CDM Watch Submission On Carbon Dioxide Capture And Storage In Geological Formations As Clean Development Mechanism Project Activities

Submission from admitted observer organisations on views on how different issues can be addressed in modalities and procedures

21 February 2011

At COP/MOP 6 in Cancun, CMP Decision[1] stipulates that carbon dioxide capture and storage (CCS) in geological formations is eligible as project activities under the Clean Development Mechanism (CDM), provided that the issues identified in Decision 2/CMP.5, paragraph 29[2], are addressed and resolved in a satisfactory manner.

The CMP Decision invited admitted observer organisations to make submissions to the Secretariat, by 21 February 2011, on views on how different issues (referred in paragraph 3 of this Decision) regarding CCS in geological formations as CDM project activities can be addressed in modalities and procedures.

The CMP Decision further requests the Subsidiary Body for Scientific and Technological Advice (SBSTA), at its thirty-fifth session, to elaborate such modalities and procedures with a view to recommending a decision to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) at its seventh session.

CDM Watch welcomes the opportunity to submit its views on this issue. In CDM Watch´s view, discussions about the future of the flexible mechanisms including the consideration of new project activities should be firmly grounded in an analysis of their performance so far. So far, the CDM has failed to meet its dual objectives of supporting cost-effective climate change mitigation and sustainable development in developing countries. This submission sets out CDM Watch´s general opposition to the inclusion of CCS in CDM and subsequently addresses the different issues referred to in paragraph 3 of the CMP Decision. It should be noted that this submission does not refer to CCS technologies outside the CDM .

1. General

CDM Watch believes that CCS technologies are not appropriate in the framework of the CDM and should not be eligible as CDM project activities. The prospect of large quantities of cheap CCS credits for Annex I parties should not override the potential negative consequences of including CCS under the CDM.

In particular, CDM Watch is strongly opposed to the inclusion of CCS in the CDM for the following reasons:

- **Uncertainties:** CDM rules and implications as identified in decision 2/CMP.5 paragraph 29 have not yet been examined fully and no satisfactory solutions have been presented. For instance, the report

[1] The specific number of the decision is unknown at the time of writing.

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

conducted by the CDM Executive Board in response to Decision 2/CMP.4[3] only presents a list of positive and negative implications but does not provide any solutions. Some of the issues identified arise from the current state of technologies and others from the lack of a proper regulatory framework at national/regional/international levels. These uncertain implications and characteristics related to CCS technologies do not comply with the "safe and sound" requirement that technologies must fulfil in order to become eligible under the CDM. The CDM should not be used as a tool for experimenting with CCS in developing countries.

- **Concerns about sustainability:** All CDM projects must contribute to sustainable development. However, CDM Watch believes that there are no reliable precedents where an Environmental Impact Assessment (EIA) has been carried out covering the full cycle of CCS in developing countries (and even in developed countries). Conducting an EIA according to the CDM modalities and procedures for a CCS project would therefore be a very challenging task.
    - The lack of experience with CCS on a commercial scale, the long lifetime of the projects and the uncertainty concerning the risk of leakage and seepage would pose unmanageable challenges for conducting a CCS EIA.
    - Even in relation to existing CDM project activities, EIAs are rarely conducted in a satisfactory manner. In the case of CCS, the risk is more severe because a faulty EIA could have regional or international implications if it leads to poor site selection or operating practices that result in leakage.
    - There is the long-term risk of a sudden and massive release of CO_2 back into the atmosphere with health and environmental consequences if storage sites are not properly selected/managed/monitored and are accidentally penetrated by, for instance, drilling activities after site abandonment. Short CDM crediting periods would make it difficult to put such management/monitoring schemes in place. Besides all the risks in terms of environmental impacts and public health, it is not possible to estimate those costs and internalize them in the project activity.
    - Another potential negative impact of geological carbon storage is contamination of potable water resources with CO_2. Sound ex-ante analysis is therefore required to prevent CO_2 from entering the groundwater.
    - Because CCS is a new technology, the exact consequences of accidental leakage from depleted oil/natural gas reservoirs is as yet unknown. The high degree of uncertainty, inherent in current CCS technologies, can only be reduced by a careful long term monitoring process which is intensive in both capital and technology.

