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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

Technological, methodological, legal, policy and financial issues relevant to the consideration of carbon dioxide capture and storage in geological formations as project activities under the clean development mechanism

Submissions from Parties

1. The Subsidiary Body for Scientific and Technological Advice, at its twenty-seventh session, invited Parties, intergovernmental organizations and accredited non-governmental organizations to submit to the secretariat, by 16 June 2008, their views on carbon dioxide capture and storage in geological formations as clean development mechanism project activities, addressing the issues identified in document FCCC/SBSTA/2007/16, paragraph 97.

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

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[*] 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/2008/MISC.10

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CONTENTS

* This submission is supported by Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Serbia, Turkey and Ukraine.

PAPER NO. 1: BRAZIL

Brazilian Submission on Carbon Dioxide Capture and Storage in Geological Formation as Clean Development Mechanism Project Activities

The Government of Brazil, in response to the invitation contained in document FCCC/SBSTA/2007/16, paragraph 97, welcomes the opportunity to submit views on issues relevant to the consideration of CCS in geological formations as CDM project activities, including but not limited to, technological, methodological, legal, policy and financial issues additional to those questions referred to in decision 1/CMP.2, and in particular reflecting the informal discussions that took place during the twenty-seventh session of the SBSTA, highlighting the particular concerns of Parties.

2. Brazil, as stated in previous submission, understands that carbon dioxide capture and storage in geological formation is an option for the portfolio of mitigation options for stabilization of atmospheric greenhouse gas concentrations. Brazil supports the acceleration of research on CCS technologies and supports the development, deployment and diffusion, including transfer of those CCS technologies that are already at least at demonstration phase. Brazil is conscious that the application of CCS in developing countries will depend on the technical maturity, costs, diffusion and transfer of the technology and assessment of environmental issues.

3. While acknowledging that carbon dioxide capture and storage in geological formation is an option for mitigation, particularly for Annex I Parties in their effort to reduce their emissions, Brazil believes that CCS technologies is not appropriate in the framework of CDM project activities and should not be eligible under the CDM.

Technological aspects

4. CCS in geological formation encompasses a great number of technologies and involves many risks. The risk analysis has to take into account the area that could be affected and the time horizon of a possible leak. Although the risk of seepage reduces with time, the area that could be affected grows. Moreover, there is a 99% probability that after 100 years some of the CO2 stored in geological formation goes back to the atmosphere. Seepage is likely to occur when CO2 concentrations in the atmosphere are larger than current CO2 concentrations. This would increase the risk of a run-off of greenhouse effect. There is also the risk of a sudden release of CO2 with massive emissions going back to the atmosphere with health and environment consequences. A large number of abandoned and unmonitored wells represent a risk of fracture on the sealing mechanism of the reservoir. In the presence of water, the CO2 have a corrosive action over the cement closure of the well heads. Besides that, the CO2 injection is basically different from injection of hydrocarbon or water. There is no long term experience on sealing failure of injection of CO2 in depleted oil/natural gas reservoirs. On top of this, a possible run-off of greenhouse effect in the future - because of higher GHG concentration in accordance with future scenarios - would have a larger impact in terms of temperature increase. A high degree of uncertainty, inherent of current CCS technologies, can only be reduced by a careful long term monitoring process which is intensive in both capital and technology.

5. Developed countries, which shall lead the process of combating climate change, should be the first to use CCS in geological formation on large scale in their territories in order to acquire knowledge about the risks related to leakage, monitoring and liability before exporting premature experiences to developing countries. CCS has many similarities to nuclear power industry regarding the long term burden and the possible ways to address them with sophisticated insurance system and

government surveillance. This model needs strong political, economic and institutional structures which many developing countries do not have.

Methodological aspects

6. Such as nuclear power, CCS technologies have implications and characteristics which are incompatible with the nature and characteristics of CDM project activities, as defined in modalities and procedures for a CDM as defined in Article 12 of the Kyoto Protocol. Issues of leakage, project boundary, long-term liability and permanence have many additional implications. Some of these issues have been examined by reliable institutions but no satisfactory solution was reached, especially if taking into account the characteristics of a CDM project activity. Some other important issues regarding the nature of the CDM and possible economic and market impacts were not yet assessed.

7. CCS in geological formations encompasses a great number of different technologies and thus cannot be easily considered as emissions reductions type of activity. While some technologies avoid emissions, others might lead to increasing emissions if the possibility of leakage and seepage is considered. Considering that the injection of CO2 in reservoirs is changing the sealing and the ecosystem of the reservoir, it should be considered as land use, land use change type of activity, a category in which only afforestation and reforestation are allowed in the first commitment period. It is clear that CCS type of activity is not covered by the Marrakech Accords, nor by Decision 19/CP.9. The inclusion of a new type of activity under CDM needs to be done by a COP/MOP decision.

8. The inclusion of CCS under CDM would add an unmanageable complexity to the mechanism. Concepts such as project boundary, monitoring, permanence and additionality, which are the pillars of the mechanism, does not apply to CCS activities. Moreover, the CDM institutional structure would have to be radically modified with changing roles of DOEs, inclusion of insurance companies, etc.

