WORLD COAL INSTITUTE

CCS & THE CLEAN DEVELOPMENT MECHANISM

A SUBMISSION ABOUT CARBON DIOXIDE CAPTURE AND STORAGE IN GEOLOGICAL FORMATIONS AS CLEAN DEVELOPMENT MECHANISM ACTIVITIES

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CONTENTS

SUMMARY

In response to decision FCCC/SBSTA/2007/L.19, the World Coal Institute (WCI) welcomes the opportunity to make this submission. This summary details the WCI's key conclusions and recommendations. Information supporting these conclusions and recommendations can be found in the underlying report.

Rising world energy demand is being met through increased use of fossil fuels

World energy demand is rising steadily and is forecast to rise 55% by 2030, driven primarily by developing countries seeking to meet development goals. Recent projections have been significantly revised upwards and may reach even higher levels if high rates of economic growth in developing regions are maintained. Fossil fuels are forecast to meet 84% of this extra demand but will also result in global carbon dioxide (CO_2) emissions that are 57% higher in 2030 than in 2005. The world is committed to the use of fossil fuels for the foreseeable future and efforts to address climate change must align the continued use of fossil fuels with climate change goals.

Carbon Capture and Storage (CCS) is essential to enable increased fossil fuel use to be compatible with climate change goals

CCS enables deep cuts in CO_2 emissions to be made across a host of CO_2-intensive industries. CCS storage sites are numerous and widely distributed, promoting the deployment of CCS projects around the world and enabling CCS to play a significant role in the reduction of greenhouse gas emissions. The inclusion of CCS within a portfolio of mitigation technologies will lower the costs of stabilisation by 30% or more.

CCS meets the objectives and criteria of the Clean Development Mechanism (CDM) as detailed in Article 12.5 of the Kyoto Protocol and the Marrakech Accords and should be eligible to receive credits under the CDM

The CDM enables non-Annex I Parties to achieve sustainable development, contributes to the ultimate objective of the Convention and assists Annex I Parties to achieve compliance with their emission reduction commitments. Emissions reductions from CDM project activities are certified on the basis of: voluntary participation approved by each Party involved; real, measurable, and long-term benefits related to the mitigation of climate change; and reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

The Marrakech Accords noted that it is "the host Party's prerogative to confirm whether a Clean Development Mechanism project activity assists it in achieving sustainable development" and so only Parties that volunteered to host CCS projects, having decided that CCS meets their sustainable development goals, would do so. CCS is a critical technology to achieve the stabilisation of atmospheric greenhouse gas concentrations in an economically efficient manner and is key to achieving the ultimate objective of the Convention.

Verification of emissions reductions from CCS projects on a case-by-case basis will ensure that CCS delivers the real, measurable benefits demanded of CDM projects. Finally, CCS projects fulfil the additionality criteria of the CDM and in the absence of a mechanism such as the

CDM to address the additional costs of the technology the incentive to deploy CCS is significantly reduced, with CO_2 instead vented to atmosphere. Permitting CCS to be included under the CDM will enhance this important flexible mechanism and help enable it to meet its purpose and objectives.

WCI provides the information requested on the inclusion of CCS in the CDM

The COP/MOP has requested, on a number of occasions, submissions on a variety of issues relating to the inclusion of CCS under the CDM. The WCI has addressed in this document the issues raised at COP/MOP-3 in Bali and compiled a table listing various sources of information that pertain to the issues raised by Parties over the last three years (see Appendix A). WCI provides this body of information, gained during the operation of CCS and related technologies, to give confidence to remaining Parties with concerns on the inclusion of CCS in the CDM that CCS can be practiced safely and with environmental integrity. The information is available now to permit CCS to be included under the CDM to enable the long-term storage of CO_2 that will otherwise be vented to the atmosphere and to support the transfer of this environmentally safe and sound technology to non-Annex I Parties.

WCI recommends a process to resolve outstanding issues and that the COP/MOP agrees to the inclusion of CCS in the CDM at its fourth session (December 2008)

The WCI recommends that the COP/MOP approves the inclusion of CCS as CDM project activities in Poland in December 2008. Any outstanding technological, methodological, legal, policy and financial issues raised would be addressed during the project validation phase as is standard with other CDM projects. Those CCS projects that have additional complexities, such as the injection from multiple sources into one reservoir or the use of CCS for Enhanced Oil Recovery (EOR), should not distract from the critical objective of including CCS in the CDM. As detailed later, such complexities can be addressed satisfactorily.

INTRODUCTION

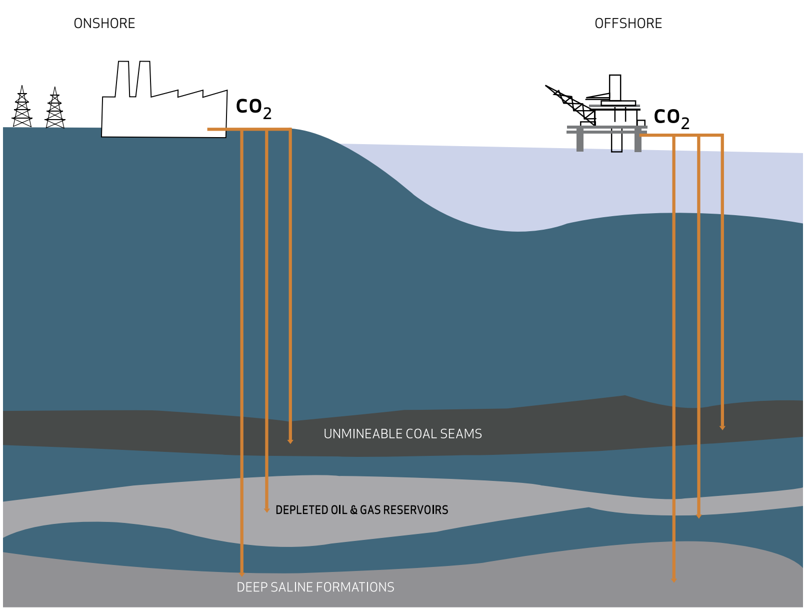
In response to decision FCCC/SBSTA/2007/L.19 inviting Parties and organisations to provide their views on the inclusion of carbon capture and storage in geological formations (Figure 1)[1] (hereafter referred to as CCS) as Clean Development Mechanism (CDM) projects, the World Coal Institute (WCI) welcomes the opportunity to make this submission.

1. Geological storage is the storage of CO_2 in geological formations such as oil and gas fields, unmineable coal beds and deep saline formations situated both onshore and offshore. This is distinct from ocean storage which involves the storage of CO_2 within the ocean water column or on to the surface of the sea bed. This submission relates solely to the storage of CO_2 in geological formations.
2. OECD/IEA "World Energy Outlook 2007, China and India Insights" (2007)
3. IPCC "Climate Change 2007: Mitigation of Climate change"
4. CO2CRC http://www.co2crc.com.au/needgeo/

The WCI is the only international, non-profit, non-governmental organisation working on behalf of the coal industry in both developed and developing countries. WCI and its member companies believe that coal is a critical part of the global energy mix, essential for a modern quality of life, a key contributor to sustainable development and enhanced energy security, and a source of energy which can be used in a manner consistent with climate change goals and a carbon constrained world.

The coal industry, together with coal users, has an important role in the development, financing and operation of CCS projects and aims to engage constructively on this matter where possible.

