GLOBAL CCS INSTITUTE

SUBMISSION TO

THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC) SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNICAL ADVICE (SBSTA)

CMP -/.6 Modalities and Procedures for Carbon Dioxide Capture and Storage (CCS) in Geological Formations under the Clean Development Mechanism (CDM)

The comments contained in this paper are independent to the Institute, and do not necessarily represent the collective views of its Membership; nor does it pre-empt the decisions of its Membership on any related matter.

Introduction

The Global Carbon Capture and Storage Institute (the Institute) is pleased to submit its views relating to addressing the issues raised in Decision -/CMP.6 (Paragraph 3) concerning the modalities and procedures (refer to Paragraph 2) for carbon dioxide capture and storage (CCS) under the Clean Development Mechanism (CDM). The Institute is in the process of seeking accreditation under the United Nations Framework Convention on Climate Change (UNFCCC) as an observer, and as such, it recognises that this submission will be treated as having been submitted by a 'non-accredited organisation'.

The Institute is well placed to offer expert views on CCS under the CDM. As a legal not-for-profit entity, the Institute brings together the public and private sectors to build and share the know-how and expertise necessary to ensure that CCS can make a significant impact on reducing the world's greenhouse gas emissions.

The Institute connects parties around the world to solve problems, address issues and learn from each other to accelerate the deployment of CCS projects by:

- sharing knowledge (collecting information to create a central repository for CCS knowledge; and creating and sharing information to fill knowledge gaps and build capacity);
- fact based advocacy (informing and shaping domestic and international low carbon energy policies; increasing the awareness of the benefits of CCS and the role it plays within a portfolio of low carbon technologies); and
- assisting projects (tackling specific barriers, particularly amongst early movers; bridging knowledge gaps between demonstration efforts).

Please refer to the following website for further information on the Institute (http://www.globalccsInstitute.com/Institute).

The Institute also recognises that the Subsidiary Body for Scientific and Technical Advice (SBSTA) has been tasked to further elaborate on the issues raised in Decision -/CMP.6, with consideration for the UNFCCC Secretariat's synthesis report and draft modalities and procedures. This will culminate in SBSTA forwarding a set of recommendations to the 7th meeting of the Conference of Parties (COP) serving as the Meeting of the Parties to the Kyoto Protocol (CMP) for decision.

Overview

The *modalities and procedures* define the rules that govern the CDM. There are currently four sets of modalities and procedures including: for the CDM (Decision 3/CMP.1); for small scale projects (4/CMP.1, Annex II); for afforestation and reforestation (A&R) projects (5/CMP.1); and a simplified version for small scale A&R projects (6/CMP.1). These provide for the integrity of project registration and allow for the subsequent issuance of tradable credits by the CDM Executive Board (CDM EB) – which in turn rewards the abatement associated with the projects.

The Institute considers that to every extent possible, the sufficiency of applying existing CDM modalities and procedures (Decision 3/CMP.1) should be tested before new rules are added. The imposition of additional rules on CCS projects could create a competitive cost

disadvantage for CCS projects relative to other CDM projects. The Institute acknowledges that A&R projects are bound by an additional set of modalities and procedures, and so sets a precedent for this type of consideration under CDM.

To illustrate the reach of the existing CDM modalities and procedures, many of the issues raised in -/CMP.6 are already designated under the role of Designated Operating Entities (DOEs), including: validation (monitoring plans; risk and environmental assessments; measurement and accounting methodologies, etc); verification emission reductions/CO_2 avoided); and certification consistency of Project Design Documents (PDD) to host country laws and claims for the purposes of the CDM EB consideration and registration).

Many of the procedures required to include CCS under CDM are already in place. An exception is the requirement to monitor and verify the integrity of the storage site outside of the agreed crediting period. Decision 3/CMP.1 does not provide for this, as cited in the EB50 Report, Annex 11, Page 3.

Given that host parties remain obligated to comply with their commitments under the UNFCCC beyond the scope of any registered CDM project life, consideration should be given to strongly mitigating and remedying CCS related issues through the conditions placed on CCS projects by sovereign host governments (primarily on a fit for purpose basis), rather than in an overly prescriptive way under the CDM's modalities and procedures. This implies that host governments need to have in place effective regulatory frameworks and/or governance arrangements capable of supporting the deployment of CCS projects, and complying with the CDM's modalities and procedures.

The Institute considers it to be in all CDM stakeholder interests (including: emitters; project proponents; market participants; Parties; UNFCCC governing bodies; and civil society) to be satisfied with the rules of inclusion for CCS under CDM, and potentially other UNFCCC mechanisms. Similar to Australia's conclusions in its submission to the 32nd session of SBSTA (refer to http://unfccc.int/resource/docs/2010/sbsta/eng/misc02.pdf), the Institute considers that CCS can be readily accommodated within the CDM and all issues raised in Paragraph 2 and 3 of Decision -/CMP.6 addressed, on the basis of already established technical and scientific data and analysis, methods and expert advice.

Table 1 of this submission outlines further the Institute's views on how many of the identified issues can be best managed. For example, the modalities and procedures can be managed either on a 'best practice' basis (refer to columns 3 and 4), and/or left to host governments to address within their domestic legal and regulatory CCS regimes (refer columns 2 and 3).

There are some 235 commercial scale CCS projects in various stages of planning around the world – this is an increase of about 12 per cent when compared to the previous year. About 77 of these projects are considered large scale integrated investments (LSIPs), which individually aim to capture at least 0.8 million tonnes (Mt) of greenhouse gas emissions (CO_2–e) annually for coal fired power generation, and 0.4MT of CO_2–e annually for other industrial facilities. It is the fleet of LSIPs that are substantively informing the CCS community on how to mitigate and remedy associated project risks, and enhance the global potential to materially reduce the cost of CCS deployment.

When operational, LSIPs will not only make an immediate and positive step change to the global emissions profile, but will also support the attainment of a more sustainable future from an environmental, energy and economic perspective.