9. Accounting of non-permanence for projects with a time horizon of one thousand years is not feasible. The reversal of any removal shall be accounted for at the appropriate point in time. The mechanism of canceling units after a reversion is verified would not be possible if the reversion occurs in 200 or 500 years. If seepage occurs it will not affect allowances issued in the present for Annex I Parties. Statistical approach to anticipate seepage is highly uncertain because it only takes into account tail emissions and not extreme events like a sudden release, to which is difficult to associate a probability.

10. Project boundary is also another important concept related to quantified emissions reductions in CDM projects. A clear separation is requested for baseline emissions, project emissions and emissions from leakage. CCS projects would not fit into those definitions. A reservoir may cover different countries and after storage the plume migrates not respecting any previous plan or political borders. There is no solution for a clear separation and measurement of these emissions. Seepage may also occur in international waters which would introduce further complexities similar to those of international bunkers, whose emissions are not covered neither in national emissions nor in CDM mechanisms. This would also add legal implications with transnational liability problems, including possible transboundary problems among Annex I and/or Non-Annex I countries.

11. CDM modalities and procedures establish that both project emissions and emissions from leakage should be measured. However CO2 stored in reservoirs is not measurable, but only modeled.

12. CCS in the CDM would have many implications in terms of monitoring. As defined in CDM M&P, and checked by the EB in the process of approving CDM projects, one of the main

elements of the PDD is a detail monitoring plan with clear responsibilities and description of monitoring procedures. It is evident that it is not possible to establish such a monitoring plan for the time horizon of a thousand years. Dynamic monitoring with different monitoring plans changing over time is not a solution. In addition to that, the fact that project boundary can also be dynamic could make monitoring outside the limits of the project necessary. Defining the monitoring area is also complex due to the fact that many different injection points from different projects activities in different time frames can use the same reservoir. Lateral flows may expand the monitoring area and increase the risk of reaching areas with undetected fractures and faults. Finally, all these complexities have to be translated into economic terms for appropriate consideration in project activity and the economic theory has no solution for the anticipation of very long term values. It is clear that CDM M&P do not cover these complexities.

Liability aspects

13. Owner or operator liability is possible in the horizon of 21 or 60 years, which is the longest horizon CDM is dealing with, but not for centuries or millennia. In this expanded time horizon questions of insolvency or bankruptcy of the operator is very likely and even States can appear and disappear.

14. Recognizing that it is impossible for the project proponent to remain responsible for the reservoir for such a long time horizon, existent proposals suggest dealing with long term monitoring and all issues related to long term liability by transferring them to the host country. Transferring responsibility means transferring monitoring procedures, costs and remediation measures in the case of unexpected CO2 escaping back to the atmosphere or to saline waters. Besides all the risks in terms of environmental impacts and public health, it is not possible to estimate those costs and to calculate a present value to internalize those costs in the project activity. These externalities cannot be measured, not even estimated ex-ante and the host country would have to afford them, which is unacceptable for it means that private profit in the short term will be supported by public loss in the long term. In addition, seepage is likely to occur in a future time when the CO2 concentration in the atmosphere will be much larger than current CO2 concentration taking into consideration that even the IPCC long term scenarios cover a period up to 2100 and the seepage could occur in a scenario beyond 2100 with CO2 concentrations likely to be larger than expected CO2 concentration in 2100 increasing the risk of greenhouse run-off.

Economic aspects

15. The risks inherent to new technologies would only be minimized with the possible consideration of commercial application of mature CCS technologies. The only mature market technology for geological storage listed by IPCC in the Special Report on CCS is the enhanced oil recovery – EOR. Brazil believes that CDM was not conceived for giving subsidies for oil and natural gas production through, in particular for countries with on-shore production and very low costs of oil production. Fossil fuel producers do not need this type of subsidy, taking into account that current oil price is higher than 130 US$/bbl. Moreover, these companies have significant know-how and investments in the area of CCS technology. CDM should also not be used to give incentives for extraction of methane from deep coal mine, or in-situ burning of coal.

16. There are no studies to assess possible impacts of CCS in the CDM market. Probably, huge quantities of credits coming to the market would drop CERs prices to a level which could dismantle the carbon market. Decreasing prices of CERs would also undermine incentives for renewable energy, energy efficiency and decarbonization of the economy. Small-scale projects, which already face difficulties, would become even less attractive and competitive.

17. Brazil believes that CDM incentives should be rather used to promote clean and renewable technologies which point clearly to decarbonization of the production and consumption patterns and not to promote the enhancement of oil, gas and coal production. CCS in developing countries could be developed in another framework, using specific financial mechanisms, funding and partnerships under the Framework Convention, but not as an offset mechanism, generating carbon credits to be used by Annex I countries, such as the CDM.