Figure 1: Geological Storage Options for CO_2



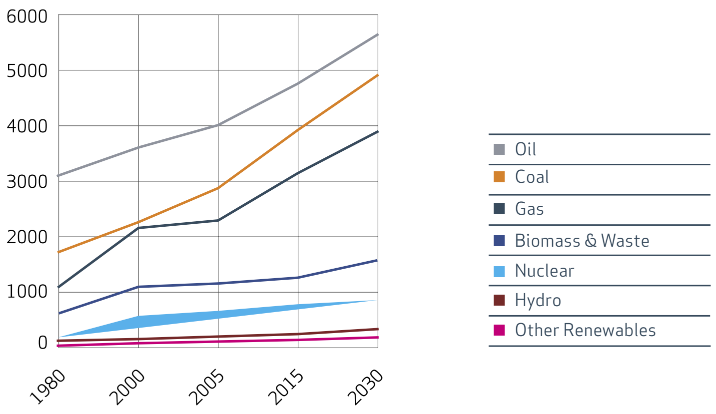
Role of CCS in the Stabilisation of Atmospheric Concentrations of Greenhouse Gases

World energy demand[2] is rising steadily and the latest projections forecast energy growth to rise by 55% between 2005 and 2030, with 74% of the increase driven by high energy demand in developing countries seeking to meet their development goals. These latest projections represent a significant upwards revision from earlier projections which underestimated demand in developing countries. Furthermore, there is the potential for energy demand to reach even higher levels than the current forecasts if the current high rates of economic growth in many developing regions are maintained.

Increased use of fossil fuels is expected to meet 84% of this extra demand but will also result in global CO_2 emissions that are 57% higher in 2030 than in 2005.[2] Coal currently supplies around 25% of primary energy demand and 40% of electricity generation worldwide. Coal also sees the biggest rise in fossil fuel demand, increasing by 73% from 2005 to 2030, underlying its role as an essential resource in meeting the world's energy needs (Figure 2). It is clear that the world is committed to the use of fossil fuels for the foreseeable future and that efforts to address climate change must align the continued use of fossil fuels with climate change goals.

Addressing the challenge of climate change, while meeting countries' development goals and affordable energy needs, will require access to and deployment of the full range of energy efficient and low carbon technologies.

Figure 2: World Primary Energy Demand (Mtoe)



Source: IEA 2007

However, capturing carbon dioxide that would otherwise be emitted to the atmosphere and injecting it to be stored in deep geological formations, is the only technology available to make deep cuts in greenhouse gas emissions while still using fossil fuels and much of today's energy infrastructure. CCS is essential to enable the projected increase in fossil fuel use to be compatible with climate change goals by enabling deep cuts in CO_2 emissions to be made across a host of CO_2-intensive industries and technologies, including:

- Coal and natural gas-fired power generation;
- Petroleum production and refining;
- Cement manufacturing;
- Chemicals industries;
- Iron and steel production.

The International Energy Agency (IEA)[2] describes CCS as "one of the most promising options for mitigating emissions in the longer term" while the Intergovernmental Panel on Climate Change (IPCC)[3] concluded that CCS was among the technologies with the largest economic potential to reduce emissions from electricity generation, as well as in the cement, ammonia, and iron manufacturing industries. It also found that attempts to stabilise greenhouse gas concentrations in the atmosphere at lower levels increased the emphasis on technologies such as CCS. Global modelling indicates that widespread deployment of carbon dioxide capture and storage would result in atmospheric concentrations of carbon dioxide being at least 100 parts per million lower than would otherwise be the case.[4]

CCS is not a replacement for taking actions which increase energy efficiency or maximising the use of renewable or other less-carbon-intensive forms of energy. A portfolio approach, taking every opportunity to reduce emissions, will be required to meet the challenge of minimising global climate change.

The IPCC Special Report on CCS found that geological storage sites for CCS are numerous, widely distributed around the world (Figure 3) and of great capacity, enabling CCS to play a significant role in a portfolio of mitigation options for the stabilisation of atmospheric greenhouse gas concentrations (Figure 4). The availability of numerous and widely dispersed geological storage sites will promote the equitable geographic distribution of CCS projects under the CDM around the world. The IPCC Special Report on CCS also concluded that the inclusion of CCS within a portfolio of mitigation technologies lowered the costs of stabilisation by 30% or more and increased flexibility in achieving greenhouse gas emission reductions, thereby promoting sustainable economic development.

A number of industrial-scale CCS projects are deployed globally. The longest running CCS project is Sleipner in the North Sea which has safely stored 1 million tCO_2 annually in a deep saline aquifer since 1996. Industrial scale CCS is also deployed at In Salah in Algeria and Weyburn in Canada. These existing projects will shortly be joined by a fourth project at Snohvit, also in the North Sea. These industrial-scale projects are complemented by experience gained from enhanced oil recovery (EOR) projects and a large number of research and pilot projects being developed around the world, particularly with regard to the application of CCS to fossil-fuel fired power plants. The experience from EOR projects and these numerous CCS projects have resulted in the formation of a large body of experience in the safe operation and monitoring of CCS projects. Appendix A contains details of existing CCS projects.

CCS is recognised under the Kyoto Protocol, in Article 2.1(a)(iv), as an important greenhouse gas mitigation technology that promotes sustainable development. Including CCS activities as an eligible technology within the CDM will increase the financial viability of CCS projects through the ability to monetise CDM credits and is an important step for the worldwide deployment of this vital mitigation technology. CCS is crucial to enabling developing countries to meet their development goals in an environmentally sustainable manner.

