risk of leakage. However, we do not consider it necessary for the EB to complete such work before considering CCS projects.

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 this analysis shows that direct or indirect leakage 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 leakage may continue.

According to the IPCC Special Report on CCS, a retention time of CO_2 for several thousand years can be obtained for well-selected, designed and managed geological storage sites. It is also possible in some cases that the CO_2 may gradually be immobilised by various trapping mechanisms, so that it may be stored for up to millions of years.

Monitoring

The modalities and procedures for the CDM requires that the monitoring plan for a CDM 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 CO_2 injected to 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 submitted together with the application for registration of a CDM project activity.

In our view, proper and long-term monitoring of the reservoir is required, so that leakage from the site will be detected and accounted for. It is important that the monitoring program covers the CO_2 storage and addresses possible leakage pathways in an appropriate way. These leakage pathways would have been identified during the analysis of the storage site. Monitoring technology and methodology for safe storage of CO_2 are available. This includes known seismic and gravimetric techniques. The monitoring should go 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.

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 important 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 decision on long-term liability for CCS project activities.

Issues to be considered at the workshop

For practical reasons, we are of the view that the workshop on CCS under the CDM should be arranged back-to-back with the in-session workshop on the IPCC Special Report on CCS.

We think it would be useful if representatives of the IPCC are invited to present the CCS-chapter of the IPCC 2006 Guidelines, and that due time is provided for questions and discussion.

Furthermore, we propose the following list of issues to be considered for the workshop:

- Site selection: Do we need criteria and guidelines?
- Accounting for leakage
- Elements of the Monitoring plan
- Responsibility for monitoring beyond the crediting period
- Liability with regard to leakage beyond the crediting period
- Several projects using one reservoir

PAPER NO. 10: QATAR

SUBMISSION BY THE STATE OF QATAR ON THE ELIGIBILITY OF CARBON DIOXIDE CAPTURE AND STORAGE (CCS) PROJECTS AS CDM PROJECT ACTIVITIES

Draft prepared for consideration by the SCENR as National Focal Point for UNFCC

Preamble

The State of Qatar is fully committed to working together with all Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP) in achieving the laudable objectives of the Convention. In line with the principle of common but differentiated responsibility, entrenched in the Convention, the Government of Qatar, under the wise leadership of the Emir, His Highness Sheikh Hamad Bin Khalifa Al-Thani, continues to make strides in its efforts to mitigate and adapt to the negative impacts of climate change.

Qatar welcomes the recent Decision by the COP/MOP to "request the Executive Board to consider proposals for new methodologies for carbon dioxide capture and storage (CCS) as clean development mechanism (CDM) project activities with a view to making recommendations to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP), at its second session, on methodological issues, in particular with regard to project boundary, leakage and permanence".

In line with the invitation to Parties to make submission on the matter, Qatar hereby submits this paper for consideration.

Qatar's Position on CCS CDM Project Activities

In view of the potential contribution that CCS can make to the cumulative climate change mitigation effort worldwide, Qatar believes that properly designed, implemented and monitored CCS projects should be eligible for registration as CDM project activities. This consideration should extend to the whole spectrum of CCS projects activities.

The key premises for this position are further elaborated below.

Key Premises for Qatar's Position

The above position put forward by the State of Qatar is based on the following key premises :

- Potential contribution of CCS projects to climate change mitigation effort – The recent IPCC Special Report on Carbon Dioxide Capture and Storage states that available evidence suggests that there is a technical potential of at least about 2,000 GICO2 storage capacity in geological formations available worldwide. The Report assess that in most scenarios for stabilization of atmospheric GHG concentrations, CCS could contribute 15-55% to the cumulative mitigation effort worldwide until the year 2100. The technology with such a potential mitigation magnitude should not be excluded from CDM.

- Technology Transfer – There is a range of carbon capture technologies at different stages of development. The most developed has been used in the oil and gas industry for almost a century. The different CCS storage strategies and alternative modes of transporting CO2 also provide potential areas for further research, technological development, and innovation. The potential of CCS CDM project activities to contribute to the transfer of technology from Annex 1 Parties to non-Annex I Parties should be an important consideration.

- Encouraging the current practice of use of CO_2 for enhanced oil recovery (EOR) – EOR is a special case of CCS. CO_2 pumped into a near-depleted field dissolves in the oil, making it more mobile and easier to extract. This can lengthen the life of the field. Although some of the CO_2 returns to the surface with the oil, this is recaptured and added back to the CO_2 being injected CDM could provide incentive for further development and use of EOR technology beyond what is currently considered to be financially feasible.

- Drawing on the wider experience of the Oil and gas sector – CCS is not well-known by those not involved with the energy industry. In considering CO_2 capture and storage in geological structures as a CDM project activity, the key issue is the ability of geological structures to retain CO_2 over hundreds or thousands of years without leaking out. There is greater understanding of storage of CO_2 in oil and gas fields and saline aquifers. Oil and gas have been 'stored' underground for millions of years demonstrating that buoyant fluids can certainly be retained in these structures over long timescales. The climate change community must not miss the opportunity to draw on the experience associated with this natural phenomenon.