The International Energy Agency (IEA) identifies CCS as a crucial technology in the least-cost portfolio of technologies required to reduce energy related emissions in line with global climate stabilisation targets. To reach its emissions reduction potential, CCS must move rapidly from its current research and demonstration phase into large-scale, commercial deployment in all parts of the world, with around 100 CCS projects to be implemented by 2020, and over 3,000 by 2050. Of particular relevance is the IEA's indication that about 65 per cent of these projects in 2050 will need to be located in non-OECD countries (ie. the developing world).

Role of sovereign decision making

The Institute notes that while it is the Parties (sovereign governments who have ratified the Kyoto Protocol) that authorise legal entities such as companies to participate in the CDM, the ultimate responsibility for complying with and meeting the commitments of the UNFCCC rests with governments, and not with the legal private entities (refer Decision -/CMP.1, Paragraph 33).

The CDM inevitably impacts upon, and is impacted by, the domestic laws of the Parties involved. It is anticipated that most host countries would treat CCS projects in essentially the same way as other large scale infrastructure projects for the purposes of assessment. This means that domestic laws (with due consideration for international and regional arrangements) govern: (a) the content and application of all regulatory assessments (health, safety and environment - HSE); (b) all HSE regulatory approvals required to carry out the project activity including licenses, operating permits, planning permits etc; and (c) all regulatory restrictions imposed on projects including pollution controls, biodiversity etc.

For projects to receive Certified Emission Reduction units (CERs) however, they also need approval by the CDM EB to ensure that they fully comply with the CDM rules. Decision -/CMP.6 stipulates the elaboration of a number of minimum information requirements that host countries would need to consider when approving projects. If adopted by CMP, host countries would need to embed these standards into their domestic laws for the purposes of accessing CDM credits, as legally bound by their ratification of the UNFCCC and Kyoto Protocol. Breaching these and other international treaty obligations could make Parties liable to pay compensation to other countries, especially in regards to say transboundary issues.

This means that a host country's domestic law must therefore provide for: (i) approval of the implementation of CCS projects in accordance with the CDM rules, including the modalities and procedures; and (ii) a regulatory environment consistent and/or compatible with delivering on the criteria and conditions established under the CDM rules.

The CCS under CDM modalities and procedures provide guidance to host country CDM authorities (government agencies known as Designated National Authorities (DNAs)) on their responsibilities (to assess projects) and functions (to authorise projects) in regards to compliance with the CDM rules. This includes confirmation that the proposed CDM project is voluntary and can contribute to the host country's sustainable development, in accordance with the broader objectives of the CDM.

While the relationship between CDM rules and domestic law can be ambiguous, the rules of CCS under CDM (including the modalities and procedures) should seek to complement and

inform sovereign decision making in regards to legislation and supporting regulations rather than impose prescriptive requirements.

As such, the Institute recommends that a one-size-fits-all approach should be avoided where possible, and that a fit for purpose approach be adopted where appropriate, given the site specific nature of their storage solutions. Most of the issues raised in -/CMP.6 will be addressed in the PDD – and subsequently considered by the Designated National Authority (DNA) prior to being forwarded to the CDM EB for approval registration.

Depending on the system of government, CCS regimes for onshore geological storage are often enacted at a sub-national level, by non-liable Parties under the Kyoto Protocol, while national governments usually have responsibility for offshore geological storage. Regardless, adoption of the modalities and procedures for CCS project activities by Parties should aim to enhance the ability of both national and sub-national governments to put in place adequate, consistent and/or compatible regulatory frameworks (including measurement, monitoring and verification regimes) to give CCS projects a 'social license' to operate by ensuring the integrity of environmental, health and safety outcomes.

Over the short to medium term, private and public partnerships will be at the core of financing, deploying and operating CCS projects. Accordingly, the CDM rules should aim to strike a balance between ensuring a sufficient quality of information is generated by project proponents on which to base considered decisions by host countries and the CDM EB; while avoiding imposing overly burdensome requirements on CCS project proponents, thereby and creating additional barriers to deployment. This is especially important given the high costs, including time, of undertaking regulatory assessments for projects for which an environmental impact assessment would likely cover most of the issues raised in -/CMP.6.

Over the longer term this will trend more towards industry responsibilities. As such, it is critical that CDM methodologies and procedures can provide for a commercial CCS pathway, noting that a pre-commercial project today will inevitably become a commercial project for most of its 40+ year economic life. This needs to also include recognition that over the long term, the liability of any CCS project will most probably rest with government, and whether this is with the host country or the project proponent's country should largely be a matter for the respective Parties to negotiate (including provisions).

Support mechanisms

A flexible approach to CCS related modalities and procedures is also important over the short to medium period (2011–2020) given the demonstration nature of many CCS projects currently in the planning stage. A one-size-fits-all approach to CCS related modalities and procedures is unlikely to adequately: (i) characterise all associated environmental matters; (ii) specify exhaustive and appropriate site specific monitoring regimes; (iii) provide for streamlined regulation and/or governance arrangements in host countries, including permitting arrangements; (iv) provide the flexibility to proponents to shift project risk to the private sector through risk hedging products and services; or (v) give effect to commercially attractive CCS projects and mitigation efforts.

Indeed, the EB26 Meeting Report (Annex 13, Page 5) notes that the monitoring of geological CCS projects may require a process adapted to the unique, evolving circumstances of this project type, as well as the heterogeneity of storage sites. Similar to site selection criteria,

developing and reviewing monitoring approaches for CCS (whether discrete methodologies or general guidance) requires specialized expertise, and a balance between general prescription to ensure integrity, and site-specific flexibility to recognize the evolving and diverse possibilities for monitoring techniques, and the geological uniqueness of each storage site.

The Institute considers that a fit-for-purpose approach can appropriately and sufficiently provide for accurate, conservative, relevant, credible, reliable, complete, and verifiable data to support monitoring plans and measurement methodologies (refer EB55 Report, Chapter II – 'validating and verifying information provided by project participants').

The PDD will be the vehicle for addressing the methodological remedies and redressing associated risks identified in Decision -/CMP.6. The information contained within this document ultimately falls to accredited DOEs to validate, verify and certify – the integrity of the DOEs is paramount to the successful deployment of CCS projects in developing countries, and so they will need to be able to demonstrate a very high technical competence in the field of CCS deployment.