- **Enhanced Oil Recovery:** Enhanced Oil Recovery (EOR) is a generic term referring to the techniques used to increase the amount of crude oil that can be extracted from an oil field. It is achieved by injecting a gas, for example CO_2, into an oil reservoir. By using EOR, 30-60 % or more of the reservoir's original oil can be extracted compared with 20-40% using primary and secondary recovery. Oil reservoirs are favored sites for underground CO_2 storage, notably because under the CDM they are the only sites where CO_2 capture could produce additional income to that generated by the credits awarded for CO_2 storage. It is also the only mature market technology for geological storage listed by the IPCC in the Special Report on CCS and enhanced oil recovery (EOR). Supporting CCS through the CDM indirectly supports EOR. CDM Watch believes that the CDM was not conceived for providing subsidies for oil and natural gas production, in particular for countries with on-shore production and very low costs of oil production. It is very likely that CCS/EOR projects will not depend on CDM incentives and may therefore not be additional. However, the CDM has performed very badly in terms of screening out non-additional projects so far. It is reasonable to assume there is a risk that some EOR-based projects will enter CDM even if they are not additional. Fossil fuel producers do not need this type of subsidy, taking into account that the current oil price is higher than US$80/barrel. Moreover, these companies have significant knowhow and investments in

[3] Annex II to the annual CDM EB report FCCC/KP/CMP/2009/16

the area of CCS technology. CDM should also not be used to give incentives for the extraction of methane from deep coal mines, or in-situ burning of coal. Additionality is crucial for preserving the environmental integrity of the CDM and any non-additional credits are directly undermining Annex I emission reduction targets. Given the large proportion of credits that could be expected from CCS projects in the CDM, this risk must be avoided. Moreover, considering the overall costs of CCS projects, it is not credible that additional funds from the CDM would be "decisive for the investment decision" as required by the CDM rules[4].

- **Perverse incentives:** CCS CDM projects would generate large quantities of credits within a short timeframe while failing to help the transition from carbon-based economies to decarbonized economies both in host countries and developed countries. It is important to recognize that there is a risk that CCS would end up buying additional time for the current fossil fuel-based economy. The risk needs to be carefully considered and it is CDM Watch's view that the CDM has to prioritize areas such as renewables and energy efficiency. The inclusion of CCS in the CDM could postpone important investment that could lead to the introduction of renewable energy technologies in the developing world. In addition, CCS in the CDM would generate large projects, particularly concentrated in a few countries. This would further prevent equitable participation of non-Annex I countries under the CDM and would indisputably create additional barriers for small-scale projects if such large-scale projects were favoured by the market. Inclusion of CCS within the CDM may place less emphasis on finding other more suitable financial mechanisms under the UNFCCC or government policies.

- **Energy Penalty and Costs**: There are huge costs associated with CCS: the additional energy used for the capture is enormous and referred to as the "energy penalty." According to the Hamburg Institute of International Economics this can range from 15-40% of energy output, pushing the cost of CO_2 avoided up to somewhere in the range of €24–€52/t. However, the right mix of capture, transport and storage options – with enhanced oil recovery at the top of the list – can generate enormous profits per avoided tonne of CO_2, reaching hundreds of € per avoided tonne of CO_2.

- **International law conflicts:** Existing international treaties and regulations are not sufficient to address the concerns related to CCS as CDM project activities. Although some legal and regulatory efforts under domestic legislation have been identified in some countries and there have been a few attempts to address the issues in international treaties like the London Protocol, much remains to be done. It is quite premature to try to consider elements under International Law when even domestic legislation remains under construction. Seepage may also occur in international waters which would introduce further complexities similar to those related to international bunkers, whose emissions are not covered either in national emissions inventories This would also add legal implications with transnational liability problems, including possible transboundary problems among Annex I and/or Non-Annex I countries. None of the marine treaties in place were drafted with CCS activities in mind. This has further complications in relation to offshore geological storage.

- **Undermining the carbon price:** There are no studies assessing the possible impacts of CCS on the CDM market. Currently, CCS projects are still expensive to implement. However, if the cost of capture decreases and non-additional, economically-already-viable EOR/CCS projects enter the CDM, it is likely that huge quantities of credits from CCS projects would depress CER prices to a level which could undermine incentives for domestic emission reductions. The decreasing price of CERs could 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 uncompetitive.

- **Real emission reductions (**Article 12.5 (b) of the Kyoto Protocol): While some technologies avoid emissions, others might lead to increased emissions if the possibility of leakage and seepage is considered. Moreover, one of the main requirements of CDM project activities is that although they only generate credits for a relatively short period of time, they should also provide real and measurable long-term benefits. CCS activities in the CDM would generate a huge amount of credits in the short term, but the credited reduction would not necessarily be permanent. This means that the question of whether CCS as a technology fulfils Article 12.5 (b) of the Kyoto Protocol that states that "the emission reductions resulting from each project activity shall be certified on the basis of real, measurable, and long-term benefits related to the mitigation of climate change" will always be dependent on stringent monitoring of the site. It should be noted that whether that is possible is still under exploration even in developed countries.