Policy and Ethical aspects

18. One of the main characteristic of CDM project activities is that it generates credits within a short timeframe but it should generate real and measurable long term benefits. CCS activities in the CDM would generate an important amount of credits in the short term, but would lead to no long term benefit. The long term consequence would be to buy additional time for the current fossil based economy. Buying time is not without consequences. CCS in the CDM would generate large projects, particularly concentrated in a few countries. It would prevent further equitable participation of non-Annex I countries under the CDM and certainly would create additional barriers for small-scale projects. Moreover it would postpone important investment that could lead to the introduction of renewable energy technologies in the developing world. In this regard, CCS is clearly a technology that can be used by Annex I countries in its mitigation efforts, for these countries have an enormous infrastructure based on fossil fuels and need to significantly reduce its emissions in the short term. This is typically a "transition technology" to be used in the passage from a fossil fuel based economy to a low carbon economy. Developing countries need to invest the scarce resources available to them to promote the development of a low carbon economy, and the CDM is an important instrument for this transformation. CCS under CDM would create perverse incentives for the increase of fossil energy production in developing countries and would reinforce the existing technological gap between the developed and the developing world.

19. Regarding sustainable development aspects, there is no doubt that it is a prerogative of the non-Annex I Party to assess whether a clean development mechanism project activity assists in achieving sustainable development. Nevertheless, it is clear that, taking into account the aspects that countries are generally using to assess the contribution of CDM projects to sustainable development, CCS activities do not contribute to achieving it. . For Brazil in particular, CCS in the CDM would not contribute to sustainable development. Finally we would like to comment on a frequent argument used in this debate that states that no country is obliged to accept CCS in its own territory because of the concept of voluntary participation. Voluntary participation being one of the requirements for participating in the CDM does not mean that each country decides by its own judgment if a type of activity is eligible as CDM activity. As it was stated previously, CCS in geological formation encompasses a great number of different technologies which are not covered by the CDM regulation and the inclusion of new type of activity requires a COP/MOP decision and is not a matter of voluntary participation.

Conclusion

20. The appeal of large quantities of cheap credits for Annex I parties should not hide the bad consequences of taking CCS under the CDM. First, this would change the very nature of the CDM: it would be necessary to introduce significant modification in the rules already established and in the institutional structure to deal with the CDM. It would destabilize the carbon market, would be a perverse incentive to developing countries, would prevent small-scale projects and would prevent further equitable participation. Finally, it would divert from

the central idea of the CDM which is to promote long term benefits in the direction of low carbon economy towards creating subsidies to enhance fossil fuel production.

21. For all these reasons, Brazil proposal is that CCS shall not be eligible under the CDM.

PAPER NO. 2: NEW ZEALAND

Carbon Dioxide Capture and Storage (CCS) in Geological Formations in the Clean Development Mechanism

Submission by New Zealand

New Zealand wishes to make the following submission in response to SBSTA's invitation at FCCC/SBSTA/2007/16, paragraph 97.

New Zealand provisionally supports the inclusion of CCS in the CDM. This support is subject to a number of outstanding considerations, including but not limited to:

- Ensuring that investment in renewable energy and energy efficiency projects is not crowded out by investment in CCS as a CDM activity;
- Ensuring that the risk of leakage of CO_2 is properly managed by setting strict criteria for site selection and management, risk management, and monitoring and remediation plans;
- Ensuring that, should leakage of CO_2 accidentally occur, liabilities are appropriately attributed (bearing in mind the need to balance ongoing liability with the commercial viability of CCS projects);
- Avoiding perverse incentives to low-efficiency technologies and carbon-intensive projects;
- Ensuring that accounting methodology provides for the extended lifetime of a CCS project relative to the CDM crediting period, and the upstream and downstream emissions associated with CCS projects that might extend beyond the project boundaries;
- Ensuring technical assistance is provided to host countries, when making decisions whether to approve a CCS project or not. This could potentially be done by way of an independent expert panel.

General Points

New Zealand considers that carbon capture and permanent geological storage (CCS) is an important option in the portfolio of mitigation measures available to reduce carbon dioxide (CO_2) emissions to the atmosphere. As it is predicted that fossil fuels are likely to remain the dominant fuel source globally until at least the middle of this century under business as usual scenarios, CCS potentially offers a key technological mitigation option[1]. According to the Intergovernmental Panel for Climate Change (IPCC), the widespread application of CCS will depend, *inter alia,* on technical maturity, uptake capacity, costs and regulatory frameworks.

New Zealand considers CCS technology-transfer highly important in improving these key aspects of CCS, and that, the Clean Development Mechanism (CDM) will facilitate CCS technology-transfer and the further development of CCS.

[1] The International Panel for Climate Change's Special Report on CCS, 2005.

Issues to consider before incorporating CCS in the CDM

As summarised in our opening paragraph, New Zealand is of the view that, in incorporating CCS in the CDM, there are a number of outstanding policy-related issues that require resolution by the SBSTA at CMP in Poznan.

Competition with renewable energy and energy efficiency projects

Because of the significant financial investment required to develop and implement CCS, (and the potential for large volumes of CERs to be generated from CCS projects), there is some concern that CCS could crowd out investment in renewable energy options in the CDM. Therefore, when developing accounting methodologies for CCS projects, consideration should be given to the implications of including CCS in the CDM for other types of projects.