As such, according to the modalities and procedures DOEs are charged with the responsibility for ensuring that project proponents have adequately addressed the following issues in a PDD:

- community acceptability of the PDD by soliciting public comments and outlining how these have been subsequently considered;
- submission of an environmental impact assessment (EIA) in accordance with requirements of the host country (including transboundary impacts);
- emission reductions are additional to what would have occurred in the absence of the project;
- baseline and monitoring methodologies comply with CDM EB requirements (including modalities and procedures of a new methodology);
- monitoring, verification and reporting are consistent with the Kyoto Protocol's requirements (including Decision 17/CP.7 (refer FCCC/CP/2001/13/Add.2));
- all necessary governance approvals (including host government requirements such as approval from the DNA);
- legitimacy of proposed baseline establishment;
- a 'crediting period' is selected (ie. timeframe where the project can generate CERs);
- adjustments are made to emission estimations for leakage;
- project boundaries include all emission sources under the control of the project participant;
- a monitoring plan is included covering: all data for estimating/measuring emissions over the crediting period and within project boundaries; all data for determining the emission baseline over the crediting period and within project boundaries; all potential sources and actual data on emissions outside the project boundary that are reasonably attributable to the project over the crediting period; quality assurance for CDM EB approved monitoring processes; procedures for calculating emission by sources and leakage of the project; monitoring reports in accordance with the monitoring plan for the purposes of verification and certification);

- project verification (independent review of the monitored emission reductions over the credited period) and certification (written assurance that emission reductions have been verified); and
- the request for the issuance of CERs to the CDM EB (and registry).

The CDM modalities and procedures (Decision -/CMP.1, Appendix C) already include stringent rules for baseline establishment and monitoring methodologies, which is supported by a comprehensive 'validation and verification manual' (refer EB55 Report; Annex 1).

The Institute considers that many of the issues associated with the application of CCS under CDM are relevant to all potential support mechanisms, including the Kyoto Protocols' Joint Implementation (JI) and International Emissions Trading (IET). While the CDM and JI adopt a baseline-credit accounting framework, and the IET a cap and trade framework, the Institute considers that the international acceptance of systematically including CCS under CDM may address the institutional arrangements needed to underpin the inclusion of CCS under any mechanism, including any future non-tradable arrangements.

The integrity and robustness of the CDM rules for projects generating CERs are vitally important to provide market participants with the confidence to engage, and to avoid distorting the supply and market price of CERs by under- or over- estimating the amount of abatement rewarded. This is because CERs are additional to the fixed quantum of Assigned Amount Units (AAUs) tradable under the IET. This applies as much to CCS projects as it does all CDM project activities – especially A&R which has to address many similar categories of issues to CCS such as permanency and long term contingent liabilities, but for which fundamentally differs in nature (ie. forestry sequestration is inherently short term whereas geological sequestration is very long term).

In 2001 (Marrakech Accords) Decision 17/CP.7 (Paragraph 10.b), the COP tasked SBSTA to develop definitions and modalities for including A&R project activities under CDM, taking into account the issues of: non-permanence; additionality; leakage; uncertainties and socio-economic and environmental impacts including impacts on biodiversity and natural ecosystems. Consequently, in 2005 the modalities and procedures (including a simplified version for small scale projects) governing the inclusion of A&R under CDM were adopted (refer Decision 5/CMP.1).

The inclusion of a CCS project under a cap and trade scheme (such as IET) differs to that of a baseline-credit (such as CDM) in that under the former, the emissions that are captured, injected and geologically stored do not count towards an originating entity's gross carbon liability as they are not released to atmosphere. Liability would arise however for all fugitive emissions (leakage) within the CCS system (and permits acquired and acquitted) – including from capture, transport, injection and storage. The likelihood of rising carbon prices over time, driven by increasingly stringent carbon constraints, serves as an effective incentive to operators to preserve the integrity of the stored emissions, as they would otherwise be treated as point source emissions and subjected to carbon liabilities.

Consistent with the CDM's *Validation and Verification Manual* (EB55 Report, Annex 1, Chapters II and III), the principles of: accurate; conservative; relevant; credible; reliable; consistent; transparent, and impartial can and should be applied to the data requirements underpinning the CDM modalities and procedures. This provides for added confidence in the CER trading markets extending beyond the CDM into broader national carbon trading

schemes, as well as facilitating trade in inputs such as equipment, services and expertise needed to deploy CCS at a localised project level.

CCS under UNFCCC

CCS has been explicitly recognised by the UNFCCC as a legitimate mitigation option since the Kyoto Protocol was adopted in 1997. Article 2.1.a.iv of the Kyoto Protocol states that Parties will 'implement and/or further elaborate policies and measures in accordance with its national circumstances, such as research on, and promotion, development and increased use of … carbon dioxide sequestration technologies …'.

This was supported in 2009, when the CMP formally recognised the importance of CCS as a mitigation technology (Decision 2/CMP.5) and again in 2010, when CCS was recognised as 'a relevant technology for the attainment of the ultimate goal of the Convention' (Decision -/CMP.6).

CCS under CDM

As indicated in -/CMP.6, the CMP has sought on a number of occasions further guidance relating to CCS under the CDM. In 2005, it specifically sought guidance from SBSTA (including a submission process) on project boundaries, leakage and permanence issues (Decision 7/CMP.1, Paragraph 5), with a view to making recommendations to the CMP-2.

In 2006, SBSTA was tasked to provide further guidance (including a submission process) on the methodological and accounting issues of CCS under CDM (Decision 1/CMP.2), after the CMP noted the Methodology Panel of the CDM Executive Board recommendations that the three proposed methodologies for CCS project activities at that time did not adequately address these issues in an appropriate manner (refer EB26 Meeting report, Annex 13).

The EB26 report divides the issues into: (i) methodological issues that are comparable to other CDM projects; and (ii) issues that extend beyond this scope. The first category presents comparable challenges to other CDM project activities. The latter of these categories – the issues that 'lie at the frontier of scientific knowledge and engineering practice' present the bulk of the discussion for the CCS modalities and procedures.

See Attachment 1 for a summary of the issues identified in the EB26 report.

Much has been done since 2006 to address these issues both within, and independently of the UNFCCC processes. The Institute believes that sufficient technical and scientifically valid analysis, methodology and procedures exist to address them appropriately.

