



CATO-2 Deliverable WP 2.3-D03 Background paper on “Role of CCS in the international climate regime”

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1 Abstract

In its recent roadmap the IEA argued that CCS, in order to be effective, needs to be implemented on an international level. International cooperation is necessary to reduce costs, exchange ideas with implementation issues learned from experience and increase CCS implementation in developing countries. The aim of this study is to analyse ways to increase international cooperation in order to roll out CCS globally in developed but also developing countries.

In this paper, we reviewed current international support mechanisms for CCS. Under the international climate agreement, the UNFCCC and the Kyoto Protocol, CCS does not play a major role. The clean development mechanism (CDM) is an instrument that could potentially support CCS in developing countries, but currently does not allow CCS and has no approved methodology for this technology. There are some promising developments in other areas of the international negotiations under the UNFCCC, but it is open as to what role CCS will play in them. Possible instruments include nationally appropriate mitigation actions, and climate technology innovation centres under a Technology Mechanism.

We conclude that it is promising to consider bilateral and multilateral country partnerships outside the UNFCCC process. A review of existing CCS-related partnerships, undertaken within this study, showed that a growing number of such partnerships exist. These processes tend to focus on a limited number of issues, namely financing and implementation of R&D projects in the power sector, general knowledge exchange and capacity building as well as broad regulatory studies, and regions such as China. They do not sufficiently cover other important issues, such as financing and the implementation of regulatory frameworks. Partnerships with countries other than China, such as South Africa and India, are only small in size to this date.

Considering the background information as analysed in this paper, we suggest three possible non-mutually exclusive pathways for CCS for the future. The first is to develop a sophisticated technology mechanism for CCS. The goal of such a mechanism would be to coordinate international efforts and to create a common voice for CCS. A second option is to use current or create new bilateral partnerships that can be accounted as fast track financing under the UNFCCC, which amounts to \$30 billion USD until 2012. The third option is to create bilateral initiatives between developed and developing countries that lead to a new type of carbon credits.

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Abbreviations

| | |
|---------|--------------------------------------------------------------------------------------|
| APEC | Asia Pacific Economic Cooperation |
| APP | Asia-Pacific Partnership on climate change |
| AWG-KP | Ad Hoc Working Group on Further Commitments for Annex I Parties under Kyoto Protocol |
| AWG-LCA | Ad Hoc Working Group on Long Term Cooperative Actions under the Convention |
| BAP | Bali Action Plan |
| CAGS | China Australia Geological Storage of CO ₂ |
| CAP | Climate Action Partnership |
| CCS | Carbon Capture and Storage |
| CCX | Chicago Climate Exchange |

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| | |
|-----------------|-------------------------------------------------------------|
| CDM | Clean Development Mechanism |
| CERs | Certified Emission Reductions |
| CNCCP | China's National Climate Change Program |
| CNPC | China National Petroleum Corporation |
| CO ₂ | Carbon Dioxide |
| CO2CRC | Cooperative Research Centre for Greenhouse Gas Technologies |
| COACH | Cooperation Action within CCS China-EU |
| COP | Conference of the Parties |
| CSLF | Carbon Sequestration Leadership Forum |
| EGTT | Expert Group on Technology Transfer |
| EITs | Economies in Transition |
| EOR | Enhanced Oil Recovery |
| ERUs | Emission Reduction Units |
| EUA | European Emission Allowance |
| G20 | Group of 20 |
| G8 | Group of 8 |
| GCCSI | Global Carbon Capture and Storage Institute |
| GDP | Gross Domestic Product |
| GHG | greenhouse gas |
| IEA | International Energy Agency |
| IEA GHG | IEA Greenhouse Gas R&D programme |
| IET | International emissions trading |
| IPCC | Intergovernmental Panel on Climate Change |
| IPRs | Intellectual Property Rights |
| JCG | Joint Coordination Group on Clean Coal Technology |
| JI | Joint Implementation |
| LDCs | Least Developed Countries |
| MEF | Major Economies Forum |
| NAMAs | Nationally appropriate mitigation actions |
| NAPCC | India's National Action Plan on Climate Change |
| NGO | Non-governmental organization |
| NSFC | National Science Foundation of China |
| NUMBY | Not Under MY Backyard |
| NZEC | Near Zero Emissions Initiative |
| OECD | Organization for Economic Co-operation and Development |
| OTC | Over-the-Counter market |
| PC | Photovoltaics |
| R&D | Research and Development |
| RD&D | Research, Development and Demonstration |
| RE | Renewable Energy |
| REDD | Reduce Emissions from Deforestation and Degradation |
| RITE | Research Institute of Innovative Technology for the Earth |
| UNEP | United Nation Environmental Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNIDO | UN Industrial Development Organization |
| VER | Verified Emission Reduction |

2 Summary

The discussion on the role of CCS in mitigating climate change has picked up momentum since the IPCC Special Report on CCS was published in 2005. Recently the IEA published a Global Technology Roadmap for CCS. Within this roadmap the IEA indicates that, CCS needs to be rolled out in OECD countries and non-OECD countries alike. Within this context this study aims to analyse, with a special focus on the role of developing countries, ways to increase international cooperation for an effective global implementation of CCS.

Multilateral Institutions and CCS

The United Nations Framework on Climate Change (UNFCCC) was created in 1992 as the international framework on climate change and consists of 194 parties. It is broadly accepted internationally, but it is also a long decision making process. Its current international sub-treaty, the Kyoto Protocol, is essentially technology-neutral and therefore has few direct links to CCS. One exception is the Clean Development Mechanism (CDM), as its project-based nature could directly address CCS. However, currently CCS is not eligible as a project activity in the CDM, and negotiations on whether it should be open ended. The climate negotiations for a follow-up of the Kyoto Protocol are still ongoing, and even though some contours emerged in the Copenhagen Accord of 2009, the outcome is still unclear. Aside from emission reduction targets by developed countries and mitigation actions by developing countries, financing and technology are among the most relevant topics on the table. While some of these topic fields provide promising prospects for CCS, it is difficult to predict what role CCS will actually play as the negotiations are still ongoing.

A number of UN-associated dialogues have emerged that aim to bring the UNFCCC process forward. These often focus on particular issues, e.g. reducing emissions from deforestation, or group a limited number of countries or stakeholders to reduce the complexity of the UNFCCC process. The ultimate aim of these processes is to feed back into the UN process. Currently there are no such processes with direct relevance for CCS, the processes presented could serve a potential model though.

Furthermore, a number of non-UN institutions also have focused on climate change. These include global partnerships such as the G20 and the Major Economies Forum but also regional partnerships such as the Asia-Pacific Partnership (APP). Similar to the UN-associated dialogues these processes consist of a smaller number of involved countries, which streamlines decision processes. Their political impact however depends on the relevance for the member countries as well as on the power and size of the involved countries, especially regarding emissions. These processes address CCS more explicitly than this is done under the UN framework.

An increase in multilateral institutions, such as the Global Carbon Capture Institute, with an explicit focus on CCS can be observed in recent years. Within our research we found 11 multilateral institutions in this group including the non-UN institutions mentioned above. These institutions address a number of important issues with respect to CCS as identified in the IEA roadmap (Table 2-1). However, there is still significant room for further international efforts to advance the collaboration for CCS when one compares the ongoing actions in these partnerships with the IEA Roadmap.

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Table 2-1: Multilateral Institutions with current relevance to CCS and the functions they fulfil

| Initiative name | Technology | | | | | Legal and regulatory framework | | International cooperation | | Public engagement and education | Financing projects | |
|------------------------------------------------------------------------|-------------|-------------|---------------------|----------------------|----------|--------------------------------|------------------|---------------------------|-------------------|---------------------------------|--------------------|----------------------|
| | On site R&D | Desktop R&D | Feasibility studies | Large scale projects | Roadmaps | Regulatory framework | Policy framework | Knowledge sharing | capacity building | Public engagement and education | R&D projects | Large scale projects |
| Asia Pacific Partnership on Clean Development and Climate Change (APP) | x | x | x | x | x | x | | x | x | | x | |
| Major Economies Process on Energy Security and Climate Change (MEF) | | | | | | | | x | | | | |
| Carbon Sequestration Leadership Forum (CSLF) | | x | | | | | | x | x | | | |
| Global Carbon Capture and Storage Institute (GCCSI) | x | x | | x | x | x | | x | | x | x | |
| UN Industrial Development Organization (UNIDO) | | x | | | x | | | | x | | | |
| International Energy Agency (IEA) | | x | | | x | x | x | x | x | | | |
| IEA Greenhouse Gas R&D programme (IEA GHG) | | x | | | | x | x | x | x | | | |
| IEA Clean Coal Center | x | x | | | | | | x | | | x | |
| G8 (Gleneagles meeting 2008) | | | | | x | | x | | | | | |
| World Bank | | | x | | | | x | | x | | | |
| Asia Pacific Economic Cooperation (APEC) | | | x | | | x | x | | x | x | | |

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Bilateral Partnerships and CCS

Various broad, climate-relevant bilateral partnerships among countries exist that are or might become relevant also for CCS. Often, these partnerships include the United States, China and / or the EU. On the one hand, negotiations and implementation of these processes are often easier because opinions on the respective topic often match better than in more complex processes. Because of the limited number of participants and the direct interaction also critical topics can be address more effectively. On the other hand, the limited number of countries involved often makes bilateral agreements less compulsive than processes that are broadly acknowledged on a global scale.

