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CCS projects as Kyoto Protocol CDM activities

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Abstract

The December 2011 decision by the meetings of the United Nations Framework Convention on Climate Change (UNFCCC) in Durban, South Africa, to adopt modalities and procedures for carbon dioxide capture and geological storage (CCS) as clean development mechanism (CDM) project activities under the Kyoto Protocol was the culmination of many years of international negotiation. The Durban CCS decision establishes a practical international standard for managing CCS projects that ensures a high level of environmental protection. It is an important official recognition by the UNFCCC that CCS is a technology capable of achieving deep cuts in greenhouse gas emissions in developing countries and sets an important precedent for the inclusion of CCS projects within emerging international markets and other financing and technology support mechanisms outside of the CDM. This paper analyses the Durban CCS decision and the implications for project proposals.

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Keywords: Clean Development Mechanism; carbon dioxide; CCS; CDM; CER; geological storage; liability; monitoring; Kyoto Protocol, UNFCCC.

1. Background to the CDM

The decision by the meetings of the United Nations Framework Convention on Climate Change (UNFCCC) in Durban, South Africa, December 2011, to accept carbon dioxide capture and geological storage (CCS) as 'clean development mechanism' (CDM) project activities was the culmination of many years of international negotiation. The CDM is a market mechanism under the Kyoto Protocol applicable to developing countries. The CDM is the first global, environmental investment and credit scheme to provide a standardized emissions offset instrument in the form of 'certified emission reduction' (CER) credits, each equivalent to one tonne of carbon dioxide, which can be counted towards meeting Kyoto

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Protocol targets. It allows a country with an emission reduction or emission limitation commitment under the Kyoto Protocol to implement an emission reduction project in developing countries. The intention of the CDM is to stimulate sustainable development and emission reductions while providing developed countries with some flexibility in how they achieve their emission reduction targets.

CDM projects must qualify through a rigorous and public registration and issuance process designed to ensure real, measurable and verifiable emission reductions that are additional to what would have occurred without the projects [1]. The CDM allows developed countries to invest in emission reductions at lowest cost. Since its inception the CDM has been identified as a means to provide revenue for CCS projects in developing countries and so initiate more projects. CDM projects cover a broad range of activities across the energy sector, chemical industries, mining, waste disposal, forestry and agriculture. From the start of the CDM in 2004, to the middle of 2012, over 4,600 projects had been accredited in more than 74 countries, including 3,200 renewable energy projects, and over 1 billion CERs issued.

Nomenclature

CDM	clean development mechanism
COP	UNFCCC Conference of the Parties
CMP	UNFCCC Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CER	certified emission reduction credit
DOE	designated operational entity
EB	executive board of the clean development mechanism
UNFCCC	United Nations Framework Convention on Climate Change

2. History of negotiations for CCS in CDM

The first meeting of the executive board (EB) of the CDM took place in Marrakesh, 2001, at COP 7, where at the same meeting the rules that govern the CDM - the 'modalities and procedures'- were adopted by the Parties to the Kyoto Protocol. The 22nd meeting of the EB in November 2005, considered the first methodology for CCS as a CDM project [2]. The EB considered the general issue of CCS as CDM project activities but could not come to an agreement, citing issues relating to project boundaries, leakage and permanence as areas of concern, and requested further guidance from the CMP on the eligibility of CCS projects under the CDM, taking into account these issues. A subsequent meeting of the EB in September 2006, further considered proposals for two methodologies for geological storage of carbon dioxide and one for ocean storage [3]. The EB concluded that the submitted methodologies were not adequate, that while there are methodological issues associated with CCS projects that are comparable in nature to other CDM activities, there are also aspects that go beyond the nature of other CDM methodologies. Issues that lie at the frontier of scientific knowledge or engineering practice (e.g. site selection and monitoring methods) or present unique accounting or liability challenges (e.g. permanence). New modalities and procedures (i.e. CDM rules) needed to be developed to address CCS specific technical and policy issues. This view was subsequently referred to the COP/CMP for further consideration.