Figure 3: CO_2 Storage Prospectivity

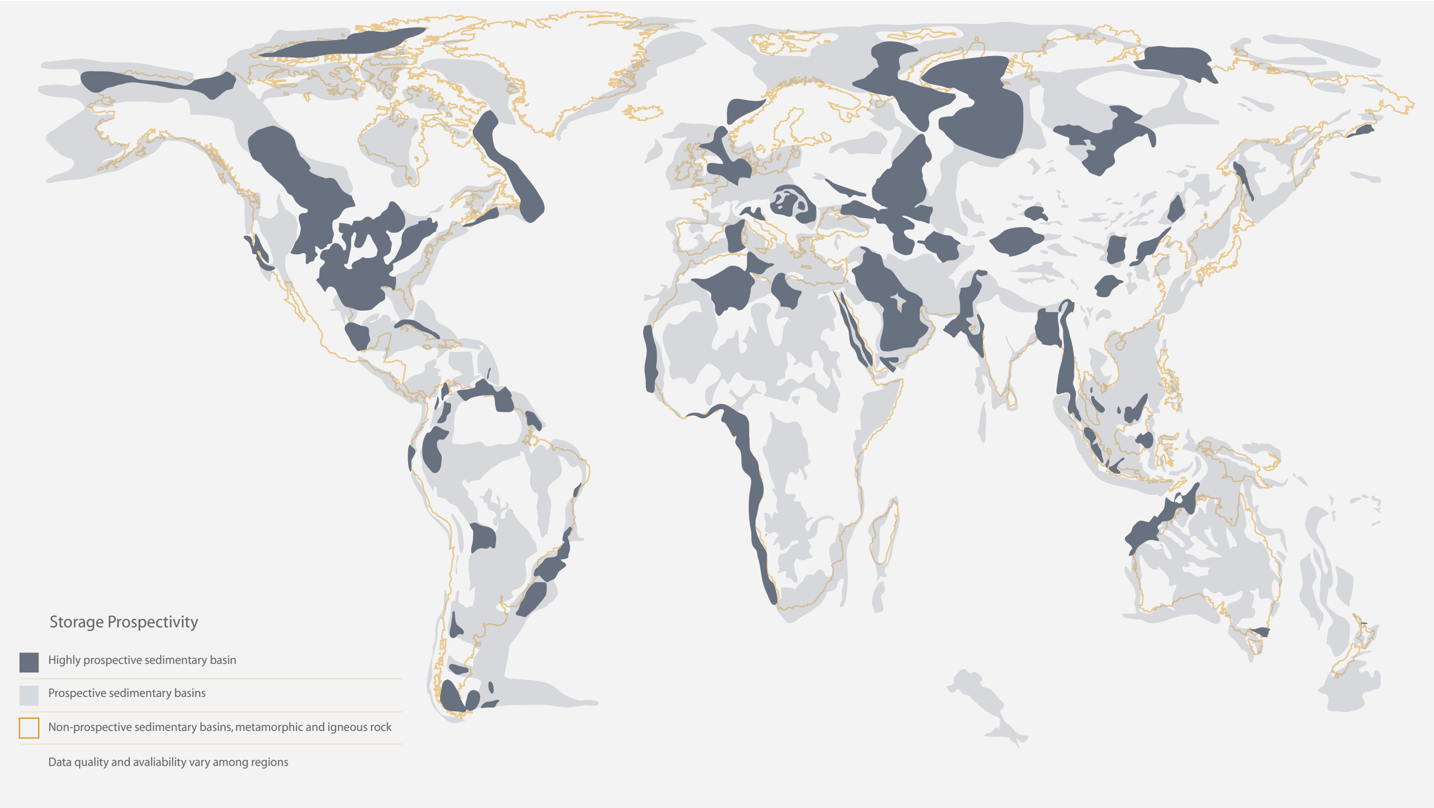
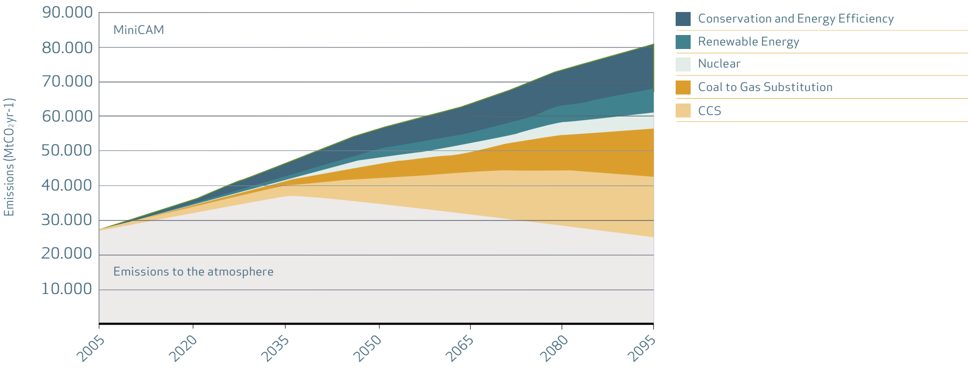
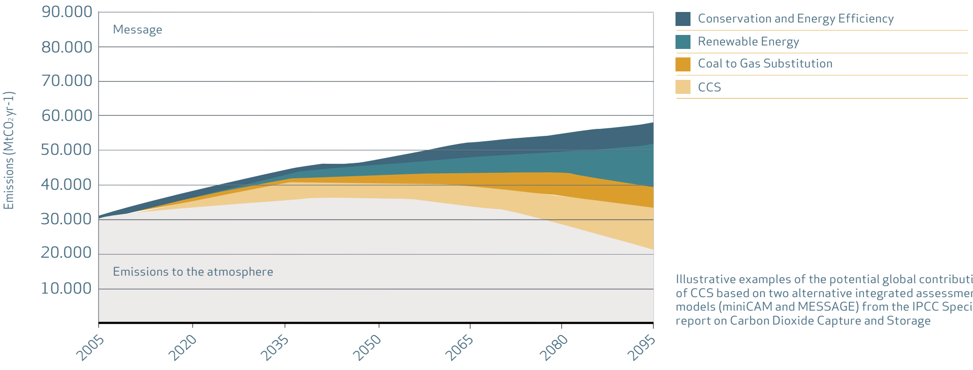


Figure 4: The Potential Global Contributions of CCS





Illustrative examples of the potential global contribution of CCS based on two alternative integrated assessment models (miniCAM and MESSAGE) from the IPCC Special report on Carbon Dioxide Capture and Storage

CCS AS CDM PROJECT ACTIVITIES

The CDM is one of the Kyoto Protocol's flexibility mechanisms and was established to allow non-Annex I Parties to achieve sustainable development, contribute to the ultimate objective of the Convention, and to assist Annex I Parties to achieve compliance with their emission reduction commitments.[5]

Article 12.5 of the Kyoto Protocol notes that emission reductions from CDM project activities are certified on the basis of the following three criteria:

1. Voluntary participation approved by each Party involved;
2. Real, measurable, and long-term benefits related to the mitigation of climate change; and
3. Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

The inclusion of CCS projects under the CDM meets the purpose and criteria of the CDM. The Marrakech Accords notes that it is "the host Party's prerogative to confirm whether a Clean Development Mechanism project activity assists it in achieving sustainable development" [6] and so only Parties that volunteered to host CCS projects, having decided that CCS meets their sustainable development goals, would be able to do so. Parties unwilling to host CCS projects, perhaps because they have decided that CCS does not meet their definition of sustainable development, would not be expected – nor could they be compelled to do so.

A key purpose of the CDM is to contribute to the ultimate objective of the Convention[7] thereby necessitating the need for CDM projects that provide real, measurable and long-term benefits to climate change mitigation. The IPCC Special Report on CCS found CCS to be a critical technology needed to achieve the stabilisation of atmospheric greenhouse gas concentrations in an economically efficient manner, concluding that by 2100 CCS could contribute up to 55% of the cumulative mitigation effort whilst reducing the costs of stabilisation to society by 30% or more.[8] In addition to the significant long-term benefits to climate change mitigation, verification of emissions reductions from specific CCS projects on a case-by-case basis is manageable and will ensure that CCS delivers the real, measurable benefits demanded of CDM projects.

Finally projects must be additional[9] to qualify for CDM credits. For a number of mitigation technologies – including efficiency projects, renewable energy deployment and methane capture – electricity and energy prices can act as a very strong driver for their development, even in the absence of a carbon price, leading to legitimate concerns over additionality. CCS projects will, in virtually all circumstances[10] fulfil the additionality criteria as CCS technologies add to the cost of supplying energy services. Thus in the absence of a mechanism to address these additional costs, such as CDM credits, there is no incentive and instead a real economic burden to deploying CCS and the CO_2 will instead be vented to atmosphere.

Considering the above, WCI concludes that CCS meets the objectives and criteria of the CDM as detailed in the Kyoto Protocol and Marrakech Accords and should be eligible to receive credits under the CDM. Furthermore, WCI would like to support the conclusions of the CDM Executive Board (EB) when it approved the CDM methodology for efficient combustion technologies on new fossil fuel power plants. The EB noted that a number of developing countries are dependent on fossil fuels and will remain so in the future and that this methodology will help incentivise efficient technology deployment in such countries.[11] It is hoped that this constructive rationale is extended to the discussions on CCS that are scheduled for the next climate change discussion which will be held in Poland in December 2008. Permitting CCS to be included under the CDM will enhance this important flexible mechanism and help enable it to meet its purpose by promoting sustainable development in non-Annex I Parties, assisting Annex I Parties to achieve compliance with their emission reduction commitments and contributing to the ultimate objective of the Convention.

5. Kyoto Protocol, Article 12.2
6. UNFCCC Decision 17/CP.7
7. UNFCCC, Article 2: "The ultimate objective of this convention...is to achieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system...within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."
8. IPCC "Special Report on Carbon Capture and Storage" (2005)
9. UNFCCC Decision 17/CP.7 "A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity."
10. CO_2 can be injected into oil and gas reservoirs to enhance the production of hydrocarbons with the value of the additional hydrocarbon production offsetting the costs of the CO_2. For EOR projects to be economically viable a low-cost source of CO_2 is needed. Many existing EOR projects use naturally occurring CO_2 sources as current CO_2 capture costs are typically too high to enable the use of anthropogenic CO_2.
11. http://cdm.unfccc.int/EB/034/eb34rep.pdf

ENABLING CCS IN THE CDM

The issue of whether CCS should be included in the CDM was first referred to the COP/MOP in Montreal in December 2005. The COP/MOP has since requested, on a number of occasions,[12, 13] submissions from Parties and other organisations on a variety of issues relating to the inclusion and deployment of CCS under the CDM.