We identified 11 bilateral partnerships between developed and developing country parties. As Table 2-2 shows, most of these include China. Each of the larger developed countries (including the EU) has at least one bilateral agreement with China. Bilateral agreements with other emerging economies such as India or South Africa that are also heavily coal dependent are limited and the actions taken with these countries mainly focus around capacity building and feasibility studies. Similar to the multilateral institutions explicitly focusing on CCS, the bilateral partnerships address a number of CCS relevant issues but also leave others open as analysed below.

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Table 2-2: Bilateral Partnerships with current relevance to CCS and the functions they fulfil

| Initiative Name | Partnering countries | Technology | | | | | Legal and Regulatory framework | | International cooperation | | Public engagement and education | Financing projects | |
|--------------------------------------------------------------|--------------------------|-------------|-------------|---------------------|----------------------|----------|--------------------------------|------------------|---------------------------|-------------------|---------------------------------|----------------------|----------------------|
| | | On site R&D | Desktop R&D | Feasibility studies | Large scale projects | Roadmaps | Regulatory framework | Policy framework | Knowledge sharing | Capacity building | Public engagement and education | On Site R&D projects | Large scale projects |
| Cooperation Action within CCS China-EU (COACH) | EU - China | | X | X | X | X | X | X | X | X | X | | |
| Near Zero Emissions Initiative (NZEI) | EU (UK) + Norway - China | | X | | X | X | | X | X | X | | | |
| STRACO2 | EU - China | | | | | | X | X | | | | | |
| U.S.-China Clean Energy Research Center | U.S. - China | X | X | X | | | | | X | | | X | |
| Fossil Energy Protocol | U.S. - China | X | X | X | | | | | X | | | X | |
| Climate Action Partnership (CAP) | Australia - China | | | | X | | | | | | | | |
| Joint Coordination Group on Clean Coal Technology (JCG) | Australia - China | X | X | | | | | | X | X | | X | |
| China Australia Geological Storage of CO ₂ (CAGS) | Australia - China | X | | | | | | | X | X | X | X | |
| CCS- EOR cooperation | Japan - China | X | | | X | | | | X | | | | |
| Smaller initiatives - exemplary chosen | | | | | | | | | | | | | |
| - | UK - India | | | | | | | | | X | | | |
| South Africa CCS Centre | UK- South Africa | X | X | X | | | | | | X | X | | |

Coverage and Gaps within CCS action by the various initiatives

We analysed gaps within current multi- and bilateral processes for CCS by reviewing a total of eleven bilateral and eleven multilateral partnerships. For each partnership, the planned and implemented actions were categorized according to a set of functions we developed based on the IEA roadmap (Table 5-1 and Table 6-1). Using this overview, we analyzed the topics that the agreements cover and identified existing gaps. The milestones, as formulated in the IEA Technology Roadmap for CCS (IEA 2009), are used as a guide for this gap analysis.

With respect to the technology milestone our analysis identified a lack in research collaborations on industrial and biomass projects but also within the upstream sector. With respect to the

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regulatory milestone we found that the partnerships focus on general studies on the identification of issues to be solved if large-scale implementation of CCS should take place, but lack support in the national implementation of CCS regulatory frameworks. Financing of large scale projects is lacking in both the bilateral and multilateral partnerships as partnerships mainly focus on supporting R&D efforts. With respect to public acceptance issues we found that multi- and bilateral partnerships are currently not involved in developing (local) communication strategies. There is also a strong focus on China within the partnerships.

Ways forward - Future pathways for CCS

On the basis of our analysis we suggest three possible combinable pathways for CCS for the future. The first is to develop a sophisticated technology mechanism for CCS. The goal of such a mechanism would be to coordinate international efforts better and to create a common voice for CCS. A second option is to use current or create new bilateral partnerships that can be accounted as “fast track financing” under the UNFCCC, which was pledges to be \$30 billion USD until 2012. The third option is to create bilateral initiatives between developed and developing countries that lead to a new type of carbon credits.

3 Introduction

This paper aims at providing recommendations on how CCS can be best facilitated globally. It analyses the role of CCS in the international arena and reviews and evaluates ongoing processes. We thereby provide an overview of climate relevant multilateral institutions as well as bilateral partnerships and describe the role CCS plays within these. The paper ends with an assessment of gaps within current processes¹, and makes recommendations on possible future pathways to bring CCS forward.

Background

As an option to mitigate climate change, the discussion concerning the role of CO₂ capture and storage has picked up momentum since the IPCC Special Report was published in 2005. Since then CCS is a relevant topic in several processes.

The current legally binding framework for climate change under the UN is the Kyoto Protocol. Agreed in 1997, it established binding emission reduction targets for industrialised countries (so-called Annex I countries) for the period 2008-2012. As it is essentially technology-neutral there is little focused discussion on concrete technologies such as CCS. An exception is the Clean Development Mechanism (CDM), as its project based nature could directly address CCS. However, currently CCS is not eligible as a project activity in the CDM. The discussions on the eligibility of CCS in the CDM have been ongoing since 2006. While the parties were not able to agree on this issue in Copenhagen, due to outstanding substantial questions and concerns, it was decided to consider this again in 2010, with a view to come to a decision at COP16 in Mexico in December 2010.

With the lack of success in the UNFCCC process, partnerships and institutions outside the UNFCCC could become more important. Thereby a number of processes exist that might be relevant to CCS but mainly focus on more broader climate issues and a number of processes that primarily or explicitly focus on CCS. While some processes include only two partners (bilateral partnerships) others include a variety of partners (multilateral institutions). Either of these processes play important roles and could become more and more relevant for CCS if the climate negotiations fail to deliver. They can often address CCS more directly than this can be done in the UNFCCC process.

Paper outline

In a first step, we provide an overview of the ongoing multilateral processes with relevance to CCS. Starting with the UN institutions dealing with the international climate regime, we review the current UNFCCC framework as well as the ongoing negotiations. This includes a brief review of the role CCS plays in this context. On top of that we provide an overview of climate relevant non UN processes outside the UNFCCC. Then we turn to multilateral processes with an explicit focus on CCS and evaluate these more thoroughly according to the methodology described in Section 4. We finish the section with providing an overview of multilateral processes and their role for CCS (Chapter 5).

¹ Within the paper we refer to bilateral processes as partnerships and to multilateral processes as institutions for consistency reasons. We do not intend to judge the correct wording thereby.

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In a second step we turn to bilateral partnerships. First we review some of the largest current climate relevant partnerships and discuss briefly their relevance for CCS. Similar to what we did for multilateral processes we then turn to partnerships between developed and developing countries with an explicit focus on CCS. The Chapter finishes with an overview of bilateral processes and their relevance for CCS (Chapter 6).

After a brief excerpt on the voluntary market, which is currently the only mechanism that supports CCS (Chapter 7), we review in how far the CCS relevant bilateral partnerships and multilateral institutions are in line with the IEA roadmap. For that purpose we review the milestone mentioned in the IEA roadmap for each partnership using the methodology described in Chapter 4. Based on this evaluation we identify the coverage and gaps within CCS actions by the various initiatives (Chapter 8).

In the last part of this paper we shift the view towards the future and provide three potential pathways for enhancing CCS. These pathways are based on the results of the previous sections and include our expert judgements (Chapter 9).

4 Goal and Approach

Against the background that CCS is only one of many topics on the agenda of the international climate framework, the general goal of this report is to explore which international cooperation can advance global implementation of CCS. A first operational goal is then to provide the reader with information on the current role of CCS internationally. Thereby we evaluate the current coverage of international initiatives of CCS activities. Based on this analysis we attempt to reach a second operational goal in providing some recommendations on how to move forward. In order to do so we explore a set of possible scenarios for CCS cooperation.

We implement these goals' through a four fold approach:

1. Inform on the current status of multilateral institutions and bilateral partnerships and develop an overview of the most relevant processes with potential relevance to CCS (Chapter 5 and Chapter 6)/
2. Identify and analyse gaps within the current international cooperation on CCS (Chapter 5 and Chapter 6).
3. Based on step 2 provide recommendations on how to close existing gaps in international cooperation and identify fields for future enhanced cooperation (Chapter 8).
4. Based on step 1, 2 and 3 provide recommendations on possible future pathways based on the analysis performed in the earlier steps (Chapter 9).