Five years of negotiations, technical workshops, capacity building and reporting ensued [4, 5, 6, 7, and 8]. In 2010, the UNFCCC meeting in Cancun (COP 16/CMP 6) put in place a work program to address

outstanding issues of general concern before CCS could be included in the CDM [9]. Issues to be addressed included, amongst other things, criteria for selection of storage sites, monitoring plans, suitability of modeling, risk assessment, project boundaries, liability, and provision for damages. The Cancun work program for 2011 consisted of submissions from governments [10] and non-government organisations, a synthesis report [11], a technical workshop in Abu Dhabi in September with subsequent report [12], culminating with the UNFCCC Secretariat producing draft 'modalities and procedures' describing comprehensive requirements for CCS projects within the CDM in November [13]. This nineteen page 'rule book' provided the basis for negotiations in Durban.

3. Durban negotiations

The draft 'modalities and procedures' for CCS were negotiated during the two weeks of UNFCCC COP 17/CMP 7 meetings in Durban, South Africa, as an agenda item under the Subsidiary Body for Scientific and Technological Advice (SBSTA). The challenging negotiations began on 30th November and concluded on 9th December 2011, with Parties finally agreeing to the text specifying the 'modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities' [14]. The provisions of the Durban CCS decision cover a range of technical issues including technical definitions, site selection and characterization, risk and safety assessment, monitoring, liabilities, verification and certification, environmental and social impact assessments, responsibilities for non permanence, and timing of the CDM project end. A number of the provisions contain requirements that are new to the CDM, for example, enhanced participation requirements for host countries (including the requirement to have national laws covering geological storage), the reserve account for net reversal of storage, risk and safety assessment, and requirements for financial provision. The remainder of the paper discusses key elements of the Durban CCS decision.

4. Modalities and Procedures

The modalities and procedures for CCS are additional to existing parent CDM modalities and procedures.

4.1. Participation requirements

Only non Annex 1 countries (i.e. Developing Countries and Least Developed Countries) may host CCS projects as CDM activities, and only if the jurisdiction has established laws and regulations to control and permit CCS projects. Domestic regulations must cover, amongst other things, site selection and characterization, access rights to storage sites, redress for affected entities and liability. The host jurisdiction also has to agree to financial provisions for each project activity, responsibilities for liability and responsibilities for 'net reversal of storage' (discussed below). As development of domestic CCS regulations can take many years, those jurisdictions with CCS regulatory regimes in place first will have a competitive advantage in attracting CDM projects to their country.

4.2. Validate and verify

Figure 1 shows the CDM project validation and verification process. Before project participants can apply for project approval by the EB, the 'project design document' must be validated by a 'designated

operational entity' (DOE). DOEs are either a domestic legal entity or an international organization accredited and designated by the EB to firstly 'validate' and subsequently request registration of a proposed project, and secondly, to 'verify' emission reduction of a registered CDM project activity, and if appropriate, certify and request that the EB issues CERs accordingly. Validation of a CCS project covers issues such as site characterization, risk and safety assessment, environmental and socio-economic assessment, provisions for liability and financial provisions for long term liability.