Importantly, the EB26 report noted that it is important that the technical and methodological issues, in particular the suitability of storage sites, be resolved on the basis of policy and legal guidance, in particular on acceptable levels of long-term leakage (escape of CO_2 from project boundaries) and seepage (escape of injected CO_2 from storage reservoirs) risk and uncertainty. This suggests that due recognition must be given to the rights of sovereign decision making in the development of CCS modalities and procedures.

In 2006, CMP subsequently identified a range of issues (Decision 1/CMP.2) requiring further guidance from SBSTA with a view to submitting recommendations for consideration at CMP-3, for decision at CMP-4 (see Attachment 2 for a summary list of these issues).

In 2008, the CDM EB was tasked by the CMP (Decision 2/CMP.4, Paragraph 41) to further assess the implications of the possible inclusion of CCS as a CDM project activity, taking into account technical, methodological and legal issues, with a view of reporting back at CMP-5. The EB subsequently commissioned an expert report (refer EB49 Annex 4; EB50 Report Annex 1 and 11) on the possible implications of including CCS as a CDM project activity.

The report generally found (as summarised by the Institute) that:

1. CCS as CDM can provide real, measurable and long term emission reductions compatible with the Modalities and Procedures of the CDM;
2. the options to resolve the issues above have already been considered comprehensively in two UNFCCC Synthesis Reports (FCCC/SBSTA/2008/INF.1 and FCCC/SBSTA/2008/INF.3);
3. the IPCC Special Report on Carbon Dioxide Capture and Storage (IPCC-SR) concludes the fraction of carbon dioxide (CO_2) retained is very likely to exceed 99 per cent over 100 years, and is likely to exceed 99 per cent over 1000 years (based on appropriate site selection);
4. IPCC-SR also concludes that the risk of seepage is expected to decrease over time with the gradual onset of trapping mechanisms;
5. given the site specificity or differentiated nature of CCS projects, the issue of effective long term emission reductions (permanence) is a risk management issue that can be mitigated through effective storage site selection including characterisation, selection and management of the site;
6. there are few apparent technical barriers to CCS deployment, but there are methodological issues such as site characterisation, risk management, monitoring, measurement and verification (MMV), and reporting; and
7. CMP should further clarify how the UNFCCC process can support the development of regulatory capacity in potential host countries for CCS CDM project activities.

In 2009, the CMP again tasked SBSTA to provide further guidance on a list of issues (2/CMP.5, Paragraph 29) with a view to a decision at CMP-6. While similar to the list of technical, legal, methodological issues outlined in -/CMP.2 (see above), they included:

a. non-permanence, including long-term permanence;
b. measuring, reporting and verification;
c. environmental impacts;
d. project activity boundaries;
e. international law;
f. liability;
g. the potential for perverse outcomes;
h. safety; and
i. insurance coverage and compensation for damages caused due to seepage or leakage.

The draft conclusions proposed by the Chair of SBSTA (FCCC/SBSTA/2010/L.11) to CMP again reiterated that the careful selection of the storage site is key to addressing issues related to permanence of storage, liability, the international legal framework and environmental impacts, including transboundary impacts.

In 2010, CMP formally adopted CCS as an eligible project activity under CDM (Decision -/CMP.6) provided that a range of issues can be addressed in the modalities and procedures (listed in paragraph 3 of -/CMP.6).

a. **storage site selection** (needing stringent and robust criteria to ensure integrity of permanence) – to be adopted by the CMP (see bullet point d);
b. **stringent monitoring plans** (to enhance environmental integrity of the storage site);
c. **suitability of modeling for monitoring plans** (to meet stringency requirements);
d. see bullet point (a);
e. **project boundaries** (comprehensive definition including: capture; transport; injection; storage; for all associated CO_2 sources; and all potential migratory pathways) – and clearly identified (see bullet point f);
f. see bullet point (e);
g. **all emissions** bounded by (d) **to be measured and accounted for** in monitoring plans (including independently verified continuous measurement of reservoir pressure);
h. the appropriateness and implications of **transboundary projects** to be assessed;
i. see bullet point (g) including ex-ante (ie. upfront) estimation of likely emission leakage;
j. **risk and safety assessment** (methodology specified in monitoring plans and to include independent assessment of socio-environmental impacts; as well as assessments of risk; and proposals to mitigate any leakage of emissions);
k. see bullet point (j), risk assessment to include: **leakage** (for all boundaries – see bullet point (e)); **non-leakage** (including: seepage; lateral flows; underground water dissolution); and **non-technical** (such as consequences of the impact from – including 'massive and catastrophic' – releases on: human health; ecosystems; and consequences for climate change);
l. results from bullet points (j) and (k) to be considered when assessing the technical and environmental viability of CCS projects;
m. **liability** from [leakage; seepage; induced seismicity; geological instability; or any other damage to: property; environment; health] **over the periods** [during and after the crediting period];
n. determine **provisions to redress** liability [for Parties; communities; private sector entities; individuals] with clear **identification** [of all liable entities] and including **allocating** liability [among entities that share the reservoir] with a view of **possibly transferring** liability [at end of crediting period or any other time] including **State liability** [affording redress to all potential liabilities mentioned above]; and
o. bullet point (n) needs to be **'adequate'** for restoration of damaged ecosystems; and **fully compensate** affected communities – and must be **'established' prior to** CCS deployment.

Addressing the issues in Decision -/CMP.6

As stated previously, much work has been done over the period between 2005 and 2010 to address the issues listed in Paragraph 3 of -/CMP.6.

The Institute acknowledges a large number of published peer reviewed expert reports that contain approaches and recommendations to address and/or redress issues contained in Decision -/CMP.6. These documents include (among others):

Parties

- DIRECTIVE 2009/31/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 *on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006*;
- London Protocol: *Risk Assessment and Management Framework for CO_2 sequestration in sub-seabed structures*; LC/SG-CO2 1/7, annex 3; and
- Ministerial Council on Mineral and Petroleum Resources (MCMPR): *Australian Regulatory Guiding Principles – Carbon Dioxide Capture and Storage* (2005).