Methodology²

In a first step (Step 1), we present the most relevant information on the processes. We briefly describe the processes. For those processes with particular relevance to CCS the description includes the following fields:

- Extend/ Fields of cooperation (broad/ narrow, major fields of cooperation, part of the CCS chain)
- Partners (government, industry, university, R&D, etc)
- Organization of the project (Work packages, phases)
- Current status (completion data, start date; execution, planned, implemented)
- Funding (amount and source, if available)

A detailed overview of the initiatives in tabular form can be found in the Appendix I

For the analysis (step 2) eleven multilateral initiatives and eleven bilateral partnerships with relevance to CCS were reviewed (see Table 5-1 and Table 6-1). For each initiative, the planned and implemented actions were categorized according to predefined fields of cooperation as defined within the IEA roadmap. These fields of cooperation are very broad and do not lend themselves fully to evaluate the current actions undertaken by the partnerships. Especially the field of technology includes desktop based studies, on-site research as well as feasibility studies. In order to be able to take account of such different types of activities, we also added a set of functions partnerships fulfil and assigned them to the fields of cooperation. This set of functions was partially derived from the IEA Roadmap and further developed in the course of the evaluation of the partnerships in an iterative process. Within this process, we repeatedly enhanced the initial set of functions when we found that actions did not match the functions. The resulting set of functions closely corresponds with earlier sets of functions for CCS (e.g. de Coninck 2010). Table 4-1 depicts these fields and functions together.

² The Methodology applies to both the multilateral institutions as well as the bilateral partnerships

Table 4-1: Categorization of fields of collaboration

| Fields as defined in the IEA roadmaps | Functions derived for this study |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technology | Implementation of <ul style="list-style-type: none"> - desktop R&D - on site R&D (Pilot & Demo) - large scale projects (large and small commercial) Development of <ul style="list-style-type: none"> - feasibility studies - Roadmaps |
| Financing projects | Financing of <ul style="list-style-type: none"> - R&D projects (demonstration projects) - Large scale projects (commercial scale deployment) |
| Legal and Regulatory framework | <ul style="list-style-type: none"> - Regulatory framework development - Policy framework development |
| Public engagement and education | <ul style="list-style-type: none"> - Public engagement and education |
| International cooperation | <ul style="list-style-type: none"> - Knowledge sharing and technology transfer - Capacity building |

Source: author's structure, IEA 2009

We categorized the planned and undertaken actions within the partnerships according to the functions mentioned in Table 4-1. For each partnership we evaluated which fields of cooperation were covered and which not. The work is based on a review of the internet presence of the partnerships as well as presentations held on the partnerships that were freely available in the internet.

We also identify major gaps in the agreements (step 3). The analysed functions of the partnerships are compared with the milestones, as formulated in the IEA Technology Roadmap for CCS (IEA 2010; IEA 2009). Every milestone formulated for the categories Technology, Regulatory, Finance and Public Engagement, is extracted from the CCS Roadmap. Per milestone we investigate the extent to which bilateral partnerships and multilateral institutions include the specific milestones in their (work) program.

In a last step (step 4) we provide expert judgements on possible ways forward. The suggested paths were chosen on the basis of the analysis performed in this report.

5 Multilateral institutions and CCS

5.1 UN - institutions and associated dialogues

The following section gives an overview of the United Nations Framework on Climate Change and how CCS is embedded in it.

5.1.1 UNFCCC

The international community has agreed to take first steps against global climate change with the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Since then, all parties meet once a year, at the Conference of the Parties to the UNFCCC (COP). The UNFCCC entered into force in 1994 and is to date supported unanimously by 194 parties. It has as its ultimate objective to stabilize the greenhouse gas emissions to prevent dangerous anthropogenic interference with the climate system. Obligations are distributed according to the principle of “common but differentiated responsibilities and capabilities”. All participating countries agreed to prepare emission inventories and to promote emission reduction and cooperation. In addition, all countries are grouped, depending on their state of development and responsibility for climate change. These grouping are listed in Annexes to the UNFCCC:

- *Parties included in Annex II to the Convention* encompass the countries that were members of the Organization for Economic Co-operation and Development (OECD) in 1992.
- *Parties included in Annex I to the Convention (Annex I Parties)* encompass both the countries that were members of the Organization for Economic Co-operation and Development (OECD) in 1992 and countries with “economies in transition” (EITs), that are the Russian Federation and several other Central and Eastern European countries. Annex I countries are to take the lead reducing emissions.
- *Parties not included in Annex I to the Convention (Non-Annex I Parties)* encompass those countries that are not member of Annex I, including all newly industrialized countries and developing countries. Non-Annex I countries received no additional obligations.

5.1.1.1 Current Framework – Kyoto Protocol

The UNFCCC set the basis as an international treaty that recognizes climate change as a global problem. The Kyoto Protocol, adopted in 1997 and entered into force in 2005, provides concrete reduction targets for countries. It requires developed countries to take the lead with legally binding emission reduction targets.

The UNFCCC provides the basis in 1992 as an international treaty that recognizes climate change as a global problem. The Kyoto Protocol, a protocol to the UNFCCC, was adopted in 1997 and entered into force in 2005. It requires developed countries to take the lead with legally binding emission reduction targets: Annex I countries that have ratified the Kyoto Protocol have taken on the commitment to reduce their greenhouse gas emissions together by around 5% between 2008 and 2012 compared to 1990 levels. The US is the only Annex I country that has not ratified the KP.

The Kyoto Protocol provides flexible mechanisms to reach the emission reduction targets in the most efficient way. These include:

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- *International Emissions Trading*: Trading of emission rights between member countries shall ensure that emissions are reduced at minimum costs. It is considered as additional element, supplementary to emission mitigation.
- *Joint Implementation*: Under Joint Implementation (JI) Annex I countries can implement emission reduction measures, and thus reduce emissions, in other Annex I countries while counting the realised reduction for achieving their own reduction target. The main precondition is that both countries have reduction obligations under the Kyoto Protocol. This mechanism shall reduce costs and use reduction potential and increase technology transfer especially in Eastern European countries.
- *Clean Development Mechanism*: Under the Clean Development Mechanism (CDM) Annex I countries can implement emission reduction measures and thus reduce emissions, in non-Annex I countries while counting the realised reduction for achieving their own reduction target. The main precondition is that the host country, where emissions are reduced, has no reduction obligations under the Kyoto Protocol and that the emission reduction would not have been implemented without the CDM (additionality). This mechanism aims to contribute to sustainable development, reduce costs, use reduction potential and increase technology transfer especially in developing countries.

It is broadly recognized that further steps are necessary to stabilize the climate in the long term. The Kyoto Protocol itself demands the negotiation of further targets, which should start seven years before end of the first commitment period (2008-2012).

5.1.1.2 Ongoing negotiations – Copenhagen and beyond

All Parties to the UNFCCC meet (at least) once a year at the Conference of the Parties (COP) to negotiate and decide on future developments of topics related to the UNFCCC, such as future commitments of Annex I and non Annex I countries, CDM, JI, etc.

At COP 13 in December 2007 the Bali Action Plan (BAP) was agreed upon. Its intention was for two parallel working groups to come to an agreement on further cooperative action by December 2009 in Copenhagen, one under the UNFCCC encompassing all countries, and one under the Kyoto Protocol, including only those that support it (i.e. without the USA). As negotiations for the follow-up of the Kyoto Protocol had to start quickly, expectations were high. However, the goal of the BAP was not met. Instead, the countries merely “took note” of the ‘Copenhagen Accord’³ and extended the mandate of the two working groups until December 2010.

The Copenhagen Accord makes several recommendations, but leaves many unanswered questions open to interpretation. Though it adopts the goal of limiting global warming to below 2°C, the Accord provides little guidance of how to achieve it or relative to which year. Instead it requests countries to submit their emission reduction proposals or actions. However, the aggregated reductions pledges and actions submitted by the countries (including developing countries) do not yet signal the achievement of the 2°C goal, rather they reflect a limit of 3.5°C (Climate Action Tracker 2010).

Considered by many as one of the few successes of the Accord itself, the developed countries committed themselves to mobilizing \$ 30 billion in fast track financing (2010-2012), as well as \$100 billion annually as of 2020, for mitigation and adaptation activities in developing countries.

³ The Copenhagen Accord is a document that delegates at the 15th session of the Conference of Parties ([COP 15](#)) to the [United Nations Framework Convention on Climate Change](#) agreed to “take note of” at the final plenary on 18 December 2009.

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Aside from the Copenhagen Accord, the two Ad-hoc Working Groups (AWG) under the UNFCCC (AWG-LCA)⁴ and under the Kyoto Protocol (AWG-KP)⁵, resulted in further developments, however at differing paces. For example, contact groups negotiating Adaptation and Technology Transfer have nearly reached strong enough consensus to pass the negotiating texts to the political level. This is important, especially to developing countries. A constructive development on these topics could also have a positive influence on negotiations in other areas. On the other hand, contact groups for other issues, especially regarding mitigation, were unable to resolve several major issues. Decisions were postponed to COP 16 in 2010, which prolongs the negotiation progress for a future international agreement even more.

The outcome of the COP15 leaves many challenges for the near future. Currently there are still several major questions confronting the ongoing negotiation process:

- Could the combined text including the Copenhagen Accord lead to an ambitious agreement by COP 16?
- Can a compromise decision be reached in some issues such as Adaptation, Technology Transfer or deforestation before consensus on all issues under one comprehensive agreement is reached?
- What is the future of the Kyoto Protocol and its institutional architecture? Should, and if so how, can the emission reduction targets under the Copenhagen Accord be transformed into targets under the Kyoto Protocol, if the U.S. and several other countries are not yet able to commit to a legally binding, ratifiable agreement?
- How can agreements and initiatives outside of the UNFCCC be used to advance agreements under the UNFCCC?