This topic was also discussed at COP/MOP-3 in Bali, in December 2007, resulting in another decision to request further submissions on the following additional issues of concern that were raised by Parties during the informal discussions:[14]

1. Implications of CCS activities for other CDM activities;
2. Long-term monitoring of leakage (seepage) and coverage area of monitoring;
3. Liability issues relating to the difference in time periods between the crediting period and closure of the reservoir;
4. Possible implications of the additional revenue generated by the CDM on increased fossil fuel production;
5. Relevant regulatory approaches to CCS;
6. Project boundary issues and projects involving more than one country;
7. A possible process to deal with technical issues.

In response to this request the WCI has addressed below these seven issues raised during the informal negotiations in Bali. WCI has also compiled a table listing the various sources of information that pertain to all of the issues raised by Parties over the last three years (see Appendix A). WCI hopes that this wide body of information will provide confidence to those remaining Parties with concerns on the inclusion of CCS in the CDM that CCS can be practiced safely and with environmental integrity.

1. Implications of CCS activities for other CDM project activities

A key characteristic of CCS projects is the potential to mitigate large quantities of CO_2. A resulting concern in some quarters is that the introduction of CCS projects into the CDM will overwhelm the carbon market, suppressing demand for credits from other project activities. While the eventual global contribution of CCS to climate change mitigation is likely to be large – up to 55% of cumulative mitigation efforts by 2100[15] – and needs to be if the ultimate objective of the Convention is to be met, its contribution in the near-term under the CDM will be significantly lower.

A scenario where CCS projects will negatively impact other CDM activities is highly unlikely. The expected number of credits generated from CCS CDM projects will be limited in the Kyoto Protocol's first commitment period and will only be equivalent to a small fraction of the 2,700 million credits that will be issued to 2012.[16] The IEA[17] estimated that non-Annex I Parties over the period to 2012 will generate approximately 584 million tCO_2 annually of "capture-ready" CO_2 which could technically be available for CCS at a reasonable cost. However, at the current low value of CDM credits only a small fraction of this CO_2 would be used for CCS generating no more than tens of million credits to 2012. The current CER price will only be sufficient to fund CCS projects in niche applications where costs are modest, such as sites where a concentrated CO_2 stream is currently vented to atmosphere and where a highly suitable storage site is situated nearby. The threshold costs for CCS projects in power plants, which would have the potential to generate very significant numbers of credits, is significantly higher (US$50 – 100 tCO_2) than the predicted near- to medium-term CER prices, preventing domination of the CDM market by CCS. However, the inclusion of CCS in the CDM is crucial to store CO_2 that would otherwise be vented to

12. See paragraphs 5–8 in the following document for the full COP/MOP-1 decision: http://unfccc.int/files/meetings/cop_11/application/pdf/cmp1_24_4_further_guidance_to_the_cdm_eb_cmp_4.pdf
13. See paragraphs 18–24 in the following document for the full COP/MOP-2 decision: http://unfccc.int/resource/docs/2006/cmp2/eng/10a01.pdf#page=3
14. The full decision made at COP/MOP-3 is contained in the following document: http://unfccc.int/resource/docs/2007/sbsta eng/l19.pdf
15. IPCC "Special Report on Carbon Capture and Storage" (2005)
16. UNFCCC CDM Statistics, 2008, http://cdm.unfccc.int/Statistics/index.html
17. OECD / IEA "Carbon Capture and Storage in the CDM" (2007)
18. IPCC "Climate Change 2007: Synthesis Report" (2008)
19. WCI / IEA Greenhouse Gas R&D Programme "Storing CO_2 Underground" 2007

atmosphere in the absence of credits and to build capacity in developing countries on this critical technology. Furthermore, the continued exclusion of CCS from the CDM acts as a powerful disincentive for developing countries to undertake the necessary national assessments of their CCS deployment potential, such as geological storage capacity, as there is no prospect of these countries recouping these costs in the form of bankable CCS projects.

Deep and liquid carbon markets are needed if the ultimate objective of the Convention is to be realised. The distortion of the carbon markets by the exclusion of legitimate mitigation technologies will impact negatively on the ability of the world to stabilise atmospheric concentrations of greenhouse gases. Indeed, the flexible mechanisms such as the CDM will need to be greatly scaled up if Parties are to be able to undertake the significant cuts in emissions sought.[18] Actions that restrict the supply of CDM credits are counterproductive to these efforts and should be discontinued. The main criteria for the eligibility of projects under the CDM should be those detailed in Article 12 of the Kyoto Protocol and the Marrakech Accords.

2. Long-term monitoring of leakage (seepage) and coverage area of monitoring

Monitoring of injected CO_2 is essential to verify that the CO_2 is safely stored and that the CCS project has fulfilled the CDM criteria of being a “real, measurable, and long-term” reduction in emissions. A wide range of monitoring techniques can be deployed to provide certainty that stored CO_2 is behaving as expected and to quantify the emissions reductions from the CCS project activities.

Key to the safe and secure storage of CO_2 is the selection of a suitable storage site. During the site selection and characterisation stages the CCS operator will select a geological formation that contains a geological feature to trap the injected CO_2 and will identify potential leakage pathways and CO_2 migration pathways. Once injection of the CO_2 commences it will form a distinctive plume under the geological trap. The growth and movement of the CO_2 plume will be monitored to ensure that the plume behaves as modelled during the site characterisation phase.

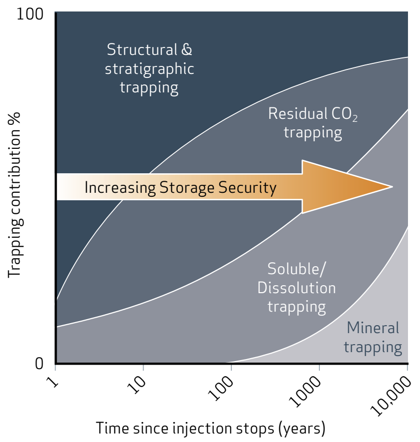
The coverage area of the monitoring will include the portion of the reservoir that the CO_2 plume will occupy. It is not necessary to monitor the whole reservoir, which might be of huge size, if there is no realistic possibility of the CO_2 plume extending across the whole reservoir. Excessive monitoring will not enhance the environmental integrity of the project. In addition, the CCS operator will also monitor potential seepage pathways, such as oil and gas and injection wells and geological fractures, identified during the site characterisation phase. A process outlining responsibility for the monitoring of the CO_2 is covered in section 3 in the discussion of liability.

3. Liability relating to the difference in time periods between the crediting period and closure of the reservoir

The issue of liability for the stored CO_2 is closely linked to the risks of CO_2 seepage. Before considering the issues of seepage risk and liability it is important to note that CO_2 stored in a geological formation is trapped in a number of ways. When CO_2 is first injected into geological formations, such as old oil and gas reservoirs and deep saline formations, it rises through the formation until it becomes trapped under the cap rock. As the CO_2 moves up through the reservoir some of it becomes trapped in the pore space of the rock formation in a process known as residual trapping. Over time the trapped CO_2 dissolves into the briny water of the storage formation; this causes the density of the water to increase and it sinks down into the formation. Finally, the CO_2 begins to react with the minerals in the geological formation and becomes permanently bound to the rock.[19] Importantly, the four stages of trapping listed above become increasingly secure as the stored CO_2 moves from being trapped by the caprock to eventually becoming bound to the

Figure 5: Trapping Mechanisms

Source: IPCC 2005



geological formation (Figure 5). Thus the risk profile and probability of seepage of the stored CO_2 declines over time as the trapping mechanisms underpinning storage become more secure. The trapping mechanism for CO_2 injected into unmineable coal seams differs from that in oil and gas reservoirs and saline formations. In this case the injected CO_2 will travel into the coal seam through fractures and then diffuses into the coal’s micropores where it is tightly adsorbed to the surface of the coal.