- **Risks of seepage:** Seepage can occur a long time after the crediting period expires. If seepage occurs in the mid- or long-term it will not affect allowances issued in the present for Annex I Parties. Project emissions as well as leakage could occur a long time after the crediting period has expired. This means that carbon credits from CCS project activities would have to account for future potential seepage. Considering that seepage could occur in 200, 500 or 10,000 years, cancelling units after a verification of reversion would not affect allowances issued. There could be some approaches to this problem such as discounting, insurance mechanisms or collective pooling of credits but the seepage issue represents another example of the inadequacy of the CDM in terms of dealing with challenges related to CCS. A massive discounting factor could potentially account for future leakage. However, a discounting factor would have to be agreed upon upfront and would come with the risk that reservoir owners would have a potential incentive to "empty" the reservoir once the crediting period is over in order to use the same reservoir again to receive more carbon credits.

If it were to be implemented at all, CCS in developing countries could be developed in another framework, using specific financial mechanisms, funding and partnerships under the UNFCCC, but not as an offset mechanism, generating carbon credits to be used by Annex I countries. Inclusion of CCS within the CDM would provide perverse incentives as it would potentially place less emphasis on finding other more suitable financial mechanisms under the UNFCCC or government policies.

While CDM Watch believes that the CDM is not the right forum for CCS, we would like to make reference to key principles that must be taken into account when discussing the potential inclusion of CCS as CDM project activities.

2. The selection of the storage site

- Site selection is key as it would affect all the later stages of the CCS project. Therefore, it would have to be based on robust criteria that ensure that only geological formations that ensure that there would be no risk of seepage under any conditions of use, and no environmental or health risks are selected. These criteria should be agreed upon at international level after consultation with relevant stakeholders including admitted observer organisations. It is essential that local communities and Indigenous Peoples have full and effective participation in all elements of CCS, including storage site selection, and that their free, prior and informed consent for activities that affect them is given.
- A specialised DOE should independently verify whether the criteria are met.
- The following places should be excluded from the scope of possible sites upfront:
    a. CO_2 storage in the water column, including storage on the sea bed, freshwater aquifers and potential underground sources of drinking water.
    b. Storage reservoirs that could potentially be used for renewable sources of energy.
    c. Geological formations that are prone to risks of eruptions

3. Boundaries of CCS in CDM

- CCS is a combination of different technologies. If at all, any CCS project that would be eligible for CDM certification would therefore need to comprise the entire technology chain from carbon capture over transportation to sequestration.
- Emissions throughout the whole project cycle, including indirect emissions from enhanced oil recovery or from several injection points from different project activities at different times for example, would need to be taken into account

4. Stringent monitoring plans

- It is evident that it is not possible to establish a monitoring plan for the time horizon needed to monitor a potential CCS plant and site.
- Any potential monitoring plan would need to address the entire CCS project cycle, including potential seepage during the pre-injection (CO_2 capture and transportation), injection, and post-injection phases of a CCS project as well as monitoring outside the project boundary when necessary.
- Monitoring of injection facilities would have to be done regularly for the purpose of comparison between the actual and modelled behaviour of CO_2. Any detected difference, including those related to sustainable development and the surrounding environment would need to be reported immediately.
- The monitoring plan would have to be updated regularly to take account of changes to the assessed risk of seepage, changes to the assessed risks to the environment and human health, new scientific knowledge, and improvements in best available technology.
- In addition to monitoring, regular inspections of all storage complexes for the purposes of checking and promoting compliance with the requirements and of monitoring the effects on the environment and on human health would have to be carried out.

5. Suitability of the use of modelling

- CDM modalities and procedures establish that both project emissions and emissions from leakage should be measured. However CO_2 stored in reservoirs is not measurable, but only modelled. This method is not suitable because only the quantity of CO_2 captured and injected can be monitored and verified.

6. Criteria for site selection and monitoring plans

- A suitable national regulatory framework for the environmentally safe capture, transport and geological storage of CO_2 must be established before the CCS project can be implemented in the host country.
- Monitoring plans would need to be site-specific taking into account geological characteristics of the sites selected for storage.
- Measures would need to be taken to ensure that geological storage of CO_2 meant permanent containment of CO_2. All negative effects or risks to the environment and human health must strictly be avoided.
- Well trained and well equipped agencies are basic preconditions for the operation of underground carbon storage facilities.
- Finally, extensive capacity building would be needed to implement CCS legislation in the host countries in order to guarantee high standards of environmental integrity.