UNFCCC

- UNFCCC Experts Report: [*Possible*] *Implications of the Inclusion of Geological Carbon Dioxide Capture and Storage as CDM Project Activities* (EB49 Report, Annex 4 and EB50 Report, Annex 1 and 11) (2009)
- UNFCCC (FCCC/SBSTA/2008/INF.1): *Synthesis of views on issues relevant to the consideration of CCS in geological formations as CDM project activities. Note by the secretariat* (SBSTA-28, 2008); and
- UNFCCC (FCCC/SBSTA/2008/INF.3): *Synthesis of views on technological, methodological, legal, policy, financial and other issues relevant to the consideration of CCS in geological formations as CDM project activities. Note by the secretariat* (SBSTA-29, 2008);
- EB55 Report: *CDM: Validation and Verification Manual;*
- UNEP (and Baker and Mackenzie): *Implementing CDM Projects – A Guidebook to Host Country Legal Issues* (2009).

Intergovernmental agencies

- Intergovernmental Panel on Climate Change (IPCC): *Special report on Carbon Dioxide Capture and Storage* (2005);
- IPCC: *Guidelines for National Greenhouse Gas Inventories* (Volume 2, Chapter 5) (2006);
- International Energy Agency Greenhouse Gas R&D Programme (IEAGHG): ERM – *Carbon Dioxide Capture and Storage in the Clean Development Mechanism* (2007);
- IEAGHG: *Geological Storage of CO_2 - Staying Safely Underground (*2008).
- International Energy Agency (IEA): *Carbon Capture and Storage – Model Regulatory Framework* (2010);
- IEA: *Carbon Capture and Storage – Legal and Regulatory Review, Edition 1 (2010); and*
- IEA-OECD: *Carbon Capture and Storage in the CDM* (2007).

Non-government organisations

- World Resources Institute (WRI) with support from the Institute: *Carbon Dioxide Capture and Storage and the UNFCCC* (2010); and
- WRI: *Guidelines for Carbon Dioxide Capture, Transport, Storage* (2008).

Table 1 (below) serves to illustrate the nature of the issues raised in previous CMP decisions (CMP.2; CMP.5; and including -/CMP.6) identified as needing to be addressed and/or redressed. It is the Institute's view that many of these issues can be resolved over the short term (as indicated in column 5); and addressed through either: (i) a policy oriented approach such as the establishment and adoption of best practice guidelines and/or suggested methodologies, potentially contained in the modalities and procedures (as indicated in columns 3 and 4); or (ii) by host country's embedding them within their domestic legal and regulatory regimes (as indicated in columns 2 and 3).

As such, the 'methodologies' (see column 3) lend themselves to being applied either on a non-mandated 'best practice' basis and/or on a more legally prescriptive basis. The black ticks in column 3 indicate those methodologies for which the Institute considers can be best addressed on a non-mandated basis, and the mauve ticks indicate the Institute's preference for a more prescriptive application.

Table 1 – Timeframe and approach to issues raised in CMP decisions

		column 1			column 2	column 3	column 4	column 5
		UNFCCC References			DOMESTIC LAW	METHODOLOGY	BEST PRACTICE	LIKELIHOOD OF ADDRESSING (in 2011)
		CMP.2	CMP.5	CMP.6				
1	permanence	a	a		✔	✔		●
2	risk of leakage	a		j, k		✔	✔	●
3	project boundaries	b	d	e	✔	✔	✔	●
4	transboundary projects	b		h	✔			●
5	monitoring (including methodologies and plans)	c		b	✔		✔	●
6	remediation measures	c			✔			●
7	liability	d	f	m, n, o	✔			●
8	accounting options for seepage	e		g		✔	✔	●
9	site selection (including criteria)	f		a		✔	✔	●
10	leakage pathways	g		k		✔	✔	●
11	operation of reservoirs	h				✔	✔	●
12	other matters - environmental impacts	i	c	k	✔	✔	✔	●
13	potential for perverse outcomes		g				✔	●
14	measuring; reporting and verification (MRV)		b		✔		✔	●
15	international law		e		✔			●
16	safety		h	j	✔	✔	✔	●
17	insurance cover (including compensation)		i		✔	✔	✔	●
18	modelling (for monitoring purposes)			b	✔	✔	✔	●

● DONE
● HIGH
● LOW

This supports the Institute's view that:

- to every extent possible, the sufficiency of applying existing CDM modalities and procedures (Decision 3/CMP.1) should be tested, as the imposition of additional rules on CCS projects could impose competitive cost disadvantages relative to other CDM projects; and
- where appropriate, a fit-for-purpose approach can sufficiently provide for: accurate; conservative, relevant, credible; reliable; complete; and verifiable monitoring plans and measurement methodologies.

Table 2 (below) illustrates a non-exhaustive catalogue of remedies already deliberated within the UNFCCC. These are clearly matters for: SBSTA to further elaborate; Parties to negotiate; the CDM EB to recommend; and the CMP to decide.