A clear understanding of the liability process and its relationship to seepage risks needs to be part of the project approval process. The reduction in risk over time has important implications for liability and for a CCS project this means that the liability for the stored CO_2 will pass through three distinct stages (Figure 6):

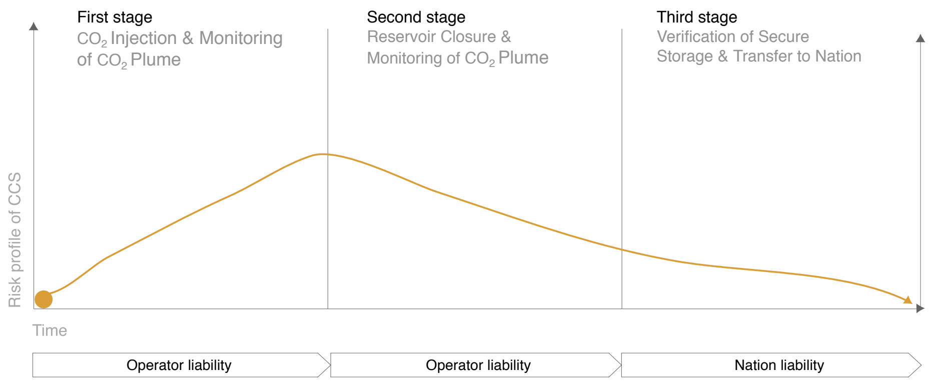
1. During the CO_2 injection phase of the CCS project the liability for the CO_2 will rest with the operator and any seepage during capture, transport and storage will be accounted for so that only CO_2 safely stored will be credited. Responsibility for monitoring the injected CO_2 and any remediation requirements from seepage which cannot be resolved through the accounting process will reside with the operator.

2. Following the end of CO_2 injection and closure of the storage site the operator will continue to hold responsibility for the stored CO_2 for a defined period – the length of which will be subject to agreement with the host Party – which might extend from a period of years to several decades. During this phase the project operator will be responsible for monitoring the stored CO_2 plume and for any remediation in the event of CO_2 seepage.
3. Once the storage of the CO_2 has been verified through demonstration that the CO_2 is behaving as expected and the risk of CO_2 seepage has declined, then the liability for any subsequent monitoring or remediation of the stored CO_2 can be transferred to the host country. At this post–closure stage of the site there will be no reasonable expectation that the stored CO_2 will seep from the geological formation. It is unlikely that any further monitoring will be required at this point, although the host country may choose to undertake some periodic monitoring for assurance purposes. The timing of the liability transfer and any residual monitoring requirements will be defined by the host country on a case-by-case basis.

Nation states are long-lived entities that are better placed to accept long-term, low level risks than commercial entities which are characterised by much shorter lifetimes. As the risk of CO_2 seepage is greatest – although still low – during CCS operations and for a relatively short period following closure of the storage reservoir, then the risks from the subsequent transfer of liability to the host country is very low. Only Parties willing to accept long-term liability of the stored CO_2 would volunteer to host CCS projects under the CDM.

Once the crediting period ends there will be no revenue stream with which to cover the costs of CCS and therefore the injection of CO_2 will cease. At this point the reservoir will be closed with the operator retaining liability as described in stage 2 above. The highly additional nature of CCS – without a revenue stream from credits CCS projects will not be undertaken – will result in operators closing the reservoir once the crediting period expires. Therefore in practice there will be no difference in time period between the crediting period and the closure of the reservoir. In the highly unlikely event that CO_2 injection was to continue beyond the crediting period – if for example the host government decides to continue CO_2 injection – then the proportion of the closure costs associated with the CDM project activity can be held in escrow pending closure.

Figure 6: Risk profile of CCS changes over time with rising storage volume then site closure and storage



4. Possible implications of the additional revenue generated by the CDM on increased fossil fuel production

The world is forecast to achieve the majority of its increased energy demand through the greater use of fossil fuels. From a climate change perspective the level of fossil fuel production is less important than how those fossil fuels are ultimately utilised. It might be argued that it is more important to pose the question of the implication of the additional revenues generated by the CDM for the environmentally effective use of fossil fuels. This logic prevailed in the recent approval by the CDM EB of the new CDM methodology for efficient fossil fuel power plants (see above) and should be extended to the decision on CCS. Fossil fuels, used with CCS, have the same net benefit to the environment as other low-carbon technologies and are essential to help society to reach the ultimate goal of the Convention.

Concerns have been raised that including CCS under the CDM could cause leakage[20] if the CO_2 captured is used for Enhanced Oil Recovery or Enhanced Gas Recovery (EGR) resulting in increased oil and gas production and global CO_2 emissions. EOR and EGR increases the amount of oil and gas produced from a particular field rather than increasing global oil and gas consumption. In order to increase global oil and gas consumption, EOR and EGR would need to reduce the price of oil and gas thereby stimulating increased demand. WCI remains unconvinced that including CCS in the CDM will have any material effect on the global oil price, demand or consumption. However, even if it did, using CO_2 for EOR can still result in a net reduction of CO_2 emissions with more CO_2 being stored in the geological formation than would be emitted from the combustion of the resulting oil production.

Calculations for an EOR project in the UK showed that 1.8 – 2 million tCO_2 would be injected annually resulting in the storage of 40 million tCO_2 over the 20 year life of the project. This would produce an additional 40 – 60 million barrels of oil which, when combusted, would release approximately 20 million tCO_2[21].

Leakage was reviewed by the IEA[22] which concluded that fears that the use of CO_2 for EOR or EGR would increase global emissions and therefore that the issue of leakage should not prevent the inclusion of CCS as CDM activities were groundless; although they noted that the CDM Executive Board might choose to consider impacts on specific regional or local markets. The IEA reached this conclusion as it considered the measurement and attribution (see definition of leakage above) of increased CO_2 emissions from EOR and EGR activities to be impossible, while fuel substitution impacts could be just as likely to increase or decrease emissions depending on the fuels being substituted.

Leakage under the CDM has also been addressed within the context of gas flaring, for which a number of existing methodologies for gas flaring reduction activities as CDM projects have been approved. A World Bank report[23] focusing on flare reduction in the CDM noted that previously flared gas might be: 1) used for on-site power, 2) placed into a gas pipeline with multiple sources and users, or 3) re-injected for EOR. In the first example where the gas is used for on-site power then this would be included in the project boundary and would not constitute leakage. In the second and third examples, the World Bank concluded that where the additional gas is supplied to international markets it is highly unlikely that the downstream emissions could be measured and attributed and therefore would not fit the definition of leakage. Where the additional gas is supplied to local markets then project developers should demonstrate that this will not impact on gas supply and demand or should account for any leakage.

WCI agrees with the conclusions above and believes that leakage issues should not present a barrier to the inclusion of CCS as CDM project activities and should be addressed when such cases arise. In the interim they should not hinder the deployment of CCS projects in which the CO_2 is stored in geological formations and is not used to enhance hydrocarbon production.