Permanence of CO_2 storage

The possibility of CO_2 leakage from CCS project activities back to the atmosphere would undermine the environmental integrity of CCS. Ensuring that the risks of leakage are properly and appropriately managed is critical.

As the IEA_GHG outlined in 2007, the risk of leakage is dependent on site selection processes, site operations, risk management practices, and monitoring and remediation commitments. New Zealand proposes that stringent requirements must be developed for each of these elements as prerequisites for registration of CCS projects as a CDM project activity. Importantly, liability for CO_2 leakage must be considered and attributed upfront. In the event of leakage, liability is likely to fall into two types:

i) liability for offsetting the actual amount of CO_2 accidentally released; and

ii) liability for any damage caused by a release (for example, damage to the local environment).

The approach to attributing liabilities between the host country, the project proponent and the associated emission unit holder(s) is critical and needs to be worked through in detail. The IEA_GHG programme's report on CCS in the CDM points out that liability should be attributed upfront and that a balance between liability and commercial practicality must be struck. New Zealand agrees that there is a vital need for certainty over liability, so that commercial uptake of CCS is not limited by this issue.

Accounting issues

It is important that the relative benefits of different types of CCS projects can be assessed under the CDM methodology (for example, retrofitting CCS into existing power plants vis-à-vis new CCS installations). The accounting methodology must also take into account potential perverse incentives to low-efficiency technologies (for example, replacing CCGT[2] with gas-fired boilers with steam turbines to obtain more concentrated CO_2 streams) and carbon-intensive projects (for example, the development of CO_2-rich gas fields to gain more credits from CCS relative to less CO_2-intensive fields).

Other considerations for the accounting methodology include:

i) that the overall CCS project life will generally be much greater than the CDM crediting period;

ii) that CCS projects are energy-intensive, and emissions from the energy usage by CCS projects must be counted; and

iii) that Enhanced-Oil-Recovery projects create downstream emissions from the additional oil recovered, and whether the magnitude of these emissions should be accounted for in the CCS project.

Capacity of host countries to consider and approve CCS projects

Given that a host country of a CCS project will potentially be the most exposed to potential environmental and safety risks of CCS projects, it is critical that the host country is well-positioned to make informed decisions when considering a CCS project proposal. However, as CCS for climate change purposes is still at the early stages of development, it is likely that decision-makers do not yet have the comprehensive technical knowledge of integrated CCS operations that will be required to assess a proposal. An option to address this could be the establishment of an expert panel to provide host countries with assistance in considering CCS project proposals under the CDM.

Concluding Remarks

New Zealand recognises the importance of CCS as a potential globally significant technology option in the portfolio of mitigation options. The transfer of CCS technology is critical to improving global CCS expertise, lowering the costs of the technology, and enhancing CCS-compatible infrastructure for future uptake.

New Zealand is supportive of incorporating CCS in the CDM subject to satisfactory resolution of the issues raised above.

[2] CCGT: Combined Cycle Gas Turbine

PAPER NO. 3: NORWAY

Submission from Norway on the inclusion of carbon capture and storage in the Clean Development Mechanism

Introduction

At its second session the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP2) gave through Decision 1/CMP.2 the Subsidiary Body of Scientific and Technological Advice (SBSTA) a clear mandate (Decision 1/CMP.2): To prepare recommendations on rules and modalities for carbon dioxide capture and storage (CCS) in geological formations as clean development mechanism (CDM) project activities, with a view to taking a decision at the fourth session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (COP/MOP4). The SBSTA at its twenty-seventh session invited Parties, non-governmental organisations and intergovernmental organisations to submit their views on a range of questions regarding CCS as CDM project activities. A decision on these issues at COP/MOP4 will be important for an early world-wide dissemination of this technology. Norway welcomes the opportunity to present our views on this important issue. We would also refer to our previous two submissions on this issue.

Norway works towards achieving the ultimate objective of the Convention: To ensure the stabilisation of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate. We must respond adequately to the long-term goal of the Convention. It is our view that this cannot be met without limiting the global average temperature rise to a maximum of 2 ˚C compared to pre-industrial level.

In our view, it is crucial that we welcome, promote and contribute to research, innovation, development, testing and dissemination of new technologies that will help us mitigate climate change. This requires increased focus on renewable energy and energy efficiency. But we must also meet the challenge of securing a sustainable future energy supply by reducing the emissions from the production and use of fossil fuels. CCS is one of the most promising technologies to achieve that. This technology will complement other climate change mitigation actions by providing an option for using fossil fuels, including coal, during the transition to a low-carbon economy.

According to the Intergovernmental Panel on Climate Change (IPCC) CCS has, after energy efficiency, the second largest potential for global emission reductions. An enforced effort to stimulate development, deployment and dissemination of this technology at a global scale will in our view be vital to keep the increase in global average temperature within 2 ˚C.

Norway has considerable experience in storing CO2 in geological formations under the seabed, and today CCS is an integrated part of Norway's national mitigation policy. (See below).

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 in the CDM will give an important contribution to the dissemination and deployment of this technology in non-Annex I countries.