Table 2 – Summary of EB49 (Annex 4) and EB50 (Annex 1 and 11) Reports

		UNFCCC REFERENCES			EB49/EB50 FINDINGS (NON-EXHAUSTIVE SUMMARY ONLY)	ADDITIONAL REFERENCES
		CMP.2	CMP.5	CMP.6		
1	permanence	a	a		**According to the IPCC SR, storage could become more secure over longer time due to these trapping mechanisms and CO_2 could be retained for up to millions of years. (EB49 p22; EB50 p33)** CCS projects differ from other CDM activities in one fundamental way; the potential for long term seepage of CO_2 will by far outlast the CDM project crediting period. (EB49 p29) The First and Second UNFCCC Synthesis Reports reflect a broad agreement in Parties submissions that site characterisation and selection is the most critical element in ensuring long-term or permanent CO_2 storage. (EB49 p8) In an appropriate geologic storage formation, CO_2 is held in place by one or more of several trapping mechanisms, depending on geology and time ... these types of trapping mechanisms have retained buoyant gases in geological formations for millions of years. (EB49 p21; EB50 p31)	FCCC/SBSTA/2008/INF.1 and F.3
2	risk of leakage/seepage	a		j, k	**The 2006 IPCC Guidelines state that its Tiers 3 methodology can be implemented to support zero emission estimates from appropriately selected and managed CO_2 storage sites. (EB49 p32; EB50 p48)** All the evidence and expert judgement suggests (IPCC SR, 2006 IPCC GHG Guidelines, etc) that with appropriate site selection and operation, this risk should be extremely small. (EB49 p32; EB50 p48) The IPCC has assessed minimum expected CO_2 retention levels for appropriately selected and managed formations and concludes, based on observations and analysis of current CO_2 storage sites, natural systems, engineering systems and models, that the fraction retained is very likely to exceed 99% over 100 years, and is likely to exceed 99% over 1000 years. (EB49 p7)	IPCC-SR
3	project boundaries	b	d	e	**There is clarity amongst Parties on all the aspects of a CCS project which should be included within the project spatial boundary, i.e. all aspects from capture, transport and storage. (EB49 p11; EB50 p46)** Spatial boundaries: all aspects from capture, transport and storage; all above ground and below ground components. (EB49 p31) Temporal boundaries: in the crediting period and after project closure until evidence indicates that the CO_2 plume is stabilising at its long term distribution, and even potentially after liability transfer to a host country. (EB49 p31)	
4	transboundary projects	b		h	**The 2006 IPCC Guidelines provide guidance on the responsibilities in terms of reporting emissions from storage which crosses national boundaries (e.g., the Second Synthesis Report, paragraph 64). (EB p34; EB50 p46)** Due to the additional legal implications for cross-border storage it is suggested that CCS projects in the first and a second commitment period would be limited to take place within national boundaries and with no risk of migration across national boundaries. (EB49 p13) In terms of offshore storage, the London Protocol Article 6 currently prohibits cross-boundary transport of CO_2 for geological storage in the marine area. There is currently proposed amendment to the London Protocol Article 6 to provide for this. (EB p34; EB50 p51)	IPCC-G

		UNFCCC REFERENCES CMP.2	CMP.5	CMP.6	EB49/EB50 FINDINGS (NON-EXHAUSTIVE SUMMARY ONLY)	ADDITIONAL REFERENCES
5	monitoring (including methodologies and plans)	c		b	**The 2006 IPCC Guidelines are non-prescriptive on monitoring techniques because it is recognised that every storage site is geologically different and that different monitoring techniques have different applicability for different geological situations. This means that the monitoring programme and techniques selected for any CCS project activities under the CDM should be determined by the ex ante site characterisation and modelling of the CO_2 behaviour and will therefore be site specific. (EB49 p9; EB50 p42)** A framework for monitoring of geological CO_2 storage projects is provided in the 2006 IPCC Guidelines. In addition, experience of monitoring geological CO_2 storage is accumulating from existing research and demonstration activities. (EB49 p9; EB50 p42) New Monitoring Methodologies would need to be created for any CCS project activities under the CDM, and it is recommended that all CCS Monitoring Methodologies should follow the same four objectives of performance monitoring, seepage detection, seepage quantification and seepage impact assessment, with the latter two objectives only being triggered if leakage is detected or suspected from the monitoring results of the first two objectives. (EB49 p9; EB50 p43) Different monitoring techniques have different applicability for different geological situations, which means that there should be flexibility in the monitoring programme details, whilst setting the overall objectives. This allows the most appropriate monitoring techniques to be selected for each site. (EB49 p28) The level of monitoring can be reduced if evidence indicates the CO_2 is approaching its predicted long term distribution with no suggestion of potential seepage. (EB p29; EB50 p43)	IPCC-G EU ETS Monitoring and Reporting Guidelines for CCS EU Directive
6	remediation measures	c			**The IPCC SR provides an overview of remediation options for a range of seepage scenarios. (p9)** Possible remediation measures are furthermore highlighted by the two Synthesis Reports. These techniques could involve standard well repair techniques or the extraction of CO_2 by intercepting its leak into a shallow groundwater aquifer. (EB49 p9)	IPCC-SR FCCC/SBSTA/2008/INF.1 and F.3
7	liability	d	f	m, n, o	**Liability for safety and environmental damage should be dealt with through appropriate national regulations, although compensation arrangements can be included in the project design. (EB49 p12)** During the crediting period of a CCS project under the CDM, the liability for CO_2 seepage should reside with the operator. The 2006 IPCC Guidelines established the principle that CO_2 transferred to a CO_2 storage site counts as not emitted. If there is subsequent seepage emissions from storage, then the storage operator has to surrender emission allowances equivalent to the seepage amount (in the short and long-term). (EB49 p13) It is likely that the host country will ultimately assume long term liability, as they have responsibility in terms of regulatory approval, site ownership and jurisdiction over the site. The risk can be reduced or removed from host countries with the use of a broad range of options (instruments such as long-term financial bonds or insurance or contractual arrangements with the project operator). Given the limited number of projects likely to be deployed in developing countries during the first and a second commitment periods, it is suggested that host countries should be allowed to choose their liability transfer and funding mechanisms. It is recommended that the DOE and the CDM EB would need to be satisfied with the outline arrangements to undertake liability transfer, which should be detailed in advance in the post-closure plan in the PDD. (EB49 p12) It is recommended that the structure of liability provisions needs to be practical and predictable for both project developers and the international GHG market. (EB49 p49) It is important ... to cap the residual liability on the requirement to purchase any CERs in the event of seepage emissions ... (otherwise) investment decision-making would be impossible as the project would involve the taking-on of unquantifiable contingent liabilities, which would be commercially unworkable. (EB49 p49)	FCCC/SBSTA/2008/INF.3