5. Relevant regulatory approaches to CCS

A variety of existing and proposed regulatory approaches relevant to CCS projects are available to enable host countries to regulate CCS activities safely and with environmental integrity. Relevant regulatory approaches available to host Parties include the modification of existing regulations used for technologies and industries that are analogous to the component technologies – capture, transportation and storage – used in CCS. Existing regulations that pertain to the separation and handling of CO_2 in the natural gas processing, food and beverage, and refining industry can be modified to manage the capture component of CCS. The transportation of CO_2 by pipeline to geological storage sites is directly analogous to the transportation of hydrocarbons and the regulatory frameworks that regulate this activity around the world are directly applicable to the regulation of CO_2 transportation. The storage component of the CCS chain is analogous to existing regulations under mining and petroleum law, resource conservation laws, waste disposal, acid gas injection, enhanced oil recovery, natural gas storage, and others.[24]

In addition to the existing body of regulatory frameworks used for analogous activities to CCS, considerable efforts are ongoing in a number of jurisdictions to develop regulatory frameworks specifically for the management of CCS activities. These legal and regulatory frameworks include, but are not limited to;

- IOGCC "A Legal and Regulatory Guide for States and Provinces";
- European Commission proposed Directive on the Geological Storage of Carbon Dioxide;
- Amendments to the London Convention and OSPAR to permit the storage of CO_2 in sub seabed formations.

20. The Marrakech Accords define leakage under the CDM "as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity"
21. http://www.guardian.co.uk/commentisfree/2008/mar/20/carbonemissions.oil
22. OECD / IEA "Carbon Capture and Storage in the CDM" (2007).
23. The World Bank "Gas Flaring Reduction Projects – Framework for CDM Baseline Methodologies" (2005).
24. IPCC "Special Report on Carbon Capture and Storage" (2005)

Furthermore, the IEA has recently launched the International Network of CCS Regulators which will inform the development of CCS legal and regulatory frameworks around the world. Further details on the existing regulatory frameworks can be found in Appendix A.

6. Project boundary issues and projects involving more than one country

The project boundary of CDM projects should "encompass all anthropogenic emissions by sources of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the CDM project activity".[25] The boundary for CCS projects will cover all elements of the technology chain; CO_2 capture, transportation and storage. Therefore the definition of a project boundary for CCS presents no practical difficulties for its inclusion under the CDM and will include:

- Capture of CO_2 from a point source;
- Transportation via pipeline or ship to the storage site;
- Compression and injection into the geological formation;
- The stored CO_2 plume within the geological reservoir.

The project boundary need not include the whole reservoir if the CO_2 plume is a more appropriate measure. As some reservoirs are huge with no realistic possibility of the CO_2 plume extending across the whole reservoir, then extending the project boundary will not improve the environmental integrity of the project.

The 2006 IPCC National Inventories Guidelines[26] details how to account for emissions in projects that involve more than one country. For projects where more than one country uses a geological storage site, the country where the geological storage site is located accounts for the emissions from the storage site. If the storage site covers more than one country then the countries will agree to report a given percentage of the total emissions. However, it must be remembered that the number of CCS projects involving more than one country will be small compared to the total number of CCS projects as most countries will be able to accommodate the entire CCS project boundary within their jurisdiction. Moreover, in the early stages of CCS deployment through the CDM, it is entirely likely that no CCS projects will be submitted that involve more than one country. As transboundary issues do not pose any insurmountable barriers they should be dealt with when they arise. In the interim they should not hinder the deployment of the early CCS projects that will only involve one host country.

7. A possible process to deal with technical issues

The WCI believes there to be no significant technical barriers that should significantly delay or preclude the inclusion of CCS under the CDM. The IPCC has concluded that the component technologies needed for CCS are already either part of a mature market or economically feasible under specific conditions (Figure 7).[27] In many cases the component technologies are already deployed in developing countries providing these countries with the institutional, expert and technological capacity to undertake CCS safely and with environmental integrity.

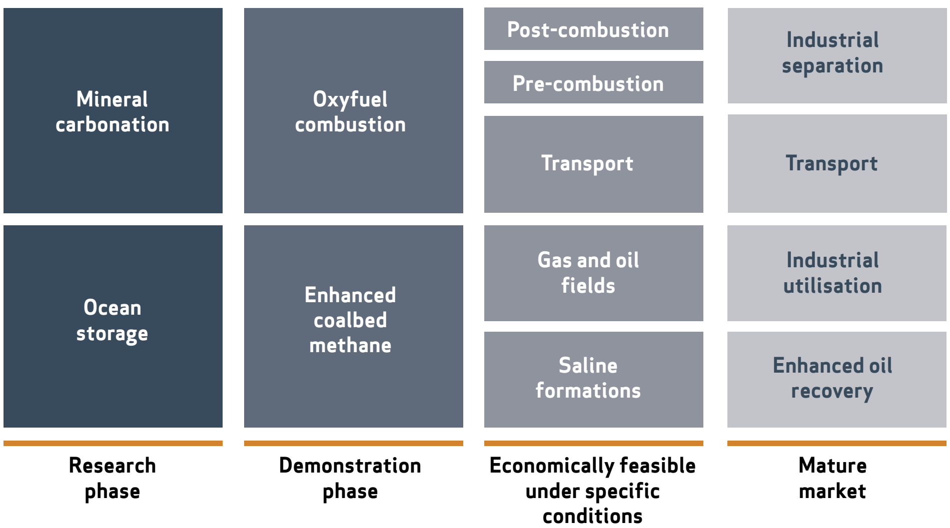
This technical capacity has been developed through decades of operational experience from existing industrial-scale CCS projects, underground injection of CO_2 for enhanced oil recovery, acid gas injection, natural gas storage and other technologies widely deployed in the petroleum industry. These industrial experiences are complemented by numerous research-scale CCS projects, research programmes, stakeholder networks and partnerships.
In light of this extensive body of experience the WCI believes that any remaining technical issues can be readily resolved and do not constitute a barrier to the inclusion of CCS in the CDM.
The WCI recommends that a process be established to satisfactorily resolve technical issues.

The WCI recommends that the COP/MOP approve CCS to be included as CDM project activities following which technical issues would be resolved following standard CDM procedures. Any remaining technical issues raised in the Project Design Document (PDD) would therefore be addressed by the Designated Operational Entity (DOE) during the project validation phase.

25. UNFCCC Decision 17/CP7
26. IPCC "2006 IPCC Guidelines for National Greenhouse Gas Inventories" (2006)
27. IPCC "Special Report on Carbon Capture and Storage" (2005)

Figure 7: Maturity of CCS Technology

Source: IPCC 2005



WCI CONCLUSIONS AND RECOMMENDATIONS

The WCI believes that the information is available now to permit CCS to be included under the CDM. The large body of experience, in both Annex I and non-Annex I countries, gained during the operation of CCS activities and related technologies should provide Parties with the confidence that CCS can be practiced safely and with environmental integrity.

It is crucial that CCS be eligible to receive permanent credits under the CDM that are fungible with other carbon credits in the global carbon markets. Enabling CCS under the CDM will result in the long-term storage of CO_2 that will otherwise be vented to the atmosphere and will support the transfer of this environmentally safe and sound technology to non-Annex I Parties.

The WCI recommends that the COP/MOP approves the inclusion of CCS as CDM project activities at its next meeting in Poland in December 2008. As noted in this submission, WCI believes there to be no significant barriers to the inclusion of CCS as CDM project activities. As with other CDM project activities any outstanding technological, methodological, legal, policy and financial issues raised in the Project Design Document (PDD) would be addressed by the Designated Operational Entity (DOE) during the project validation phase.

The issue of CCS projects that might have additional complexities, such as the injection of CO_2 from multiple sources into one reservoir or the use of CCS for EOR purposes, should not distract from the critical objective of including CCS in the CDM. It is entirely likely that such projects will not be submitted for approval in the first commitment period and so this must not delay the deployment of this vital mitigation technology. As noted above, such complexities can be addressed satisfactorily.