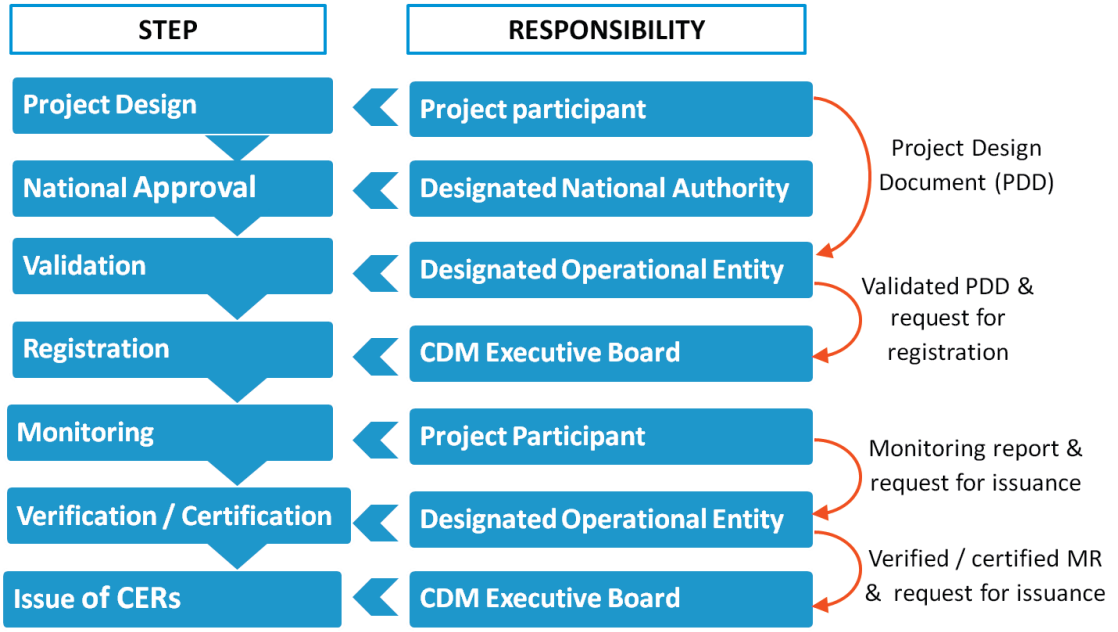

Fig. 1. The CDM project cycle, validation and verification (UNFCCC Secretariat, Abu Dhabi, 7 September 2011).

4.3. New definitions

The modalities and procedures are structured around several key technical definitions that are unique to the CDM and to the CCS industry, e.g. definitions for 'seepage', 'net reversal of storage', and the 'reserve account'. The definition of **seepage,** in the context of emission reductions, was the subject of lengthy debate in Durban. Parties agreed to be guided by the 2006 IPCC Guidelines for National Greenhouse Gas Inventories [15], eventually agreeing to define seepage as 'a transfer of carbon dioxide from beneath the ground surface or seabed ultimately to the atmosphere or ocean'. Monitoring programs must therefore be capable of detecting and quantifying seepage of carbon dioxide at the ground surface or the seabed. The CDM definition of seepage is for the purposes of global emissions accounting rather than local impacts. Host jurisdictions may impose more stringent domestic definitions of seepage for domestic assurance and liability impacts on the environment, communities and other resources.

Net reversal of storage is defined as emissions which exceed emission reductions over the verification period. Net reversal of storage is not likely to be a consideration before injection of carbon dioxide ends. After that time, when there are no further emission reductions, then any emissions generated by the facilities or seepage from the geological storage site, will result in a net reversal of

storage. The host country may determine, on a project by project basis, the responsible entity for managing any net reversal of storage, either the host country or the country purchasing the CERs.

To account for any net reversal of storage, the CDM registry is required to establish a **reserve account** for each CCS project, into which 5% of issued CERs will be withheld (a "buffer account"). If net reversal of storage occurs during the period of the CDM project then an equivalent number of CERs will be deducted in the first instance from the reserve account. After completion of carbon dioxide injection; and a period of post-injection monitoring has elapsed with no seepage; and the last certification report has been accepted by the EB; the CDM registry administrator is required to release any remaining CERs in the reserve account to the project proponents. The reserve account provides assurance that seepage will be addressed. By returning remaining CERs in the reserve account to project participants, the reserve account mechanism also provides a financial incentive for project participants to maximize the number of CERs it receives by taking reasonable, cost effective measures to avoid seepage.

4.4. Monitoring, Verification and Crediting

CCS CDM activities comprise two phases of verification. The first phase is the crediting period, covering the period of carbon dioxide injection, which enables CERs to be earned. The second phase is the period after the last crediting period up until monitoring of the storage site has been terminated. The crediting period for a CDM activity is currently up to 7 years with allowance for 2 renewals. A CCS project can therefore only earn CERs for a maximum of 21 years. Any seepage that occurs during the crediting period is deducted from the number of CERs issued for that period. Any seepage that occurs after the end of the last crediting period will be quantified, reported in the monitoring plan, and addressed by the reserve account.