		UNFCCC REFERENCES CMP.2	CMP.5	CMP.6	EB49/EB50 FINDINGS (NON-EXHAUSTIVE SUMMARY ONLY)	ADDITIONAL REFERENCES
8	accounting options for seepage	e		g	**Methods for estimating emissions under the various categories of: (a) fugitive emissions (above ground physical leakage of CO_2 from the capture, transport and injection system); (b) seepage emissions (gradual long-term physical leakage from the storage site); (c) storage site breach (sudden release of CO_2 from the storage site) are provided in the 2006 IPCC Guidelines. (EB49 p25)** **Indirect emissions (resulting from the use of energy for the CCS project) can be estimated by standard approaches already applied under the CDM. (EB p25)** The primary measurements of CO_2 quantity are likely to be made using mass-balance measurement techniques, which will determine overall net fugitive emissions from the transport and injection stages and the quantities of CO_2 injected to storage. (EB p29) If seepage occurs during a crediting period, these emissions can be monitored and reported as Project Emissions. (EB p48)	IPCC-G
9	site selection (including criteria)	f		a	**A recommended approach to site characterisation and selection is contained in IPCC-G. (EB49 p8; EB50 p35)** Detailed characterisation including identifying and quantifying relevant properties of the formation, determining its capacity to trap CO_2 and assessing site-specific risks of potential long-term seepage is a requirement for appropriate site selection. Techniques developed for the exploration of oil and gas reservoirs, natural gas storage sites and liquid waste disposal sites are suitable for characterizing geological storage sites for CO_2. (EB49 p7; EB50 p35)	IPCC-SR IPCC-G London Protocol (Amendments) OSPAR Convention
10	operation of reservoirs	h			**The IPCC SR provides detailed descriptions of relevant parameters to monitor as well as applicable monitoring techniques, including, injection rate and injection well pressure, repeated seismic surveys for tracking the underground migration of CO_2, sampling of groundwater and the soil between the surface and water table for directly detecting CO_2 seepage, and CO_2 sensors at the injection wells for detecting seepage. (EB49 p25; EB50 p36)** Proper management of CCS projects is of utmost importance in minimising fugitive emissions from CO2 capture, transportation and injection as well as seepage and, furthermore, the importance of appropriate monitoring programmes and approaches related to prevention of fugitive emissions and seepage. (EB49 p25) The IPCC SR states that careful storage site selection, design and operation, together with methods for early detection of seepage, are effective ways of reducing hazards associated with diffuse seepage. Geological storage projects should always be selected and operated to avoid seepage. However, in the event seepage should occur remediation techniques are available to stop or control them. (EB49 p25; EB50 p36)	IPCC-SR
11	other matters - environmental impacts	i	c	k	**A process for defining the potential environmental, health and safety impact assessment of a CCS project activity under the CDM has been proposed - IEA Greenhouse Gas R&D Programme, "ERM Carbon Dioxide Capture and Storage in the clean development mechanism", 2007/TR2, April 2007. (EB49 p37)** It is recommended that the Environmental Impact Assessment carried out for each potential CCS project under the CDM, albeit governed by national regulations, should be based on the risk assessment procedure that should be outlined in any CCS CDM methodology and PDD. (EB49 p13; EB50 p36) Impacts of CCS projects on the environment and human health are ... linked with the overall characteristics of CCS projects and are independent of whether they are implemented as a CDM project activity or not. However the prevention and the treatment of potential environmental impacts if CCS projects are implemented under the CDM should be treated in the same way as for other CDM project activities. (EB49 p35)	National Regulations IEAGHG IEAGHG Risk Assessment Network database

		UNFCCC REFERENCES CMP.2	CMP.5	CMP.6	EB49/EB50 FINDINGS (NON-EXHAUSTIVE SUMMARY ONLY)	ADDITIONAL REFERENCES
12	potential for perverse outcomes		g		Need to avoid potential perverse incentives for technologies with higher emissions, and to ensure that emissions from additional fuel used in CCS projects are taken into account.	Synthesis Report 1, p8
13	measuring; reporting and verification (MRV)		b		**The 2006 IPCC Guidelines provide guidance on the responsibilities in terms of reporting emissions from storage which crosses national boundaries (e.g., the Second Synthesis Report, paragraph 64). (EB49 p34)** **An example of how to apply a conservative principle [for accounting purposes] is provided by the EU ETS Monitoring and Reporting Guidelines for CCS. (EB50 p44)** The methodology provided by the IPCC **(a Tier 3 methodology based on site characterisation, modelling and monitoring)** states that zero seepage can be assumed for appropriately selected and managed sites if the evidence from modelling and monitoring indicates so. This methodology for monitoring and verification could also be applied to CCS project activities under the CDM. (EB49 p9; EB50 p42) There are a range of available measurement techniques for detection and quantification of seepage from geological storage, although their accuracy is site and situation specific. (EB49 p25-26) Monitoring activities carried out by the host country could be reported in its National Communications to the UNFCCC, following IPCC Guidelines applicable at the time. (EB49 p31)	IPCC-SR IEAGHG FCCC/SBSTA/2008/INF.1
14	law		e		**There needs to be a sufficient regulatory framework in place in the host country to control the project, and appropriate regulatory approvals given to the particular project. (EB49 p31)** **CCS can be assumed to be not incompatible with the Kyoto Protocol. (EB49 p34)** Regulation of CCS in the host country with an appropriate regulatory body to administer it is highly important. It is recognised that it may take time and resources for a host country to develop regulation to the degree and detail that exists in the examples mentioned and support to facilitate such developments may be considered. (EB49 p31) For example, an International framework for best practice could be established. (EB49 p31) Under the Kyoto Protocol (international law), emission reductions are to be real, measurable and of long term benefit (Article 12 of the Kyoto Protocol, paragraph 5). There should also be legal clarity over ownership of the pore space that is to be used for the CO_2 storage. (EB49 p34) In terms of offshore storage, the London Protocol Article 6 currently prohibits cross-boundary transport of CO_2 for geological storage in the marine area. There is currently proposed amendment to the London Protocol Article 6 to provide for this. (EB49 p34)	IEA Regulatory Review London Protocol Kyoto Protocol OSPAR
15	safety		h	j	The IEA GHG Risk Assessment network agrees for the future development of risk assessment methodology that "demonstration projects will be a significant source of information". When future developing demonstration projects will be built, risk assessment should be consolidated. In the interim period, "natural and industrial analogues may be used as sources of information and to generate confidence in geological storage of CO_2 as a safe and environmentally acceptable global warming mitigation option. (EB49 p36-37) A site should therefore only be selected as a storage site, if there is no significant risk of leakage, and if in any case no significant environmental or health impacts are likely to occur. (EB49 p37)	
16	insurance cover (including compensation)		i		Risk can be reduced or removed from host countries with the use of instruments such as long-term financial bonds or insurance or contractual arrangements with the project operator. (EB49 p33)	
17	modelling (for monitoring purposes)			b	**It is possible to determine the project emissions through modelling and simulation. (EB50 p3)** Regulatory best practice now shows that permit applications should include a risk assessment (including the site characterisation and modelling), monitoring plans, remediation plans (in the event of seepage), and closure plans. (EB49 p31) Using a good site characterisation and modelling could be considered sufficient for projects to be able to proceed in the CDM. (EB49 p31)	