Two topics currently discussed are particularly important for CCS, i.e. “nationally appropriate mitigation actions” and a new technology mechanism. These two issues are discussed in the following sections.

5.1.1.2.1 Nationally appropriate mitigation actions

Already in 2007 the Bali Action Plan (Paragraph 1 (b) (ii)) mentioned Nationally appropriate mitigation actions (NAMAs) for the first time. These are measures “by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity building, in a measurable, reportable and verifiable manner.” NAMAs could play an important role for future climate negotiations and the design of a medium-term climate agreement.

However, the negotiations so far have failed to define what NAMAs actually are. Thus, different interpretations on what the term stands for remain to exist. Views also differ on the institutional structure needed for providing support to NAMAs as well as ways to measure, report and verify actions. Due to the many uncertainties surrounding the scope and definition of NAMAs, the NAMA discussion remains very general, making it difficult to work on concrete implementation issues. It remains to be seen what role CCS could play within this context.

NAMAs can consider very different broadness of scope and different types of action. Measures can range from project level investments to government policy implementation. They can include:

- data collection, studies, research
- strategy development on national/regional and sectoral level
- (pilot-) projects
- definition, implementation and enforcement of regulation

⁴ Ad Hoc Working Group on Long Term Cooperative Actions under the Convention

⁵ Ad Hoc Working Group on Further Commitments for Annex I Parties under Kyoto Protocol

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- capacity and institution building
- provision of financial incentives
- awareness raising/campaigns.

This diversity of possible NAMAs has an impact on the complexity of implementation and measurement, reporting and verification (MRV) of the actions as well as on the scale of potential impacts and the timeline for these impacts.

A general question to answer in the future will be the financing of NAMAs. As NAMAs per definition include development as well as climate change elements financing could be based on (existing) development aid as well as on climate funds, apart from domestic or bilateral funding.

Regarding the climate component of NAMAs an overlap with the CDM has to be considered. To reduce the danger of double counting of emission reduction effects, NAMAs should not be implemented in areas or sectors where CDM projects are developed.

Generally, NAMAs are a good tool to target more strategic, long-term, transformational measures, which are unlikely to be funded through carbon marked mechanisms, which focus on maximum short-term emission impacts (Jung et al. 2010).

5.1.1.2.2 Technology

Technology is a well advanced issue within the climate negotiations. In comparison to other negotiation fields within the climate negotiations, there has been significant movement in the technology contact group of the AWG LCA, with the achievement of consensus on most of the critical issues. Below we list the most important parts of this technology discussion and link this to CCS.

Parties have identified a non-exclusive list of activities that could be supported with technology. The choice of the activities to be supported should be determined by a country driven process and be guided by consideration for efficiency and effectiveness. Still remaining open is the discussion on whether the purchase of licences and Intellectual Property Rights (IPRs) should also be supported here in this context.

In the current negotiating text, the technology mechanism will consist of a Technology Executive Committee, which is to replace the current Expert Group on Technology Transfer (EGTT), as well as climate technology centres nested within a network. It is unclear to what degree this mechanism takes account of the activities identified or if and how this mechanism will be linked to a possible financial mechanism. However, a list of actions that a technology mechanism should support is given.

The Climate Technology Centres should support and accelerate the diffusion of technology by providing technical assistance and training upon request of developing country parties. The climate technology centres are to support development in all parts of the technology deployment process, from the needs assessment to the provision of information, the design of programmes to the evaluation. Furthermore, national as well as a number of regional innovation centres, together with a climate technology network and a roster of experts shall be established.

Intellectual Property rights (IPRs) remain the most heavily disputed issue in the technology discussion. While one option is to make no reference at all to them in the text, the other option is to take actions to remove the barriers posed by IPRs to technology transfer. The latter lays down various options that include the creation of a global IPR pool and sharing publicly funded

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technology know-how in the public domain or even the full removal of IPRs in developing countries.

CCS could for instance play a relevant role within the context of the Climate Technology Centres as well as the climate technology networks. For instance existing CCS technology centres as such as the Australian funded Global CCS Institute (see also Section 5.3.2) could become part of the network. What role they will play in such a network remains to be seen. Another way of strengthening the role of CCS here is through including CCS experts in the roster of experts.

5.1.1.3 Current status of CCS within the UNFCCC

The Kyoto Protocol and CCS

As laid out in Section 5.1.1.1 the Kyoto Protocol established binding national emission reduction targets for the period 2008-2012 for Annex I countries. In that sense, the Kyoto Protocol is essentially technology-neutral on an international level. Annex I countries have to reach the established emission reduction targets through their national climate policy and report on their achievement to the UNFCCC. The reporting is guided by the IPCC Guidelines for National Greenhouse Gas Inventories.

The Clean Development Mechanism (CDM) due to its project-based nature could directly address CCS. However, currently CCS is not eligible as a project activity in the CDM. The discussions on the eligibility of CCS in the CDM have been ongoing since 2006. While the parties were not able to agree on this issue in Copenhagen in 2009, due to outstanding substantial questions and concerns, it was decided to consider this again in 2010.

The IPCC as a scientific body established under the United Nations to study climate change, published a special report on CCS in the year 2005 (IPCC 2005). The goal of this report was to provide information on CCS for policy makers, scientists and engineers. Furthermore Chapter 5 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories explicitly regards "Carbon Dioxide Transport, Injection and geological storage" (IPCC 2006). These two reports show that an internationally accepted scientific basis has been established for the use of CCS.

Copenhagen outcome and CCS

The outcome of the climate negotiations in Copenhagen mainly focuses on recommendations, but leaves many unanswered questions open to interpretation. The major questions that led to a stagnation of the official negotiations in the AWG LCA and KP still need to be solved. Aside from the Copenhagen Accord, the two AWGs have produced draft texts that serve as a basis for this discussion. While CCS is not explicitly mentioned in the main drafts it is mentioned several places in other draft documents (inf.1 and inf.2 documents) (Svenningsen 2010).

On top of the direct mentioning of CCS, Copenhagen saw progress in a few fields with potential relevance to CCS. These especially include finance and technology but also the discussion around Nationally Appropriate Mitigation Actions (NAMAs) (see Section 5.1.1.2). Many of these are still very vague and negotiations on the issues are ongoing. They still need to be translated into legally binding form and it even remains unclear whether this will be possible.

One important milestone was that developed countries have pledged "fast start" financing of 30 billion US\$ for the period 2010 to 2012 for mitigation and adaptation and further financing of 100

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billion US\$ yearly by 2020 for mitigation (see Section 5.1.1.2). The Copenhagen Accord proposed a High Level Panel to study the contribution of potential sources of revenue. This Panel has completed its work (see Section 5.1.2.1). A Copenhagen Green Climate fund was proposed as an operating entity of the financial mechanism. Yet many issues are left open by the Accord. Among these are the distribution among the beneficiaries of the resources and the distribution of the contributions of the donors. As the negotiations only progress slowly processes outside the UNFCCC might become more important and with that respect also for CCS.

The Copenhagen Accord proposes the establishment of a Technology Mechanism but leaves many aspects open. The basis of any further discussion is summarized in the draft conclusion of the AWG LCA (FCCC/AWGLCA/2009/L.7/Add.3). The conclusions discuss the creation of a Technology Executive Committee and Climate Technology Centers. The exact structure of these bodies and their role are yet to be determined. Nevertheless these mechanisms could address CCS in one or another form. Especially the creation of Climate Technology Centers potentially foresees the inclusion of CCS.

5.1.2 UN Associated Dialogues

A number of processes have emerged in the past that aim to advance the climate negotiations under the UNFCCC. Major processes are described in the following sections. These processes do not cover CCS directly or at all currently. Nevertheless they could provide an example of how CCS could be advanced within the climate negotiations.

5.1.2.1 High-level Advisory Group on Climate Change Financing (AFG)

The Secretary-General of the United Nations established a High-Level Advisory Group on Climate Change Financing (AFG) on 12 February 2010 for the duration of 10 months. Prime Minister Meles (Ethiopia) and Prime Minister Brown (Great Britain) co-chair the group. The other 17 members include Heads of States and Government, high-level officials from Ministries and Central Banks, as well as experts on public finance, development and related issues.

The AFG will be studying “potential sources of revenue that will enable achievement of the level of climate change financing that was promised during the United Nations Climate Change Conference in Copenhagen in December 2009”, which is about US\$100 billion annually by 2020. These resources shall support adaptation, mitigation, technology development and transfer, and capacity building in developing countries, with priority for the most vulnerable countries.

The Group developed practical proposals on how to significantly scale-up long-term financing for mitigation and adaptation strategies in developing countries from various public as well as private sources. Final recommendations are available since November 2010 on the Groups web site (UN 2010).