The Synthesis Report (FCCC/SBSTA/2008/INF.1) demonstrates the extensive work undertaken and the range of options that exist to address the outstanding issues for environmentally sound CCS projects to be included as CDM activities. Norway commends the Secretariat for their conscientious and thorough work on compiling the report.

As mentioned by Parties in the discussions at the SBSTA at its twenty-eighth session in Bonn, the technical issues of CCS project activities have been addressed and guidelines have been adopted in other international fora, such as the London Convention, under the International Maritime Organisation (IMO), and the OSPAR Convention. Relevant work under these bodies may serve as a useful input to the discussions on CCS in geological formations as CDM project activities.

Guidance to the Executive Board

In order for CCS projects to be considered as CDM activities, the CDM Executive Board (EB) should consider methodologies and projects, judging them against a set of provisions. Some candidates for such provisions are considered below:

General comments

For Norway it is important to ensure that Certified Emission Reductions (CER) resulting from environmentally safe 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 CO2 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. However, the guidance provided by the COP/MOP4 to the EB must ensure the maximum environmental integrity of the projects.

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 CO2.

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

i) The subsurface components, e.g., the installation where the CO2 is generated, the capture plant, any additional CO2 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 typical 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 CO2 is stored. Site characterization and storage performance assessment studies carried out as part of the feasibility study in advance of CO2 injection operations will define the project boundary for the reservoir.

iv) The locations around the reservoir such as the caprock 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 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 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.

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

Seepage 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 seepage from the storage site should be accounted for. "Seepage" here 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 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. It should further be ensured that the storage sites proposed for CCS projects in the CDM have been thoroughly characterized 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 caprock/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 characterization 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, and available industry best practice.

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.

According to the IPCC Special Report on CCS, a retention time of CO2 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 CO2 may gradually be immobilised by various trapping mechanisms.

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 as well as available best industry practice.

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 pathways would have been identified during the analysis of the storage site. Monitoring technology and methodology for safe 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.

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 clearly defined long-term liability, which extends the crediting and project period.

In the PDD project participants should demonstrate procedures for the proper and safe sealing and abandonment of the reservoir; responsibilities for monitoring of the reservoir in the operational phase, post-closure/ medium-term and long term; credible demonstration of the expectation 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.

Implication of CCS activities on other CDM activities

There have been concerns raised about the possibility that emissions reductions from CCS activities would overflow the global CDM market. While the potential for emission reductions from CCS is large over longer time, this argument is not based on factual figures as far as the near and medium term time period is concerned.

Studies by Point Carbon, the IEA and others show that due to the long lead times for implementation of CCS projects and the high cost of the technology, only a limited number of projects will have the potential to generate credits in the first commitment period of the Kyoto Protocol. It is therefore unlikely that potential CCS-projects will have a large crowding-out effect on other CDM project activities in the first commitment period. The potential market effect of any specific technology or project activity in subsequent commitment periods will depend on the ambition level and content of these commitments, and should not have any impact on rules and modalities for CDM projects in the first commitment period.

The Norwegian Storage Experience

Norway welcomes the proposals of several Parties at SBSTA at its twenty-eighth session on means to enhance the capacity building and facilitate the sharing of information on CCS in geological formations. Norway has extensive experience in storing CO2. Over the last 12 years a total amount of 10 million tons of CO2 have been stored in the Utsira Formation under the North Sea. We would like to share this experience with other Parties and welcome further collaboration on capacity building in this area. We believe that the Norwegian experience could be of interest and we welcome this opportunity to give a short description of the work we have done so far.

Since 1996, about one million tons of CO2 per year have been separated from gas produced on the Sleipner Vest Field in the North Sea and stored in the Utsira Formation; a saline aquifer located 1,000 metres below the seabed. The aquifer consists of unconsolidated sandstone and thin horizontal shale layers that spread the CO2 laterally. The seal consists of an extensive and 800 metre thick shale layer. The Sleipner CO2 Injection Project is so far the only facility in the world where large quantities of CO2 are stored in a geological formation below the seabed and for emission mitigation purposes. All the results from the Sleipner Project are made publicly available at: www.co2store.org.

A multinational and multidisciplinary research project named Saline Aquifer CO2 Storage (SACS) was initiated and organised by StatoilHydro involving a large number of European research institutes and commercial companies. The project has collected relevant data, modelled and verified the distribution of the CO2 in the Utsira Formation for twelve years, and developed and demonstrated prediction methods for the movement of CO2 for many years into the future. Time-lapse 3D seismic data were acquired in 1994, prior to the start of injection, and again in 1999, 2001, 2002, 2004 and 2006. New seismic data will be acquired in 2008. The data shows no unexpected movement in the storage reservoir and no sign of seepage of the stored CO2. The SACS program was continued by CO2STORE, a research project within the EU's 5th framework program, which evaluates lessons learned from previous and similar projects and how the technology can be implemented in relation to other aquifers in Europe that could serve as subsurface locations for CO2 storage, both onshore and offshore.