IPCC-SR: Intergovernmental Panel on Climate Change Special Report on CCS
IPCC-G: 2006 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories

Conclusion

The Institute considers the acceptance of CCS projects as eligible offsetting activities under the CDM is a critically important step in the financing of projects in developing countries. Such investments are essential given that developing countries are predicted to drive much of the emissions growth over the period to 2050 (IEA), and the impacts of climate change are expected to adversely affect them the hardest, posing imminent risks for food security; economic infrastructure; the urban and built environments; and water supplies. With CCS eligible under the CDM, developing nations are also further empowered to mitigate their emissions.

As a mitigation option, the IPCC concludes (IPCC-SR, *Summary for Policymakers*, Paragraph 23) that the likelihood of leakage from geological storage reservoirs is low – with the fraction of CO_2 retained in appropriately selected and managed geological reservoirs very likely (between 90 per cent and 99 per cent probability) to exceed 99 per cent over 100 years; and likely (between 66 per cent and 90 per cent) to exceed 99 per cent over 1,000 years. The Institute advocates that the CCS under CDM modalities and procedures be developed within this IPCC-SR context, and seeks a balance between ensuring a sufficient quality of information is generated by project proponents on which to base considered decisions by host governments and CDM EB, without imposing overly burdensome requirements on CCS project proponents that add to project implementation costs. A prudent risk management approach should be encouraged among all key CDM decision makers in regards to defining project requirements.

The Institute also considers that the formal resolution at CMP-7 of the limited number of issues identified in Decision -/CMP.6 will ultimately establish an international framework that provides for the institutional arrangements of CCS under any future UNFCCC mechanism and/or adopted within national government policy settings.

To recap the Institute's views expressed in this paper, it:

- notes that the ultimate responsibility for complying with and meeting the commitments of the UNFCCC ultimately rests with governments, and not with the legal private entities;
- considers that to every extent possible, the sufficiency of applying existing CDM modalities and procedures (Decision 3/CMP.1) should be tested;
- considers it to be in all CDM stakeholder interests to be satisfied with the rules of inclusion for CCS under CDM (and potentially other UNFCCC mechanisms);
- believes that CCS can be readily accommodated within the CDM (ie. all issues raised in Paragraph 2 and 3 of Decision -/CMP.6 addressed) on the basis of already established technical and scientific data and analysis, methods and expert advice;
- recommends that a one-size-fits-all approach be avoided where possible;
- views that where appropriate, a fit-for-purpose approach can sufficiently provide for: accurate; conservative, relevant, credible; reliable; complete; and verifiable data monitoring plans and measurement methodologies;
- acknowledges a large number of published peer reviewed expert reports that either contain approaches and recommendations to address and/or redress the limited number of issues contained in Decision -/CMP.6; and

- views that many of these issues can be readily addressed over the short term; and managed through either a policy oriented approach (such as best practice guidelines contained in the modalities and procedures), or within a host country's legal arrangements.

The Institute would be pleased to engage in any subsequent expert workshops organised by the UNFCCC to further discuss stakeholder preferences.

Attachment 1 – EB26 Report (Annex 13)

EB26 identifies the following issues as being generic to both CDM projects in general and CCS projects:

- identification of alternative scenarios and baseline selection;
- analysis of additionality;
- carbon dioxide leakage/seepage;
- calculation algorithms for baseline emissions;
- project emissions;
- emissions reductions; and
- sub-national project boundary questions.

The issues identified as being specific to CCS and that largely comprise the current exploration of the modalities and procedures include:

- site selection criteria;
- monitoring methods;
- accounting;
- liability;
- permanence; and
- implications of emission releases.

EB26 further characterised these issues as either policy and legal or technical. The policy and legal issues included:

- acceptable levels of long-term physical leakage (seepage) risk and uncertainty (e.g. less than X% seepage by year Y with a likelihood of Z%);
- project boundary issues (such as reservoirs in international waters, several projects using one reservoir, etc) and national boundaries (approval procedures for projects that cross national boundaries);
- long-term responsibility for monitoring the reservoir and any remediation measures that may be necessary after the end of the crediting period (i.e. liability); and
- accounting options for any long-term seepage.

The technical issues included:

- development of criteria and a step-wise guidance for the selection of suitable storage sites with respect to the release of emissions;
- how this relates to applicability conditions for methodologies;
- guidance on the development of adequate and appropriate monitoring methodologies for physical leakage (seepage) from the storage site;
- guidance related to the operation of reservoirs (e.g. well sealing and abandonment procedures); and
- remediation measures and how these may need to be addressed in baseline and monitoring methodologies.

Attachment 2 -/CMP.2

In 2006, Decision 1/CMP.2 In 2006 listed a range of issues requiring further guidance from SBSTA with a view to submitting recommendations for consideration at CMP-3, for decision at CMP-4:

a. long term physical leakage (seepage) levels of risks and uncertainty;
b. project boundary issues (such as reservoirs in international waters, several projects using one reservoir) and projects involving more than one country (projects that cross national boundaries);
c. long-term responsibility for monitoring the reservoir and any remediation measures that may be necessary after the end of the crediting period;
d. long-term liability for storage sites;
e. accounting options for any long-term seepage from reservoirs;
f. criteria and steps for the selection of suitable storage sites with respect to the potential for release of greenhouse gases;
g. potential leakage paths and site characteristics and monitoring methodologies for physical leakage (seepage) from the storage site and related infrastructure for example, transportation;
h. operation of reservoirs (for example, well-sealing and abandonment procedures), dynamics of carbon dioxide distribution within the reservoir and remediation issues; and
i. any other relevant matters, including environmental impacts.