5.1.2.2 Petersberg Climate Dialogue

The Petersberg Climate Dialogue was hosted by the German and the Mexican Governments in May 2010. Environmental and Climate Minister from 43 countries met for 2.5 days in Bonn, Germany. The meeting aimed to restore a trustful environment for discussion to further prepare the COP16 Meeting in Mexico in December 2010.

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The participants agreed that immediate action is necessary to combat climate change, claimed concrete action parallel to the UNFCCC negotiations and discussed next steps. Several countries presented climate change initiatives, such as initiatives for reducing deforestation or technology projects, as a model for future cooperation between developing and developed countries.

Germany, South Africa and South Korea launched an initiative to support developing countries to work out environment and climate friendly growth strategies. This initiative also aims at making support for developing countries transparent, measurable and comprehensible.

The Ministers reaffirmed their commitment to limit global temperature increase to 2°C. For the UNFCCC negotiations they identified the following priority issues (BMU 2010a; BMU 2010b):

- reducing greenhouse gas emissions in developed and newly industrialized countries,
- setting up an international system for monitoring mitigation activities,
- supporting adaptation measures in developing countries and
- financing international climate protection.

5.1.2.3 Greenland Dialogue

Another international Ministerial dialogue of three to four day meetings started with the invitation of Denmark in June 2005: Representatives from 22 like-minded countries met in Greenland and informally discussed the development of an inclusive strategy beyond 2012. The second meeting took place in South Africa in June 2006 which also focused on the special situation of Africa. Sweden hosted the third meeting in June 2007 (Riksgränsen 2007) where elements of an overall architecture of the post 2012 regime we discussed to include mitigation, adaptation, technology and financing. The June 2008 meeting took place in Argentina. The latest meeting was held in July 2009 in Greenland.

The informal setting for several days in attractive locations has proven to provide a constructive atmosphere among environmental ministers. While they did not make concrete recommendations on a future regime, the trust building and collection and convergence of ideas were very supportive in the past and can be in the future (Danish Ministry of Climate and Energy 2010).

5.1.2.4 Paris-Oslo process on REDD

The Paris-Oslo process aims to establish an Interim REDD Partnership between rich and poor countries to reduce emissions from deforestation and forest degradation. The process began with a meeting in Paris and ended in May 2010 in Oslo with the establishment of the REDD+ partnership. To date seventy countries have joined the partnership and are actively engaged in working together to progress this issue alongside the UNFCCC process to provide input on quick-start financing for REDD for COP16 in December 2010 in Cancún (<http://reddpluspartnership.org>).

The group also focuses on the (lack of) clarity on how the process would link with or report back to the UNFCCC. NGOs criticized the lack of transparency and participation in the Paris-Oslo process (IISD 2010; Oslo Climate and Forest Conference 2010).

5.2 Non-UN institutions

Major processes outside the UN are described in the following sections. In contrast to the UN institutions they address CCS directly.

5.2.1 Group of 20 (G20)

The Group of 20 (G20) brings together important industrialized and developing economies. In this informal group, ministers of finance and heads of central reserve banks discuss key issues in the global economy and the international financial system. The G20 was established in 1999. Its member countries are Argentina, Australia, Brazil, Canada, China, EU, France, Germany, India, Indonesia, Italy, Japan, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, United States and UK.

In 2009 the G20 announced that it will replace the G8 as new permanent council for international economic cooperation, as the G8 has only industrialized member countries and is also included in the G20.

In 2008, the G8 committed to support the launching of 20 large-scale carbon capture and storage (CCS) demonstration projects globally by 2010. In 2010, the International Energy Agency (IEA), the Carbon Sequestration Leadership Forum (CSLF) and the Global CCS Institute provided report on the progress of the CCS demonstration projects. This report also includes high level-recommendations such as “bridging the financial gap for demonstration, establishing legal and regulatory frameworks and communicating with the public” (OECD 2010).

The G20 so far did not actively focus on climate change. During the last meetings the participants discussed climate change financing options and recognized the need to increase significantly and urgently the scale and predictability of finance to implement an ambitious international agreement. The G20 also acknowledged an urgent need for a climate change deal under the UNFCCC. But so far, no specific decisions on financing climate change have been made (G20 2010; University of Toronto 2010).

5.2.2 Major Economies Forum (MEF)

The Major Economies Forum on Energy and Climate (MEF) was launched in March 2009 and includes the 17 largest economies of the world: Australia, Brazil, Canada, China, the European Union, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, South Africa, the United Kingdom, and the United States. The MEF intends to

- facilitate a dialogue among major developed and developing economies,
- help generate the political leadership necessary to achieve a successful outcome at the UNFCCC negotiations, and
- advance the exploration of concrete initiatives and joint ventures that increase the supply of clean energy while cutting greenhouse gas emissions.

In July 2009, the MEF Leaders launched the Global Partnership for low-carbon and climate-friendly technologies. As an initial step, they requested a suite of Technology Action Plans, which now span ten climate-related technologies that together address more than 80% of the energy sector carbon dioxide (CO₂) emissions reduction potential identified by the IEA. MEF partners agreed to lead the work to develop the Technology Action Plans. These technologies focus on (leading country in parenthesis):

- Advanced Vehicles (Canada)
- Bioenergy (Brazil and Italy)
- Carbon Capture, Use & Storage (Australia and United Kingdom)
- Energy Efficiency – Buildings Sector (United States)
- Energy Efficiency – Industrial Sector (United States)
- High-Efficiency, Low-Emissions (HELE) Coal (India and Japan)

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- Marine Energy (France)
- Smart Grid (Italy and Korea)
- Solar Energy (Germany and Spain)
- Wind Energy (Denmark, Germany, and Spain)

Each of the Technology Action Plans contains the mitigation potential of the technology, barriers and best practice strategies to overcome them, and a menu of specific potential actions to move towards best practice policies. Such actions shall help to reduce market barriers and realize the full potential of clean energy technologies (MEF 2010).

CCS plays only a minor role within the partnership, one of ten technology roadmaps deal with the subject. While the aim of the MEF is broad, concrete actions are limited. Through its technology roadmaps it intends to guide its members on potentially exemplary actions they can undertake. Among these are increased research, development of regulatory frameworks or the development of principles for knowledge sharing from publicly funded projects. Due to this rather advisory role the partnership assigns no concrete funding.

5.2.3 Asia-Pacific Partnership (APP)

The Asia-Pacific Partnership on Development and Climate, also known as APP, is an initiative by Australia, Canada, China, India, Japan, South Korea, and the USA (<http://www.asiapacificpartnership.org>). Countries first met under this non-legally binding framework in January 2006.

The purposes of this partnership are to “advance clean development and climate objectives [...] The Partners will enhance cooperation to meet both [...] their] increased energy needs and associated challenges, including those related to air pollution, energy security, and greenhouse gas intensities in accordance with national circumstances.”

The seven partner countries represent more than half of the world's economy, population and energy use. Globally, they are important production countries of coal (65%), cement (62%), steel (60%) and aluminium (52%). They account for 54% of global CO₂ emissions from fossil fuel consumption. (APP 2010)

The main institution of the APP is the Policy and Implementation Committee, which is chaired by the USA. It is responsible for management of the implementation of the cooperative activities of the partnership and its task forces. The Administrative Support Group coordinates the communication and was also established by the USA. Eight government-industry task forces exist.

They focus on power generation and key industry sectors of the partner countries: aluminium (Australia, USA), buildings and appliances (Korea, USA), cement (Japan, Canada), cleaner fossil energy (Chair: Australia, Co-Chair: China), coal mining (USA, India), power generation and transmission (USA, China), renewable energy and distributed generation (Canada, Australia) as well as steel (Japan, India). The transport sector is not covered.

The Asia-Pacific Partnership is seen by some of its members as an alternative to the UNFCCC and Kyoto process, and by others as a complement to it. The impact of the APP alone, on a political and global basis, does not seem sufficient to keep global average temperature increase below 2°C. It also still has to prove to be operational as a new institution. The APP could complement the UNFCCC process well if it focuses on the development of particular technologies.

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Under the Cleaner Fossil Energy Task Force three out of 5 themes refer to CCS. The cooperation is broad and ranges from pilot capture projects, desktop research on the whole CCS chain through regulatory development to the deployment of pilot CCS projects. Many bilateral actions are included in the partnership: Projects usually identify two countries/ parties working jointly on a subject. Not all project parts involve developing country parties. The partnership is ongoing and contains planned as well as running projects. There is no clear budget assigned to the partnership.

5.2.4 Asia Pacific Economic Cooperation (APEC)

Similar to the APP the Asia Pacific Economic Cooperation (APEC) consists of member countries from the Asia Pacific region, but its membership is broader (21 member countries) and especially includes from developing countries. The primary aim of the partnership lays on trade and cooperation issues. The partnership deals with CCS within its Expert Group on Clean Fossil Energy, which was started in 1993. Fields of cooperation include capacity building on the assessment of geological storage potential as well as guidelines on capture ready projects. Most of this work is executed in the form of workshops and studies.