The Utsira formation is by no means an unusual geological formation in terms of storage potential, and the Sleipner storage operation represents just one of many potential subsurface storage sites.

The Snøhvit field in the Barents Sea provides gas to the world's first LNG plant with carbon capture and storage. The first amount of CO2 was injected and stored from the Snøhvit field in April 2008. At full production, 700,000 tons of CO2 will be separated from the natural gas annually, piped back 160 km and reinjected and stored in the Tubåen Formation, a saline aquifer. This formation is located 2,600 metres below the seabed. The Tubåen Formation has greater heterogeneity and generally poorer fluid transport characteristics than the Utsira Formation, enabling useful contrasts and comparisons to be made in terms of reservoir performance. A program has been set up for monitoring the behaviour of the injected CO2. The monitoring program builds on the experience gathered in the Sleipner Project and involves a series of research institutions and companies partly financed by the EU (the CASTOR-project) under the EU's 6th Framework Program. The overall goal of the CASTOR project is to develop and validate, in public/private partnerships, all the innovative technologies needed to capture and store CO2 in a reliable and safe manner. The objective is to obtain secure management of storage sites by improving assessment methods, defining acceptance criteria, and developing a strategy for safety-focused, cost-effective site monitoring. A "Best Practice Manual" has been developed. The manual can be downloaded from the following website: http://www.co2store.org/. Another partly EU financed research project, the CO2ReMoVe project, aims to develop innovative research and technology for the monitoring and verification of geologically stored CO2. The consortium behind this project proposes a range of monitoring techniques, applied over an integrated portfolio of storage sites, which will develop:

(i) Methods for base-line site evaluation
(ii) New tools to monitor storage and possible well and surface seepage
(iii) New tools to predict and model long term storage behaviour and risks
(iv) A rigorous risk assessment methodology for a variety of sites and time-scales
(v) Best practice guidelines for industry, policy makers and regulators

One of the storage sites included in this project is the Snøhvit storage reservoir. Optimal survey design will be based on the results of the Snøhvit 2006 2D time-lapse data (interpreted in the CASTOR project). By modifying the 2D monitoring schedule, it may be possible to run the 3D and 2D monitor surveys in parallel, providing a valuable opportunity to test the relative efficiency of the techniques in terms of reservoir imaging and amplitude/offset information, moving towards developing monitoring 'best practice' for deep storage sites. Interpretative work will include detailed interpretation and modelling of processes at the reservoir/topseal interface for leak detection. Forward and inverse seismic modelling and coupled reservoir/seismic simulations will be used to elucidate specific intra-reservoir transport processes.

Appropriate selection and management of storage sites is essential to reduce the possibility of seepage to a minimum. Operators of storage sites must monitor and report in line with the 2006 IPCC GHG Guidelines.

Norway has regulated the CCS projects on Sleipner and Snøhvit under the existing legislation. We are in the process of evaluating the need for creating additional legislation for CCS activities. In accordance with the Petroleum Act and the Pollution Control Act, StatoilHydro has been required to monitor the CO2 storage in the Utsira reservoir and to report the results to the Norwegian Pollution Control Authority annually. This will also be the case for the Snøhvit-field, thus building experience to guide future CO2 storage projects. We believe that the Norwegian storage experiences will be highly relevant to SBSTA's work on guidance to the EB on CCS project activities under the CDM.

Other Norwegian CCS projects

Norway is building on the experiences from Sleipner and Snøhvit and is currently developing 3 carbon capture projects: The Test Center Mongstad, Mongstad Carbon Capture and Storage Project (full-scale CCS) and the Kårstø project. We are also in the process of identifying appropriate new storage sites offshore.

The Mongstad Carbon Capture and Storage Project: The Norwegian government and the oil company StatoilHydro have signed an agreement to establish a full-scale CO2 capture and storage plant in conjunction with a combined heat and power plant at Mongstad at the west coast of Norway. In order to reduce technical and financial risk, the project will progress in two stages. The first stage covers construction and operation of the Test Center Mongstad CO2, a capture testing facility, which will be operational by 2011. The testing facility will have the capacity to capture at least 100 000 tons of CO2 per year. The second stage, i.e. full-scale capture of approximately 1.5 million tons of CO2 per year, shall be in place by the end of 2014.

The Kårstø Carbon Capture and Storage Project: The Norwegian government intends to provide a full-scale CCS solution for a gas-fired power plant at Kårstø in the Southwestern part of Norway. The capacity of the capture plant will be 1 million tons of CO2 per year.

The captured CO2 from these plants will be stored in geological formations under the seabed. Norway has identified potential new storage reservoirs and is in the process of a thorough evaluation of these sites.

Gassnova SF, a separate legal entity owned by the Norwegian State, will be responsible for the Government's participation in CCS projects.

PAPER NO. 4: SAUDI ARABIA

Saudi Arabia Submission on Carbon Capture and Storage in geological formations as clean development mechanism project activities

Saudi Arabia would like to welcome the opportunity to submit our views on Carbon Capture and Storage in geological formations as clean development mechanism project activities under this agenda item as referenced in Paragraph 4 of document FCCC/SBSTA/2007/L.19 to facilitate the ongoing consideration of these topics under this agenda item by SBSTA.