APPENDIX A

The COP/MOP has requested over the last three years submissions from Parties and other organisations on a variety of issues relating to the inclusion of CCS under the CDM. In response to these requests the WCI has compiled the table[28] below which lists all of the COP/MOP requests for information along with the relevant information pertaining to the issues.

CCS Issues Outlined by UNFCCC	Identified	Work and Research Undertaken	Source
1. Project boundary, leakage and permanence issues	COP/ MOP-1	**IPIECA/API** Guidelines for emissions accounting CCS projects	International Petroleum Industry Environmental Conservation Association and the American Petroleum Institute (IPIECA/API), 2007, Carbon capture and geological storage emission reduction project family, in Oil and Gas Industry Guidelines for Greenhouse Gas Reduction Projects, IPIECA, London http://www.ipieca.org/activities/climate_change/climate_publications.php#1
		Existing CCS projects Frio Gorgon In Salah Ketzin Lacq Nagaoka Otway Recopol Sleipner Snohvit Weyburn	**IEA GHG RD&D Database** http://www.co2captureandstorage.info/co2db.php http://www.beg.utexas.edu/environqlty/co2seq/fieldexperiment.htm http://www.gorgon.com.au/ http://www.bp.com/sectiongenericarticle.do?categoryId=426&contentId=2000566 http://www.co2sink.org http://www.total.com/en/corporate-social-responsibility/special-reports/capture http://www.japex.co.jp/english/technology/co2.html http://www.co2crc.com.au/otway/index.html http://recopol.nitg.tno.nl/index.shtml http://www.statoil.com/statoilcom/svg00990.nsf/web/sleipneren?opendocument http://www.statoil.com/statoilcom/snohvit/svg02699.nsf?OpenDatabase&lang=en http://www.ptrc.ca/weyburn_overview.php
2. Long-term physical leakage (seepage) levels of risks and uncertainty	COP/ MOP-2	**IEA GHG Risk Assessment Network** International communications network focussing on: data management and risk analysis; regulatory engagement; and environmental impacts	http://www.co2captureandstorage.info/networks/riskassess.htm
		American Petroleum Institute Survey of enhanced oil recovery analogous to the technologies used for CCS	American Petroleum Institute (API), 2007,Carbon Dioxide Enhanced Oil Recovery, API, Washington DC. http://www.api.org/aboutoilgas/sectors/explore/upload/07APICO2EORReportFinal.pdf
		Benson et al.	Benson, S.M., Hepple, J.A., Tsang, C.F., and Lippmann, M., 2003, Lessons Learned from Natural and Industrial Analogues for Storage of Carbon Dioxide in Deep Geological Formations, Report LBNL-51170, Lawrence Berkeley National Laboratory, Berkley, California. http://www.co2captureproject.org/reports/reports.htm#

28. This table includes information contained in the tables in the submission "IPIECA's Response to the UNFCCC Invitation for Information on Issues Related to CO2 Capture and Storage (CCS) in the CDM and Interest in Capacity-Building Activities" in May 2007 and the Open Letter, dated 24 August 2007, issued by the IEA Greenhouse Gas R&D Programme – on behalf of their Working Group on Carbon Capture and Storage in the Clean Development Mechanism

3. 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)	COP/ MOP-2	**IEA GHG** Report on issues related to CCS as CDM project activities	IEA Greenhouse Gas R&D Programme (IEA GHG), 2007, ERM – Carbon Dioxide Capture and Storage in the Clean Development Mechanism, Report Number 2007/TR2, April 2007, IEA GHG, Cheltenham http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf
		IPCC Inventory Guidelines (2006)	http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm
		IPIECA/API Guidelines for emissions accounting CCS projects	International Petroleum Industry Environmental Conservation Association and the American Petroleum Institute (IPIECA/API), 2007, Carbon capture and geological storage emission reduction project family, in Oil and Gas Industry Guidelines for Greenhouse Gas Reduction Projects, IPIECA, London http://www.ipieca.org/activities/climate_change/climate_publications.php#1
4. Long-term responsibility for monitoring the reservoir and any remediation measures that may be necessary after the end of the crediting period	COP/ MOP-2	**IEA GHG (2007)** Report on issues related to CCS as CDM project activities	IEA Greenhouse Gas R&D Programme (IEA GHG), 2007, ERM – Carbon Dioxide Capture and Storage in the Clean Development Mechanism, Report Number 2007/TR2, April 2007, IEA GHG, Cheltenham http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf
		WCI submission (2008)	World Coal Institute (WCI), 2008, Submission by the World Coal Institute: Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities, WCI, London
5. Long-term liability for storage sites	COP/ MOP-2	**World Resources Institute** Formation of international working group to share information on CCS liability and accounting issues	http://www.wri.org/project/carbon-capture-sequestration
		IEA GHG Report on issues related to CCS as CDM project activities	IEA Greenhouse Gas R&D Programme (IEA GHG), 2007, ERM – Carbon Dioxide Capture and Storage in the Clean Development Mechanism, Report Number 2007/TR2, April 2007, IEA GHG, Cheltenham http://www.co2captureandstorage.info/techworkshops2007%20TR2CCS%20CDM%20methodology%20.pdf

		IEA Report (2007)	IEA Report, 2007, Carbon Capture and Storage in the CDM, December 2007, IEA, Paris http://www.iea.org/textbase/papers/2007/CCS_in_CDM.pdf
6. Accounting options for any long-term seepage from reservoirs	COP/ MOP-2	**IEA GHG** Report on issues related to CCS as CDM project activities	IEA Greenhouse Gas R&D Programme (IEA GHG), 2007, ERM – Carbon Dioxide Capture and Storage in the Clean Development Mechanism, Report Number 2007/TR2, April 2007, IEA GHG, Cheltenham http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf
		IEA Report (2007)	IEA Report, 2007, Carbon Capture and Storage in the CDM, December 2007, IEA, Paris http://www.iea.org/textbase/papers/2007/CCS_in_CDM.pdf
		IPCC Inventory Guidelines (2006)	http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm
7. Criteria and steps for the selection of suitable storage sites with respect to the potential for release of greenhouse gases	COP/ MOP-2	Development of geological survey groups to identify and assess potential CO_2 storage sites **GESTCO** **GEO-SEQ** **CSLF** US regional partnerships e.g. Westcarb database **CO2CRC**	GESTCO http://www.geus.dk/program-areas/energy/denmark/co2/GESTCO_summary_report_2ed.pdf GEO-SEQ http://www-esd.lbl.gov/GEOSEQ/ Westcarb http://www.westcarb.org/ CO2CRC http://www.co2crc.com.au/
		EU CO2STORE Project Development of methodologies for the assessment, planning and long-term monitoring of CO_2 storage sites, both on-shore and off-shore.	http://www.co2store.org/
		IEA GHG Report on issues related to CCS as CDM project activities	IEA Greenhouse Gas R&D Programme (IEA GHG), 2007, ERM – Carbon Dioxide Capture and Storage in the Clean Development Mechanism, Report Number 2007/TR2, April 2007, IEA GHG, Cheltenham http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf

8. Potential leakage paths and site characteristics and monitoring methodologies for physical leakage (seepage) from the storage site and related infrastructure - for example, transportation	COP/ MOP-2	**IPIECA/API** Guidelines for emissions accounting CCS projects	International Petroleum Industry Environmental Conservation Association and the American Petroleum Institute (IPIECA/API), 2007, Carbon capture and geological storage emission reduction project family, in Oil and Gas Industry Guidelines for Greenhouse Gas Reduction Projects, IPIECA, London http://www.ipieca.org/activities/climate_change/climate_publications.php#1
		IEA GHG Risk Assessment Network Development of international communications network to focus on demonstrating the safety of CCS technology and the limitation of environmental impacts, including collaboration on standard methods for risk assessment of storage sites	http://www.co2captureandstorage.info/networks/riskassess.htm
9. Operation of reservoirs (for example, well-sealing and abandonment procedures), dynamics of carbon dioxide distribution within the reservoir and remediation issues	COP/ MOP-2	**API (2007)**	American Petroleum Institute (API), 2007, Carbon Dioxide Enhanced Oil Recovery, API, Washington DC. http://www.api.org/aboutoilgas/sectors/explore/upload/07APICO2EORReportFinal.pdf
		NGCAS (Next Generation Capture and Storage) EU Project Research into various aspects of modelling performance of CO_2 storage in depleted oil reservoirs	http://www.co2captureproject.org/reports/reports.htm
		IEA GHG Well Bore Integrity Network Development of international communications network to assess long term integrity of well bores at CO_2 storage sites, including collaboration on design, drilling, completion and abandonment of wells	http://www.co2captureandstorage.info/networks/wellbore.htm
10. Any other relevant matters, including environmental impacts	COP/ MOP-2	**API (2007)**	American Petroleum Institute (API), 2007, Carbon Dioxide Enhanced Oil Recovery, API, Washington DC. http://www.api.org/aboutoilgas/sectors/explore/upload/07APICO2EORReportFinal.pdf
		Benson et al. (2003)	Benson, S.M., Hepple, J.A., Tsang, C.F., and Lippmann, M., 2003, Lessons Learned from Natural and Industrial Analogues for Storage of Carbon Dioxide in Deep Geological Formations, Report LBNL-51170, Lawrence Berkeley National Laboratory, Berkley, California. http://www.co2captureproject.org/reports/reports.htm#

11. Implications for other project activities under the CDM	COP/ MOP-3	**IEA GHG** Report on issues related to CCS as CDM project activities	IEA Greenhouse Gas R&D Programme (IEA GHG), 2007, ERM – Carbon Dioxide Capture and Storage in the Clean Development Mechanism, Report Number 2007/TR2, April 2007, IEA GHG, Cheltenham http://www.co2captureandstorage.info/techworkshops/ 2007%20TR2CCS%20CDM%20methodology%20.pdf
		IEA Report (2007)	IEA Report, 2007, Carbon Capture and Storage in the CDM, December 2007, IEA, Paris http://www.iea.org/textbase/papers/2007/CCS_in_CDM.pdf
		WCI Submission (2008)	World Coal Institute (WCI), 2008, Submission by the World Coal Institute: Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities, WCI, London
12. Long-term monitoring of leakage (seepage) and coverage area of monitoring	COP/ MOP-3	**World Resources Institute** **IEA GHG Monitoring Network** Formation of international working groups and communications networks on site monitoring and leakage issues	http://www.wri.org/project/carbon-capture-sequestration http://www.co2captureandstorage.info/networks/monitoring.htm
		IPIECA/API Guidelines for emissions accounting CCS projects	International Petroleum Industry Environmental Conservation Association and the American Petroleum Institute (IPIECA/API), 2007, Carbon capture and geological storage emission reduction project family, in Oil and Gas Industry Guidelines for Greenhouse Gas Reduction Projects, IPIECA, London http://www.ipieca.org/activities/climate_change/climate_publications.php#1
		WCI Submission (2008)	World Coal Institute (WCI), 2008, Submission by the World Coal Institute: Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities, WCI, London
13. Liability relating to the difference in time periods between the crediting period and the closure of the reservoir	COP/ MOP-3	**WCI Submission (2008)**	World Coal Institute (WCI), 2008, Submission by the World Coal Institute: Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities, WCI, London

14. Possible implications of the additional revenue generated by the CDM on increased fossil fuel production	COP/ MOP-3	**IEA Report (2007)**	IEA Report, 2007, Carbon Capture and Storage in the CDM, December 2007, IEA, Paris http://www.iea.org/textbase/papers/2007/CCS_in_CDM.pdf
		World Bank Report (2005)	The World Bank, 2005, Gas Flaring Reduction Projects – Framework for CDM Baseline Methodologies, Global Gas Flaring Reduction report no.6, Washington DC. http://siteresources.worldbank.org/INTGGFR/Resources/gfrmethodologyno6revised.pdf
		WCI Submission (2008)	World Coal Institute (WCI), 2008, Submission by the World Coal Institute: Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities WCI, London
15. Relevant regulatory approaches to CCS	COP/ MOP-3	**New and Adjusted National Legislative Frameworks** **Australia** - Legislation modified to include CCS **EU** - Development of documentation for inclusion of CCS in EU ETS **USA** - Development by IOGCC of a regulatory framework for CCS **Canada** - Acid gas storage regulations developed in Alberta	Australia – http://www.environment.gov.au/settlements/industry/ccs/index.html EU – http://ec.europa.eu/environment/climat/ccs/consult_en.htm USA – http://www.iogcc.state.ok.us/PDFS/Road-to-a-Greener-Energy-Future.pdf Canada – http://www.ags.gov.ab.ca/activities/CO2/CO2_main.html
		IEA GHG Programme Creation of database of CCS best practice related documentation	http://co2captureandstorage.info/BPIntro.php
		CO2REMOVE Formation of EU group aimed at developing best practice standards for site evaluation and monitoring	http://www.co2remove.eu/
		IPIECA/API Guidelines for emissions accounting CCS projects	International Petroleum Industry Environmental Conservation Association and the American Petroleum Institute (IPIECA/API), 2007, Carbon capture and geological storage emission reduction project family, in Oil and Gas Industry Guidelines for Greenhouse Gas Reduction Projects, IPIECA, London http://www.ipieca.org/activities/climate_change/climate_publications.php#1

		IPCC Special Report on CCS Identification of legal and regulatory issues relating to CCS	http://www.ipcc.ch/pdf/special-reports/srccs/srccs_summaryforpolicymakers.pdf
		London and OSPAR conventions Amendment of international conventions to include CCS regulations and allow geological storage of CO_2 under the seabed	London Convention - http://www.imo.org/home.asp?topic_id=1488 OSPAR Convention - http://www.ospar.org/eng/html/welcome.html
		DNV Joint Industry Projects examining standards for qualification of technologies for power generation with capture of CO_2, transmission of CO_2 in pipelines and qualification of sites and projects for geological storage of CO_2	http://www.dnv.no/energy/nyheter/standards_co2_capture.asp
16. Project boundary issues and projects involving more than one country	COP/ MOP-3	**IPIECA/API** Guidelines for emissions accounting CCS projects	International Petroleum Industry Environmental Conservation Association and the American Petroleum Institute (IPIECA/API), 2007, Carbon capture and geological storage emission reduction project family, in Oil and Gas Industry Guidelines for Greenhouse Gas Reduction Projects, IPIECA, London http://www.ipieca.org/activities/climate_change/climate_publications.php#1
		IEA GHG Report on issues related to CCS as CDM project activities	IEA Greenhouse Gas R&D Programme (IEA GHG), 2007, ERM – Carbon Dioxide Capture and Storage in the Clean Development Mechanism, Report Number 2007/TR2, April 2007, IEA GHG, Cheltenham http://www.co2captureandstorage.info/techworkshops/2007%20TR2CCS%20CDM%20methodology%20.pdf
		WCI Submission (2008)	World Coal Institute (WCI), 2008, Submission by the World Coal Institute: Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities, WCI, London
		2006 IPCC Guidelines for National Greenhouse Gas Inventories	http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm
17. Possible process to deal in technical issues	COP/ MOP-3	**WCI Submission (2008)**	World Coal Institute (WCI), 2008, Submission by the World Coal Institute: Carbon Dioxide Capture and Storage in Geological Formations as Clean Development Mechanism Project Activities, WCI, London

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