7. Risk and safety assessment

- One of the biggest challenges regarding CCS under the CDM would lie in identifying liability in the case of leakage and migration of CO_2 from a geological formation. The time frame of CO_2 storage raises issues surrounding the longevity of institutions and intergenerational liability.
- Any risk and safety assessment should address the potential for leakage and migration during operations as well as over the long term (i.e. after closure of the storage site).
- The risk and safety assessment would provide the basis for mitigation/ remediation /corrective measures in response to unexpected events.
- Periodic updates to the risk and safety assessment would need to be conducted throughout the project's life cycle based on updated monitoring data.
- The risk and safety assessment would need to include site-specific information, such as details regarding the terrain, potential receptors, proximity of drinking water resources, faults, and the potential for unidentified borehole locations in the area occupied by the project.
- The risk and safety assessment would need to include non-spatial elements or non-geological factors (such as population, land use, or critical habitat) that should be considered in evaluating a specific site.
- Pipelines located in vulnerable areas (populated or ecologically sensitive, areas) would require extra due diligence by project operators to ensure safe pipeline operations. Options for increasing due diligence include among other things: decreased spacing of mainline valves, greater depths of burial, increased frequency of pipeline integrity assessments and monitoring for leaks.
- The risk and safety assessment and all essential information would have to be made public in order to guarantee broad public participation in the decision-making process.

8. Socio-environmental impact assessments

CDM Watch believes that there are no reliable precedents where an Environmental Impact Assessment (EIA) has been carried out covering the full cycle of CCS in developing countries (and even in developed countries). Conducting an EIA according to the CDM modalities and procedures for a CCS project would therefore be a very challenging task

If CCS CDM projects were to occur at all, a full socio-environmental impact assessment for a CCS CDM plant would have to be carried out for CO_2 capture installations, CO_2 storage sites and CO_2 transport pipelines addressing the following aspects:

- All atmospheric emissions (NOx, SOx, dust, Hg, PAHs, etc.), solid waste generation, and water use associated with current CO_2 capture technologies.
- Impacts on people's living conditions in the potentially affected area, regardless of any borders or other administrative frontiers.

In order to guarantee broad public participation, project operators would have to ensure that all relevant information was made available to the public and to stakeholders and that they were extensively involved in the decision-making process, in line with relevant regional and international legal instruments as applicable. It is essential that local communities and Indigenous Peoples have full and effective participation in all elements of CCS, and their free, prior and informed consent for activities that affect them is given. This is no different from other project types but CCS requires additional precautions and significantly more interactive processes with stakeholders including civil society representatives in order to gain public acceptance..

9. Short-, medium- and long-term liability

Currently, the maximum length of a crediting period is 21 or 60 years (for forestry projects). But no liability has ever been agreed upon that would last for centuries or millennia. This poses a significant challenge. Project participants and buyers of credits are typically private companies but it is not practical to assume their liability for such long-term risks (e.g. seepage). Even if they can somehow be held responsible after the end of crediting periods, it is difficult to assume that liability would extend to a hundred years, let alone the thousands of years that would be required for effective CO_2 storage. The current international institutional structure does not provide for long-term liability of host countries, either. If not properly addressed, there is an issue of inequality because credits go to developed countries while liability can get left in developing countries.

Hence, rules related to long-term liability would have to be put in place both at international and national levels before any projects were allowed to proceed. CCS has many similarities to the nuclear power industry regarding long-term uncertainties and possible ways of addressing them with sophisticated insurance systems and government surveillance. This would require strong political, economic and institutional structures which some developing countries do not have. Any liability regulations must address all possible scenarios, including insolvency or bankruptcy of the operators as well as the disappearance of States and governments.