5.3 Institutions with an explicit CCS focus

A group of multilateral institutions explicitly aims at fostering the implementation of CCS. This group is analysed in more detail in this Chapter. We apply the Methodology described in Chapter 4, step 3 and identify

5.3.1 Carbon Sequestration Leadership Forum (SCLF)

The Carbon Sequestration Leadership Forum (SCLF) is a US led initiative that includes 23 countries from both the developed and developing world (especially emerging economies) as well as the European Commission. The partnership was implemented in 2003 and solely focuses on CCS. It consists of a two-tiered ministerial partnership: a technology group as well as a policy group. The partnership recognizes projects from different fields of cooperation, currently, mid 2010, 30 projects. It aims primarily at identifying potential areas for multilateral cooperation.

5.3.2 Global Carbon Capture and Storage Institute (GCCSI)

Established in 2009, the Global Carbon Capture and Storage Institute (GCCSI) is the newest multilateral initiative solely focusing on CCS. The public-private partnership initiated by the Australian government has 215 members of which 20 are countries. The Australian government contributes yearly A\$ 100 million over a 4 year period to the partnership. Despite this large funding, the amount of work undertaken within the institute to date has been limited: the partnership has so far mainly funded a stock taking of CCS projects around the globe as well as other organizations work, such as several IEA GHG reports (de Coninck 2010). The institute plans however to provide 50 US\$ yearly within its project funding and support program. The organizational structure of the Institute is not yet finalized.

5.3.3 Other multilateral institutions with a focus on CCS

The UN Industrial Development Organization UNIDO is developing a Roadmap on CCS in the industrial sector, which will be published in 2011. The International Energy Agency (IEA) with its 28 member countries has, from 2003 onwards, published various separate publications on CCS (including a Roadmap on CCS in 2009) as well as integrated CCS into its main reports. Furthermore, it held a series of capacity building workshops in non-IEA countries. The IEA Greenhouse Gas R & D programme (IEA GHG) was established under an implementing agreement under the IEA in 1991, but is independent from the IEA. The IEA GHG extensively publishes on CCS through technical and general report and also monthly newsletters. Publications range from technical research reports to studies on issues regarding policy and legal frameworks. Through its summer school, IEA GHG also provides capacity building. A further affiliate of the IEA, the 'IEA Clean Coal Centre', established in 1975, has a broader focus on clean coal. Its reports often include sections on CCS. The World Bank has also started to become active with respect to CCS and organized a first capacity building workshop in 2009.

5.4 Summary of multilateral initiatives and institutions

5.4.1 General overview

Compared to the UNFCCC, the multilateral processes consist of a smaller number of involved countries. This leads to easier decision processes. The multilateral processes are very different in focus and duration. The political impact depends on the policy level as well as on the power and size of the involved countries, especially regarding population, GDP and emissions.

The climate policy arena can be divided into the United Nations Framework Convention on Climate Change (UNFCCC) and the climate relevant processes outside the UNFCCC. The UNFCCC was created in 1992. It consists of 194 parties and is a broadly accepted framework on climate change. On the one hand, its broad international coverage leads to long decision processes. On the other hand, the UNFCCC has a high political impact.

Under the UNFCCC some processes are relevant to CCS. This relevance, though, is very limited so far. Under the Kyoto Protocol mainly the emission reduction targets for the year 2012 for industrialised countries and the option of negotiating further medium and long-term targets might have a positive influence on the development of CCS as an emission mitigation measure for the future. Also the CDM can become relevant to CCS although, so far, CCS is not eligible for CDM projects.

Under the Copenhagen Accord especially the issues on finance, technology mechanisms and Nationally Appropriate Mitigation Actions (NAMAs) could become relevant for CCS in the future.

5.4.2 Partnerships with special relevance to CCS

Geographically multilateral partnerships are either restricted to a limited region or span globally. While some countries, especially those in Asia (esp. China, Japan) and Pacific (esp. Australia,

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US) are involved in global as well as regional agreements (e.g. the APP⁶), others tend to only be involved in global multilateral partnerships such as the EU. This section presents the most relevant partnerships to CCS and briefly highlights their main characteristics, stressing the points highlighted in the introduction of this section. As with the bilateral partnerships, the Annex includes a complete overview of the agreements.

Generally multilateral agreements tend to be broader in scope in comparison to their bilateral counter parts and often include CCS only as one technology among many others.

Table 5-1: Multilateral Initiatives with relevance to CCS and their functions

| Initiative Name | Technology | | | | | Legal and Regulatory framework | | International cooperation | | Public engagement and education | Financing projects | |
|------------------------------------------------------------------------|-------------|-------------|---------------------|----------------------|----------|--------------------------------|------------------|---------------------------|-------------------|---------------------------------|--------------------|----------------------|
| | On site R&D | Desktop R&D | Feasibility studies | Large scale projects | Roadmaps | Regulatory framework | Policy framework | knowledge sharing | capacity building | Public engagement and education | R&D projects | Large scale projects |
| Asia Pacific Partnership on Clean Development and Climate Change (APP) | x | x | x | x | x | x | | x | x | | x | |
| Major Economies Process on Energy Security and Climate Change (MEF) | | | | | | | | x | | | | |
| Carbon Sequestration Leadership Forum (CSLF) | | x | | | | | | x | x | | | |
| Global Carbon Capture and Storage Institute (GCCSI) | x | x | | x | x | x | | x | | x | x | |
| UN Industrial Development Organization (UNIDO) | | x | | | x | | | | x | | | |
| International Energy Agency (IEA) | | x | | | x | x | x | x | x | | | |
| IEA Greenhouse Gas R&D programme (IEA GHG) | | x | | | | x | x | x | x | | | |
| IEA Clean Coal Center | x | x | | | | | | x | | | x | |

⁶Asia Pacific Partnership on Clean Development and Climate Change

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| | | | | | | | | | | | | |
|------------------------------------------|--|--|---|--|---|---|---|--|---|---|--|--|
| G8 (Gleneagles meeting 2008) | | | | | x | | x | | | | | |
| World Bank | | | x | | | | x | | x | | | |
| Asia Pacific Economic Cooperation (APEC) | | | x | | | x | x | | x | x | | |

6 Bilateral partnerships and CCS

6.1 Climate relevant bilateral partnerships

Various bilateral processes among countries exist that are or might become relevant also for CCS. This chapter gives a brief introduction on a selection of bilateral processes of major countries.

6.1.1 U.S. – Mexico: Bilateral Framework on Clean Energy and Climate Change

In April 2009 President Obama and President Calderon announced their plans to establish the US-Mexico Bilateral Framework on Clean Energy and Climate Change with the aim of supporting the development of a low carbon future and a clean energy economy.

The framework shall establish “a mechanism for political and technical cooperation and information exchange, and to facilitate common efforts to develop clean energy economies”. It focuses on renewable energy, energy efficiency, adaptation, market mechanisms, forestry and land use, green jobs, low carbon energy technology development and capacity building.

Another focus of the framework between the U.S. and Mexico is the cooperation in the border region on promoting efforts to reduce greenhouse gas emissions, adaptation to local impacts of climate change in the region and strengthening the reliability and flow of cross border electricity grids (Government of the U.S. 2009).

6.1.2 U.S. – Brazil climate dialogue

In 2010, the United States and Brazil launched a bilateral climate dialogue to join forces on reducing climate change. So far, this cooperation mainly focuses on reducing emissions from deforestation and degradation (REDD). But also the support of international climate talks and the research and development of clean energy technologies are part of the dialogue. (Environmental Defense Fund 2010).

6.1.3 EU – China

The EU and China jointly committed to cooperate on environment and energy issues, including climate change, in September 2005, when the EU-China Partnership on Climate Change was launched. This partnership provides a high-level political framework to further strengthen the cooperation between EU and China.

This partnership is planned to complement the UN Framework Convention on Climate Change and the Kyoto Protocol. Its goal is to strengthen the cooperation on climate change, including clean energy i.e. cooperation on the “development, deployment and transfer of low carbon technology, including advanced near-zero-emissions coal technology through carbon capture and storage”.

Phase three of this cooperation shall be completed by 2020 and will include the “construction and operation of a commercial scale demonstration plant fired by near-zero-emissions coal with CCS technology” (EU Commission 2010).

6.1.4 EU – Japan

In 2010 the 19th Japan-EU Summit took place in Tokyo. Beside other issues the Summit leaders addressed climate change. A Joint Statement identified priorities for a joint Japan-EU leadership. Among others, these included the “promotion of the development of a sustainable low carbon global economy”, the reduction of global greenhouse gas (GHG) emissions by at least 50% by 2050 against 1990 levels and reduce GHG emissions by developed countries in aggregate by 80% or more. Furthermore, also the use of Carbon Capture and Storage (CCS) under the CDM and a cooperation in the development, deployment and transfer of technologies, such as CCS, was discussed (Delegation of the EU to Japan 2010).

6.2 Bilateral Partnerships with an explicit focus on CCS

A group of bilateral partnerships explicitly aims at the implementation of CCS. We describe them below ordered by the countries participating in these partnerships.