Saudi Arabia welcomes the opportunity to submit its views on consideration of carbon dioxide capture and storage as a CDM project activity.

Saudi Arabia strongly supports the consideration of CCS projects under CDM. All studies and the latest IPCC Assessment on CCS have shown that CCS provides great potential on mitigating greenhouse gases in the short term. Delaying a decision on this matter is impacting our commitment to achieve the objective of the convention. Particularly, many developing countries that have great opportunities to contribute in this area will have no incentives in implementing such actions if this technology is not eligible under CDM.

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) technology for combating greenhouse gas emissions and welcomes all initiatives to promote and deploy this technology under the CDM.

PAPER NO. 5: SLOVENIA ON BEHALF OF THE EUROPEAN COMMUNITY AND ITS MEMBER STATES

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

This submission is supported by Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Serbia, Turkey and Ukraine

Ljubljana, 27 June 2008

Subject: **Carbon dioxide capture and storage as clean development mechanism activities**
Views on issues relevant to the consideration of carbon dioxide capture and storage (CCS) in geological formations as CDM project activities

I. Introduction

1. SBSTA 27[1] invited Parties, intergovernmental organizations and accredited non-governmental organizations to submit to the secretariat, by 16 June 2008, their views on, and including but not limited to, technological, methodological, legal, policy and financial issues additional to those referred to in the last round of submissions (September 2007), and in particular reflecting the informal discussions that took place during the twenty-seventh session of the SBSTA. The EU welcomes this opportunity to submit its views.

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

3. At SBSTA 28, the EU proposed a pilot phase approach to facilitate capacity-building, knowledge-sharing and learning-by-doing as an attempt to move the discussions forward. We would like to take this opportunity to elaborate in greater detail on this proposal.

II. Demonstration of CCS technologies

4. In order to meet the 2ºC objective, it will be essential for greenhouse gas emissions to peak within the next 10 to 15 years, followed by substantial global emission reductions of at least 50% by 2050 compared to 1990. This implies substantive cuts in emissions from *inter alia* coal-fired power generation in industrialized and developing countries, which can potentially be realised by the diffusion and deployment of CCS. It is crucial that developing countries explore the technologies in parallel to industrialized countries.

[1] FCCC/SBSTA/2007/16
[2] FCCC/SBSTA/2007/MISC.18/Add.1

5. At the G8 Energy Ministers meeting on 8 June in Aomori, Japan, Energy Ministers “strongly supported” the recommendation that “twenty large-scale CCS demonstration projects need to be launched globally by 2010, taking into account varying national circumstances with a view to supporting technology development and cost reduction for the beginning of broad deployment of CCS by 2020.”

6. The CDM is an appropriate means of promoting genuine technology cooperation and technology transfer. Through the CDM and its link into the EU ETS, the carbon market could be one among several means of supporting the demonstration, diffusion and deployment of CCS in the first commitment period and providing useful insights for discussions on CCS deployment post-2012. The prospect of gaining CERs from a CDM project can provide limited seed financing for projects of this nature, and thus contribute to their economic feasibility.

7. Our previous submission outlined activities in the EU to promote the demonstration of CCS. It also outlined the EU-China cooperation on Near Zero Emissions Coal (NZEC). The European Commission, UK and China are currently considering *inter alia* the cost and financing aspects of demonstrating CCS at commercial scale in China. The European Commission has committed itself to stepping up the CCS cooperation with China and extending it to other developing country partners. The CDM could form a significant part of the financial package for such capacity building and technology transfer activity.

III. Pilot Phase Proposal

8. The EU has proposed a pilot phase approach for the demonstration of CCS in developing countries. In our view, this could offer a way to build practical capacity and close knowledge gaps while contributing to the worldwide demonstration and diffusion of this potentially important mitigation technology. This approach can serve as a test phase to expand knowledge relevant to the areas of concern of some Parties expressed, *inter alia* at SBSTA27, regarding methodological and practical implications, environmental impacts and market effects. The advantage of having a pilot phase is the opportunity to incentivise project developers to suggest methodologies and build a broad base of experience from which to draw lessons.

9. Principal features of the pilot phase are:

- limited duration;
- a maximum of x projects,;
- a maximum creditable tonnage of y Mt/annum per project during the pilot phase e.g. a maximum volume of CERs allowed into the market as a result of the pilot while still enabling large-scale demonstration projects to reap the benefits of carbon financing;
- crediting which starts after registration, according to EB procedures;
- a window of opportunity to register projects in the first commitment period of the Kyoto Protocol (i.e. before 2013);
- evaluation of pilot phase at the earliest appropriate opportunity.

10. Furthermore, although the aim is zero seepage, accounting rules for CCS projects under the CDM should be consistent with the current approach under the Kyoto Protocol, i.e. the net quantity of CO_2 stored (including any seepage) should be reflected in the accounting scheme. The EU is of the view that the best way to avoid very complex accounting schemes for long-term seepage is to ensure that there is a very high level of confidence of permanent storage of CO_2. While there are different ways to make private entities liable for any seepage from the reservoir, the EU believes that the ultimate liability for any seepage emissions needs to be either with the host country or the country using the CERs.