- Financial Add tonality - Economic considerations indicate that is unlikely that industry will invest much in the development of CCS under current market conditions. CCS, including for EOR, could become more viable when value is attached, through the CDM, to the captured and stored CO_2.

- Equal treatment for all Kyoto Protocol Mechanisms – It is becoming more likely that investment in CCS could be encouraged under the various Emissions Trading Schemes. To maintain the principle of equal treatment for all the Kyoto mechanism, the eligibility of CCS projects as CDM project activities should be favorably considered by the CDM Executive Board.

Concluding Remarks

Qatar is committed to joining other Parties in providing appropriate guidance to the CDM Executive Board on this important matter, through its active participation at the proposed workshop at the next meeting of the Subsidiary Bodies (SBI & SBSTA) in May 2006. We will follow closely the work of the Executive Board on this matter with a view to providing the Board with appropriate inputs when required.

PAPER NO. 11: SAUDI ARABIA

SUBMISSION BY SAUDI ARABIA

February 13, 2006

Guidance relating to the clean development mechanism

The SBSTA at its 23rd session held in Montreal, invited parties to submit to the secretariat, by 13 February 2006, views on consideration of Carbon Dioxide Capture and Storage (CCS) as Clean Development Mechanism (CDM) project activities. (Document FCCC/KP/CMP/2005/L.7, paragraph 6).

Saudi Arabia welcomes the opportunity to submit its views on consideration of carbon dioxide capture and storage as a CDM project activity. Saudi Arabia also welcomes the request by COP/MOP for the secretariat to organize a workshop on consideration of carbon dioxide capture and storage as CDM project activities in conjunction with SBSTA-24.

Saudi Arabia strongly supports the consideration of CCS projects under CDM, and is pleased with the importance that the Executive Board of the CDM has given to this technology. It is important that the workshop on CCS be held within the dates specified without any delays. The agenda, terms of reference for the workshop should be prepared by the secretariat taking in considerations views from parties in that regard. Industry experts should be invited to present their perspectives and practical experiences with CCS and its application. The workshop inputs should contribute to concrete recommendations on specific actions to advance and effectively deploy this important technology and address barriers.

Saudi Arabia is closely monitoring progress under CCS, and believes that CCS is the most promising and effective win-win (win to reducing emissions and win for reducing impacts on developing countries) means to combat Carbon Dioxide emissions, and welcomes all initiative to promote and deploy this technology.

PAPER NO. 12: SWITZERLAND

SWITZERLAND

SBSTA 24
Workshop on Carbon Capture and Storage as CDM project activity

1. We welcome the opportunity to provide a list of questions to be addresses at the in-session SBSTA 24 workshop on Carbon Capture and Storage (CCS) as a potential as CDM project activities. In our view, the SBSTA should address and solve these issues before recommending to the Kyoto Protocol to allow CCS as CDM project activities.

2. We consider here geological storage in a country and not injection in ocean. In our view, CO2 injection in oceans should not be allowed, for the time being, an eligible CDM project activity because it implies numerous environmental issues not yet well understood (cf. paragraphs 23 and 26 of the SPM of the IPCC Special Report on CCS, 2005).

3. There is a need to develop methodologies to address issues in :

    - Project boundaries
    - Leakage
    - Safety
    - Reporting.

4. At the project level, important issues should be address such as :

    - Procedures to select appropriate site for storage
    - Monitoring procedures for leakage
    - Legal regulatory framework in the host country for dealing, inter alia, with monitoring of the storage site, leakage, liability
    - Remediation methods to stop or control CO2 leakage
    - Reporting and accounting on leakage
    - Liability in case of leakage.

5. Furthermore, the project should also address critical issues such as technology transfer and capacity building in the host country, given the long-term implications of carbon capture and storage.

6. Among the more specific questions that the SBSTA has to address are :

    - How to cope with the needs of possible non-existing local/national regulations on CO2 sequestration (e. g. monitoring of leakage, liability in case of accident) in investor and host countries

    - How to take into account the fact that some of the emissions and removals of CCS systems could occur outside the areas under the jurisdiction of the reporting country

    - Should the project include remediation and rescue capacities to deal with emergency cases of leakage or fugitive emissions

    - Should the assessment of local human and safety risks be part of the project

- What criteria should guide the storage site selection, and how should the project demonstrate that the proposed geological repository is reliable

- How to deal with both types of leakage scenarios, abrupt and gradual :

  Should a legal “fraction retained” be fixed for a given timescale (e. g. 100 years)

  Or should an upper limit to the leakage be fixed

  How should the project proponent compensate for leakage

  Could a maximum quantity per site (absolute – in tons per year – or relative – in percent of the total stored) be fixed for each project

  Are the new IPCC reporting guidelines sufficient for CCS

  Should a monitoring programme – and for how long – be part of the project

  Should the monitoring be done by the project initiator or an independent entity

  Who has the liability in case of accident

  How long should be the liability of the project proponent

  What should be the crediting period for the project.

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