6.2.1 European Union - China

At its 8th meeting in 2005 the EU-China summit, an annual high level meeting, the two nations agreed upon a joined declaration on climate change. In the Rolling Work plan agreed upon in 2006 they further specified this general framework and identified CCS as a priority area for cooperation. The work plan states as an objective to “develop and demonstrate in China and the EU advanced, near-zero emissions coal technology through carbon capture and storage”⁷.

The centre piece of their cooperation is the Near Zero Emissions Coal (NZE) agreement on low carbon technologies⁸. This is a cooperation between the UK as the mayor partner from the European Union and China. Recently, in 2010 Norway also joined in the partnership and said it will spend up to Nkr60 million over the next two years. The NZEC agreement is a broad cooperation focusing on R & D (mostly desktop based), capacity building, roadmaps and policy assessment in the first phase, feasibility studies on storage and capture options in the second phase, with the ultimate goal of the deployment of a demonstration plant (Phase 3) by 2015. The broad partnership includes member from industry to research institutes, including 10 EU partners and 19 Chinese partners. Phase I is completed, and was funded with up to 3,5 million pounds from UK Department of Energy and Climate Change (DECC).

Cooperation Action with CCS China-EU (COACH) is a further broad cooperation on various fields ranging from the general knowledge exchange to the concrete implementation of projects. The partnership includes 20 partners ranging from R&D organizations to industry, while the former are dominating the partnership. The partnership is organized in 6 work packages of which 4 are content oriented and two contain the project management, and consists all in all of 2 phases. The partnership solely focuses on CCS and covers the whole CCS chain. The ultimate aim of the project is to prepare the ground for running demonstration projects by 2015. The project is already well advanced: the first Phase of the project is already completed and the second and third phase runs through 2015. Funding for the project is partially provided through the FP6 framework of the European Union.

Another project, focusing mainly on regulatory issues is the Support to Regulatory Activities for Carbon Capture and Storage (STRACO2) project. Partners include research institutes and universities from both countries (EU and China). The EU partners are clearly dominating the

⁷ http://ec.europa.eu/environment/climat/pdf/china/rolling_work_plan.pdf

⁸ <http://www.nzec.info/en/>

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project though as the primary focus is the implementation in the EU: The project primarily focuses on the implementation of a comprehensive regulatory framework in the EU but explicitly regards implication for China. The overall cooperation focuses on regulatory and policy issues. The project was financed through the EU's Seventh Framework program (FP7) and is completed at this point in time. The final report has been published.

6.2.2 U.S. - China

The cooperation between China and the US on CCS recently gained momentum with the foundation of the U.S. – China Climate Energy Research Center in November 2009. The US and Chinese government initiated the Center with the aim to “facilitate joint research and development of clean energy technologies by teams of scientists and engineers from the United States and China, as well as serve as a clearinghouse to help researchers in each country” (U.S.Department of Energy 2010). Before that, the major hub for the cooperation was the Fossil Energy protocol. Both partnerships focus on broader issues for cooperation and include CCS as one option.

Partners within the Fossil Energy protocol include the US Department of Energy (DOE) and Chinas’ Ministry of Science and technology. Information on industry, university, R&D partners or other partners could not be found in the internet. The core of the protocol is to promote cooperation in fossil energy R&D, hence it focuses primarily on research (on site as well as desktop) and feasibility work as well as knowledge sharing. The project is structured into five Annexes, of which two are relevant for CCS. Implementation began in 2000, originally a 5 year work plan was agreed which was prolonged in 2005 for an additional 5 years. Activities completed to this date include a CCS prefeasibility study and a symposium on CO₂ Emissions Control Science & Technology.

The U.S.-China Clean Energy Research Center is a recent initiative founded in 2009 that focuses on cooperation in 3 core areas: Building Energy Efficiency, Clean Coal (including Carbon Capture and Storage), Clean Vehicles). The initiative is in an early stage and not implemented yet. Recently, in May 2010, interested parties could respond to the funding opportunity announcement made by the US government⁹. For each of the core areas the US is currently forming consortia. Hence no activities are undertaken to date. Members of such consortia may be “individuals from academia, the private sector, non-governmental institutions, national laboratories and elsewhere”¹⁰. Core areas of cooperation include planned feasibility studies of IGCC plants, storage site selection, joint research by scientists and engineers as well as participation in each others research projects. With respect to funding the US and Chinese government pledged \$15 million to support initial activities. Afterwards the Center “...will be supported by public and private funding of at least \$150 million over five years, split evenly between the two countries”¹¹. The anticipated funding from US government side for Clean Energy including fossil fuel amounts to \$12.5 million.

Additional to these partnerships there are further partnerships between companies and other institutions in both countries (The White House, 2009).

⁹ <https://www.fedconnect.net/fedconnect/?doc=DE-FOA-0000324&agency=DOE>

¹⁰ <https://www.fedconnect.net/fedconnect/?doc=DE-FOA-0000324&agency=DOE>

¹¹ <http://www.energy.gov/news2009/8292.htm>

6.2.3 Australia - China

Australia and China have a long-standing relationship when it comes to coal. With respect to CCS they have two major bilateral initiatives: the Joint Coordination Group on Clean Coal Technology and the China – Australia Geological Storage of CO₂ (CAGS) program. Furthermore, they both engage in a number of multilateral initiatives such as the APP or the Global Carbon Capture and Storage Institute (we discuss these initiatives in the following Chapter). Especially in the latter Australia plays a significant role as the Australian government founded and heavily funds it.

The *Joint Coordination Group on Clean Coal Technology (JCG)* builds on existing bilateral and multilateral initiatives, which support cooperation between Australia and China. The Australian Government has committed \$20 million to support low emission coal projects with China under the JCG. It supports practical cooperation between Australia and China on the development, transfer and deployment of clean coal technologies, e.g. two demonstration plants (one Post-Combustion, one IGCC), general research collaboration, capacity building and general stock taking of projects in both countries. Partners on the Australian side include Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO). Australia has committed \$ 20 Million to the group.

Within the *China Australia Geological Storage of CO₂ (CAGS)* partnership partners include research and governmental institutions (ministries) from both countries. The cooperation focuses on storage issues and includes joint research, technical workshops and summer schools. Activities to date include capacity building events, awareness building of CCS, research in storage facilities and researcher and student exchanges. The project is funded with Au\$ 2.86 million and runs from 2009 – 2011.

6.2.4 Japan – China

The cooperation on CCS between Japan and China currently focuses on one EOR cooperation project.

Within the *EOR cooperation* project partners include governmental as well as research institutions. Leading partner are the Research Institute of Innovative Technology for the Earth (RITE) for Japan, and National Petroleum Corporation (CNPC) for China as well as companies such as Toyota Motor Company. From the Japanese side, the cooperation includes a total of 6 partners. Cooperation focuses on storage issues and includes joint research and technical workshops. The project is expected to cost between 20 to 30 billion yen and started in 2009.

6.3 Summary of bilateral partnerships

The bilateral processes are the least complex processes as only two partners are involved. There are many bilateral partnerships, often involving the United States, China and / or the EU. Negotiations between two countries often make the implementation easier and opinions on the respective topic often match better than in more complex processes. Due to a more personal tone and the limited number of opinions, also critical topics, such as financing, can be addressed more effectively. However due to the limited number of countries involved, bilateral agreements often are less compulsive than processes that are broadly acknowledged on a global scale.

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With respect to CCS relevant bilateral partnerships, the majority of bilateral partnerships between developed and developing country parties include one particular country on the developing country side: China. Essentially each of the larger developed countries (including the EU) has at least one bilateral agreement with China. Tjernshaugen (2008) finds a link between a countries interest in fossil fuels and its interest in CCS. Together with the fact that China has the largest absolute CO₂ emissions worldwide this might help explain this focus on China. Bilateral agreements with other emerging economies such as India or South Africa that are also heavily fossil fuel dependent are limited though. The actions taken with these countries mainly focus around capacity building and feasibility studies. In our research, we only found a limited number of partnerships with Least Developed Countries (LDCs) such as with African countries (Energy research Centre of the Netherlands (ECN) et al., 2010).

Furthermore, bilateral partnerships are often directly or indirectly linked with multilateral partnerships discussed in the next section. They are often times either implemented as part of or are in some other way integrated with multilateral initiatives. One such example is the partnership between Australia and China, which is also represented in the Asia Pacific Partnership on climate change (APP) as well as the Global CCS institute.

The bilateral partnerships examined often involve, aside from governmental organizations of the partnering countries, other organizations such as independent research institutes or private companies. The partnerships involve in many cases a mix of stakeholders from all of these groups. In most cases, both the governmental as well as the private partners provide funding for the partnership. Unfortunately, only very few partnerships publicly state the total amount or distribution of funding available.

Table 6-1 lists the most important bilateral initiatives with an explicit focus on CCS identified for this study as well as the functions they fulfil. A total of 9 initiatives were identified between China and major developing countries. With respect to other developing countries, the initiatives taken tend to be much smaller and cover less functions. We picked two partnerships to illustratively representing these partnerships.