In particular, liability provisions must at least address the following:

- If CCS is included in the CDM at all, an effective national regulatory framework has to be developed and implemented which covers all liability before the CCS project can be authorised in the host country. In addition to general responsibility under the existing CDM rules and national legislation in the host countries, such a framework should include provisions for:

    a. Careful site selection criteria
    b. Responsibility of operators (project participants) during and after the crediting period or the closure for monitoring/reporting and accounting of emissions and corrective measures (remedies) in case of seepage.
    c. Requirements for operators to provide evidence of financial security to show management of storage sites over the necessary timeframe is possible and establishing obligation relating to the closure of sites.
    d. Rules for sharing and transferring liability between project participants and the host country governments after the end of crediting period or closure of storage sites
    e. Long-term means of redress for Parties, communities, private-sector entities and individuals affected by the release of injected CO_2 or any other adverse health and environmental impact from the CCS project, including restoration of damaged ecosystems and full compensation for affected communities
    f. Responsibility of operators (project participants) to notify the CDM Executive Board in case of significant seepage and/or irregularities and provide full information for the EB

- Before authorizing the CCS CDM project in the host country, the national obligatory and regulatory framework needs to contain closure and post-closure obligations. International rules also have to be put in place and provisions should include the following

    a. In cases of transboundary transport of CO_2, transboundary storage sites or transboundary storage complexes, the project is only eligible as long as there is clear assignment of responsibilities and liabilities, and effective accounting for emission reductions and any seepage in case of transboundary projects in terms of transport and storage sites/complexes.
    b. Conflict resolution system in case of disputes due to cross-border activities relate to CCS

c. Measures to compensate for CO_2 emissions in case of seepage
d. Possible sanctions for operators (project participants) in case of fraud.
e. Measures to deal with the uncertainty of permanence such as discounting, insurance, pooled funds, etc.

- After a storage site has been closed down, the project operator remains responsible for monitoring, reporting and corrective measures, and for all obligations relating to the accounting of emission reductions in case of leakage until responsibility for the storage site is transferred.
- Before authorizing the CCS CDM project, it would have to be demonstrated that the regulatory framework in place in the host country contains adequate provisions guaranteeing a means of redress for Parties, communities, private-sector entities and individuals affected by the release of injected CO_2 or any other adverse health and environmental impact from the CCS project in the long term, including restoration of damaged ecosystems and full compensation for affected communities.
- Storage sites, CO_2 pipelines and potential seepage locations which cross national borders would potentially have additional legal implications and might be a source of dispute between States. A cooperation mechanism between countries together with the establishment of an international body to solve potential disputes might be created in the framework of the UNFCCC and/or under international jurisdiction.
- The monitoring plan would need to include clear and explicit assignment of long-term liability for monitoring and site-management, including remediation; it should clearly specify details of any transfer of liabilities, including evidence of agreements on such transfers as well as clear evidence of compliance with financial and organizational provisions to ensure the continuing viability of the storage operation and monitoring beyond the crediting period.
- Before authorizing the CCS CDM project, the host country would have to demonstrate that there are adequate provisions guaranteeing that after closing the storage site, all legal obligations relating to monitoring and accounting of emissions in the event of leakages, have been transferred to the competent authority of the host country on its own initiative or upon request of the project operator.
- At any time in the short-, medium- and long-term, in cases of leakages and significant irregularities which imply the risk of leakage, the entity responsible would have to notify the Executive Board (EB) and take the necessary corrective measures, including measures related to the protection of human health.
- Moreover, the entity responsible would have to verify and notify the EB of the amount of CO_2 still stored safely in the relevant reservoir.
- Before authorizing any CCS CDM project activity, the CMP/EB should elaborate provisions to guarantee that the leakage of any tonne of CO_2 in the atmosphere would be compensated, including through the removal of the same amount of credits from the market and/or by remediation.
- The project operator must demonstrate its ability to meet any responsibilities – financial or otherwise - in order to ensure that all obligations during project operation as well as closure and post-closure requirements could be met. This financial security must be valid and effective before the registration of the CCS CDM project.
- The project operator's obligation to meet its responsibilities – financial or otherwise - would remain in place after a storage site has been closed, until responsibility for the storage site were transferred to the competent authority of the host country.
- If the project operator were to omit any facts related to potential leakage of CO_2, additional sanctions for each tonne of CO_2 emitted would apply.
- As zero leakage cannot be guaranteed over hundreds or thousands of years, CERs from CCS projects would need to be treated identically to CERs from other project types. Due to the inevitable risk of leakage, CCS CERs would need to be discounted. The discount rate would need

to be based on scientific analysis of long-term leakage probabilities (e.g. 0.01%) and be applied over a very long-term period (e.g. 10,000 years).

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Definitions:

Seepage refers to the escape of injected fluid from storage (migration of CO_2 out of the storage reservoir and into the atmosphere). This is commonly referred to as **leakage** in the CCS context; however, in the UNFCCC context, leakage has a different meaning (leakage in respect of carbon trading is the change of anthropogenic emissions by sources or removals by sinks which occurs outside the project boundary.)