11. Projects for inclusion in the pilot phase would be designed, developed and then submitted to the Executive Board in the usual manner and then considered for approval by the EB. They should also be assessed according to the normal additionality criteria. Projects approved and registered would then be admitted to the pilot phase and verified in the normal way before the issuance of CERs. Project proponents are invited to submit methodologies and Project Design Documents (PDDs) from the full range of technological options for capture, transportation and storage to facilitate the demonstration of a diversity of situations in a range of geographical locations.

12. In the view of the EU, a decision at CMP 4 should set out provisions for the technical, methodological, policy and legal issues (including liability) are to be tackled in the pilot phase, taking into consideration past submissions by Parties and the synthesis reports prepared by the Secretariat. The decision should mandate the EB to register a limited number of projects for a pilot phase of a limited duration, to be credited under the CDM and report in its Annual Report on progress under the pilot phase to facilitate Parties' further consideration of the pilot.

13. On the policy issues, notably market impact, liability, accounting and physical boundaries, the EU believes that the proposed pilot phase could act as a suitable environment in which to gain relevant experience.

IV. Assessment of CCS methodologies by the CDM Executive Board

14. The EU suggests that the EB should consider CCS methodologies and projects, judging them against the following provisions:

i. Methodologies 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 characterization and simulation based on the methodology and requirements of the 2006 IPCC GHG Guidelines, the general advice on site selection in the IPCC Special Report on CCS, and available industry best practice;
ii. The monitoring plan should be consistent with the methodological advice in 2006 IPCC GHG Guidelines and relevant parts of the IPCC Special Report as well as available best industry practice;
iii. The PDD should contain credible demonstration of the expectation that CO_2 within the reservoir will reach a stable distribution in the long term, entailing zero seepage to the atmosphere;

iv. Designated Operational Entities would be required to have appropriate expertise to assess the technical aspects and the regulatory and liability aspects relevant to CCS to enable them to discharge their validation and verification functions in accordance with the requirements of relevant baseline and monitoring methodologies, IPCC and available industry best practice;

v. Project participants should set out in the PDD how they plan to address long-term responsibility for monitoring for any seepage from the reservoir, long-term liabilities and accounting for any seepage, and any remediation required as well as procedures for the proper and safe sealing and abandonment of the reservoir.

15. In our previous submission, we set out our views on dealing with these and other issues. Our views reflect the planned practice in the EU, which builds on the 2006 IPCC GHG Guidelines. These Guidelines form the basis for recent amendments to the London and OSPAR Conventions to allow and regulate CO_2 geological storage and are the basis upon which the European Commission has developed a regulatory framework (currently passing through the legislative process in the EU) to enable CCS in the EU and its inclusion in the EU Emissions Trading Scheme. The principles and methodologies provided by these Guidelines, and the subsequent regulatory frameworks, will ensure environmentally safe CCS to be undertaken, with the aim of zero seepage.

VI. Learning for the future

16. The pilot phase can provide Parties with important information to enable them to take informed choices in shaping the post-2012 regime. Furthermore, it could provide an important capacity-building for and impetus to the global demonstration of CCS that is necessary in order to accurately assess the potential contribution of this technology to mitigation efforts.

17. It will be important to evaluate the pilot phase and draw appropriate lessons. An assessment of the success of the pilot phase, including the technical and methodological issues, environmental impacts, market impact and issues at policy level, should be conducted by an appropriate international body, composed of selected internationally recognised experts with input from non-Annex I and Annex I experts, after a given number of years of operation. It will be necessary to draw up strict criteria for this evaluation, including a definition of methodologies, validation, registration, monitoring and verification. The evaluation of the pilot phase should take place once a selection of projects is up and running. It should be completed at the earliest appropriate opportunity and should form the basis for CMP guidance to the EB on the modalities of any further inclusion of CCS in the CDM.

VII. Conclusions and recommendations

18. The EU believes that there are several advantages to the implementation of a pilot phase approach for further deployment of CCS projects in developing countries. We believe the CDM can contribute to such a pilot phase. We hope that this approach can provide confidence and control for Parties to enable the discussions in SBSTA to move to practical experience, capacity-building and knowledge sharing that Parties have

requested. Experience in the pilot phase will enable project proponents, host governments and Parties to build institutions and practical and institutional capacity, learn about potential impacts, and ensure that the right systems are in place for the avoidance of undesirable impacts.

19. In conclusion, the EU may support, as part of a full range of mitigation technologies, geological CCS CDM projects provided that the necessary technical, economic and regulatory framework exists to provide maximum environmental integrity and safety and with the objective of avoiding any seepage. We propose a pilot phase approach as a means to move forward on this issue. We are looking forward to hearing Parties views on the modalities of the pilot and to agreeing a decision at CMP4 in Poznan that can enable the inclusion of CCS projects into the CDM, subject to conditions such as those outlined above.

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