The geological storage site must be monitored for at least 20 years after the end of the last crediting period or after issuance of CERs has ceased, whichever occurs first. Monitoring can only be terminated if no seepage has been observed at any time during the last ten years of the monitoring period, and if available evidence indicates that stored carbon dioxide will be completely isolated from the atmosphere in the long term. History matching should show agreement between the modeling and the monitored behavior of the carbon dioxide plume, and that no future seepage can be expected.

4.5. Liability

The modalities and procedures separate responsibility for non-permanence of the carbon dioxide emission reductions from the liability for any local damages resulting from operation of the storage site. **Liability** is defined as 'the legal responsibilities arising from the CCS project activity or relevant geological storage site, with the exception of the obligations arising from a net reversal of storage'. The laws underlying liability for damages to the environment, public health and property are largely dictated by the host country which must be in line with the requirements set down in the modalities and procedures (as assessed during the validation and registration).

Figure 2 summarizes the Durban CCS decision approach to liability. The project participants are liable for damages during the operational phase, and during the period following, up until monitoring of the storage site by the project proponents is terminated and the last certification report is accepted by the EB. A transfer of liability from the project participants to the host country may then take place provided the host country has established that the conditions set out by the 'designated national authority' (DNA) in its letter of approval have been met; and relevant laws and regulations applicable to the geological storage

site have been complied with; and the project participants make financial provision for ongoing costs. Host countries are not, however, under any obligation to accept liability for a geological storage site, although where countries are not willing to take on liability it can be expected to compromise their attractiveness to potential CCS project developers.

For CCS projects which seek to operate for the maximum CDM crediting period of 21 years, and the minimum post crediting CCS monitoring period of 20 years, the project participants will be liable for the storage site for the first 41 years, with liability thereafter resting with the host country.

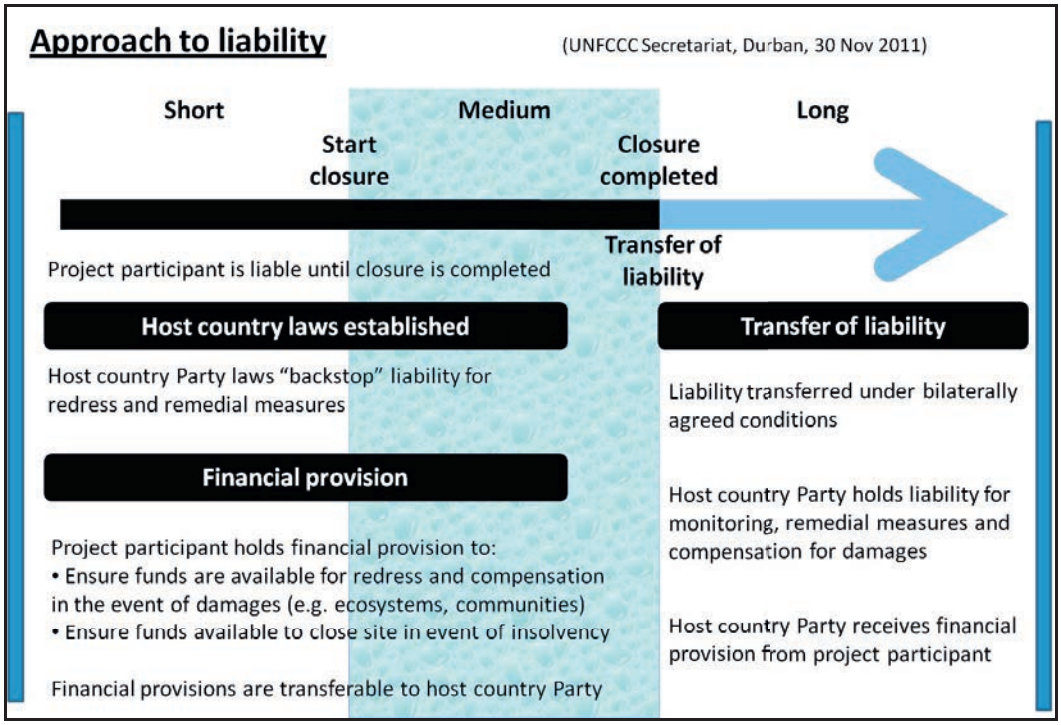

Fig. 2. Approach to liability.

5. Post Durban

While much was decided in Durban there is much still to be done. For example, negotiations excluded one contentious issue which is now the subject of ongoing negotiations, namely the movement of carbon dioxide from one country to another, either above ground or below.

The Durban CCS decision requires adoption of relevant documents to enable CCS projects to be administered and processed under the CDM, including the format for the 'project design document' (PDD) for CCS projects setting out what must be included in submissions, review and assess submitted methodologies, establish accreditation standards for verifiers ('DOEs') and requirements for financial provisions. The May 2012 meeting of the EB in Bonn released a procedure for the submission and consideration of a new baseline and monitoring methodology for CCS CDM project activities [16]; guidelines for completing the project design documents [17]; and a procedure for the submission and consideration of a proposed new baseline and monitoring methodology for CCS CDM project activities [18]. At the same meeting the EB released eight forms for assessment of new methodologies for CCS by

the CCS working group, methodology experts, public comment and DOEs [19]. The July meeting of the EB appointed members to the inaugural CCS Working Group (WG) to prepare recommendations to the EB on submitted proposals for new baseline and monitoring methodologies. The UNFCCC secretariat will publish schedules of the CCS WG meetings and deadlines for submission of proposed new methodologies on the UNFCCC CDM website [20].

6. Conclusions

The Durban CCS decision establishes a practical international standard for managing CCS projects that ensures a high level of environmental protection. It is an important official recognition by the UNFCCC that CCS is a technology capable of achieving deep cuts in greenhouse gas emissions in developing countries and sets an important precedent for the inclusion of CCS projects within emerging international markets and other financing and technology support mechanisms outside the CDM.

At the time of writing no proposals for CCS projects had been submitted to the EB for consideration. This is not surprising as the requirements for submission of CCS projects proposals as CDM activities are extensive, and will take time to address. Moreover, before a host country can sponsor a CCS project it needs to satisfy the EB that adequate domestic CCS legislation and regulations are in place.

However, other factors may also be at play. While CCS projects may now earn CERs through the CDM, the financial reward only comes when the CERs are sold. CCS projects will be competing on international carbon markets with a diverse range of emission reduction activities to sell the CERs generated by their projects. Lowest cost projects will inevitably be the first to be rewarded. Currently, carbon markets are going through a period of uncertainty as the second commitment period of the Kyoto Protocol is negotiated, and the global economy is slowing. While CERs will go a long way to defray the costs of CCS projects, recent market prices for CERs have been too low to encourage many, if any, conventional CCS project proposals to proceed to a commercial footing based on CER financing alone. Additional financial support will still be required for most CCS projects until the market for CERs improves.

The EU decision to only trade in CERs from Least Developed Countries after 2012 is likely to be a setback for the uptake of CCS in certain developing countries, and for CCS in the CDM. The decision demonstrates that carbon markets, and their national sponsors, will have considerable influence over which countries gain financial support for CCS projects through the CDM. On a more positive note, each year more jurisdictions are committing to carbon markets, particularly around the Pacific rim, which should lead to market growth and stability for both the CDM and emerging alternative international markets.

Inevitably, the prices of CERs (or their equivalent) should rise, and as they do, it appears likely that the first CCS projects funded through carbon markets will be those that require little or no CO_2 capture, and minimal transport, e.g. natural gas processing and LNG projects generating high purity CO_2 as a byproduct of their operations [7, 21]. When, and from where, these first projects will emerge is not entirely clear. What is clear is that the CDM has put in place the international legal framework, and the market mechanism, for CCS projects to proceed in developing countries, when the markets are favorable.

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