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Table 6-1: Bilateral Initiatives regarded in this study

| Initiative Name | Partnering countries | Technology | | | | | Legal and Regulatory framework | | International cooperation | | Public engagement and education | | Financing projects | |
|--------------------------------------------------------------|--------------------------|-------------|-------------|---------------------|----------------------|----------|--------------------------------|------------------|---------------------------|-------------------|---------------------------------|----------------------|----------------------|--|
| | | On site R&D | Desktop R&D | Feasibility studies | Large scale projects | Roadmaps | Regulatory framework | Policy framework | knowledge sharing | capacity building | Public engagement and education | On Site R&D projects | Large scale projects | |
| Cooperation Action within CCS China-EU (COACH) | EU - China | | x | x | x | x | x | x | x | x | x | | | |
| Near Zero Emissions Initiative (NZEI) | EU (UK) + Norway - China | | x | | x | x | | x | x | x | | | | |
| STRACO2 | EU - China | | | | | | x | x | | | | | | |
| U.S.-China Clean Energy Research Center | U.S. - China | x | x | x | | | | | x | | | x | | |
| Fossil Energy Protocol | U.S. - China | x | x | x | | | | | x | | | x | | |
| Climate Action Partnership (CAP) | Australia - China | | | | x | | | | | | | | | |
| Joint Coordination Group on Clean Coal Technology (JCG) | Australia - China | x | x | | | | | | x | x | | x | | |
| China Australia Geological Storage of CO ₂ (CAGS) | Australia - China | x | | | | | | | x | x | x | x | | |
| CCS- EOR cooperation | Japan - China | x | | | x | | | | x | | | | | |
| <i>smaller initiatives - exemplary chosen</i> | | | | | | | | | | | | | | |
| - | UK - India | | | | | | | | | x | | | | |
| South Africa CCS Centre | UK- South Africa | x | x | x | | | | | | x | x | | | |

7 Voluntary Carbon Market

The Voluntary Carbon Market is added as an excerpt here as it is currently the only mechanism that allows CCS credits and therefore serves as a source for financing.

The carbon market consists of the compliance and the voluntary market. One form of a compliance market is introduced through the Kyoto Protocol that provides three mechanisms for countries who signed the Kyoto Protocol to meet their obligations (see also Section 5.1.1.1).

- International emissions trading (IET) – trading of emission permits (called Assigned Amount Units or AAUs) among the industrialized countries
- Joint Implementation (JI) – crediting of emission offsets resulting from projects among industrialized countries (called Emission Reduction Units or ERUs)
- Clean Development Mechanism (CDM) – crediting of emission offsets resulting from projects in developing countries (called Certified Emission Reductions or CERs).

In addition countries may decide to set up domestic compliance markets and emission trading schemes.

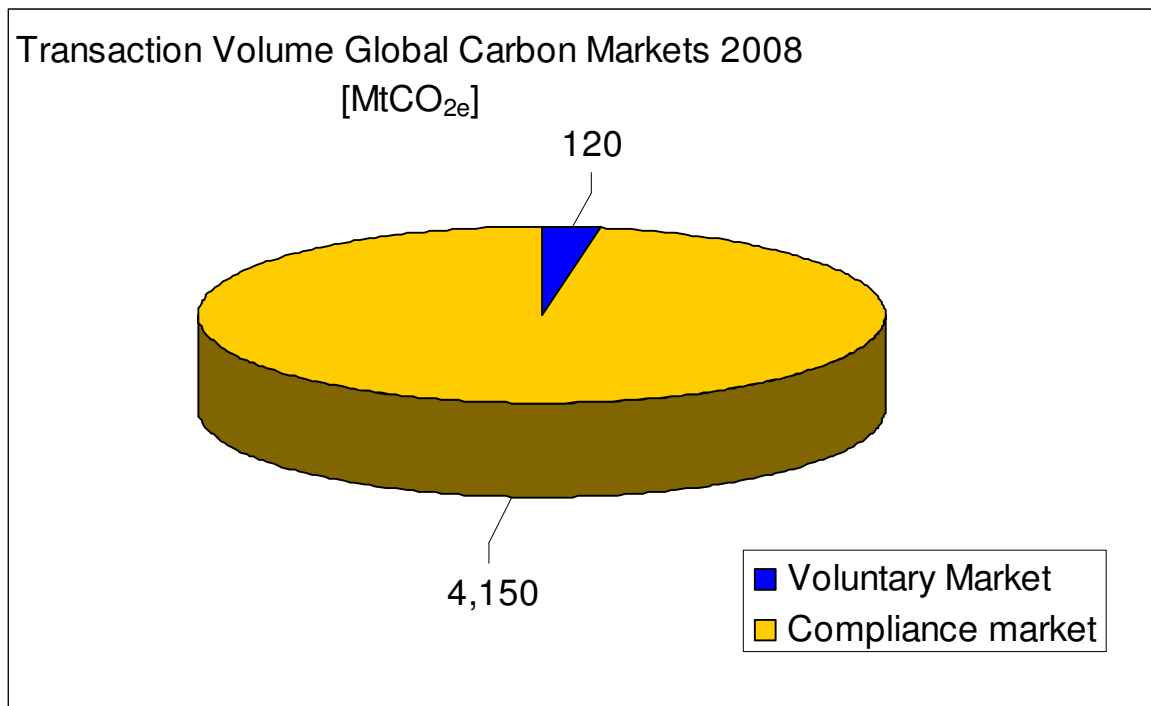


Figure 1: Transaction Volume on the Global Carbon Markets in 2008 (Hamilton et al. 2009)

The voluntary market covers all voluntary activities but emission reduction certificates generated through compliance market mechanisms can also be traded on the voluntary market. The voluntary market is generally used by companies, individuals, and other entities and activities that are not subject to mandatory limitations but wish to offset GHG emissions. Figure 1 provides an overview of the transaction volume of emission credits on the global carbon markets in the year

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2008. It shows that only a small part of the overall credited amounts are traded on the voluntary carbon markets.

The main difference between the compliance and the voluntary market are the standards and requirements that apply to demonstrate compliance. Depending on the standards used the certificates issued have different names and can be used for different purposes. Table 7-1 provides an overview of the carbon market certificates in relation to the project type they are generated from and the markets they are traded in.

Table 7-1: Overview of carbon market certificates (adopted from UNFCCC 2010)

| Type of certificate | | Project type | Market | Quality control |
|---------------------|------------------------------|------------------|-------------------------------------|--------------------------------------------------|
| CER | Certified emission reduction | CDM projects | Allowance market & Voluntary market | Standardized process according to Kyoto Protocol |
| ERU | Emission Reduction Unit | Jl projects | Allowance market & Voluntary market | Standardized process according to Kyoto Protocol |
| EUA | European Emission Allowance | EU ETS | Allowance market & Voluntary market | Standardized process according to Kyoto Protocol |
| VER | Verified Emission Reduction | Diverse projects | Voluntary market | Certified by independent third party |

Requirements for carbon reduction projects generating carbon credits differ significantly on the voluntary market, because there are no common quality standards for voluntary emission reductions. Project requirements reach from highly ambitious carbon standards covering sustainability and environmental benefits e.g. the Gold Standard¹ to less ambitious standards such as the Voluntary Carbon standards (see also Appendix II). In contrast to certificates of the compliance market (CER, ERU, EUA) voluntary carbon certificates are not registered in one central registry. However, quality requirements for carbon-offset projects increased during the last years leading to the development and further improvement of voluntary offset standards and the emergence of new registries¹² (Hamilton et al. 2009). While there are often critical voices that the voluntary carbon standards are not rigorous enough they provide an opportunity for new methodologies to be developed e.g. standards for REDD projects.

The two main voluntary markets are the Chicago Climate Exchange (CCX) and voluntary Over-the-Counter markets (OTC). In 2008, around 56 % of the carbon emissions were traded at the CCX, around 44 % on the voluntary OTC and 0.2 % at other exchanges (Hamilton et al. 2009).

¹² Proofs of the legitimacy of carbon offsets projects is a mayor issue for the purchasers of carbon credits and with a growing market, also quality requirements and standards are further developed

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Prices for carbon credits on the voluntary market

Prices for carbon credits differ according to project type and market place. Credits usually reach higher prices on the OTC market compared with the CCX. Credit prices on the OTC market ranged between \$1.2 to \$46,9/tCO₂-eq in 2008, which was a by far smaller range than the year before with \$1.8 to \$300/tCO₂-eq (Hamilton et al. 2009). CS credits (geological sequestration) are currently not traded at the CCX markets (CCX 2010) but are traded at OTC markets. On the OTC markets credits from geological sequestration reached the lowest average sales price with (\$2.58/tCO₂-eq) compared to renewable energy projects which reached sales prices up to (\$21.98/ tCO₂-eq) for credits from solar and biomass projects. All CCS credits sold on the OTC market originate from Enhanced Oil Recovery (EOR) projects based in North America. EOR credits can be produced at very low costs, as revenues are generated from the additional production of crude oil (Hamilton et al. 2009).

Buyers of voluntary carbon credits

The main motivation of private sector companies to buy credits on the voluntary market are Corporate Social Responsibility (CSR) and Public Relations (Hamilton et al. 2009). CCS credits might be less attractive for companies interested in CSR due to the lack of other sustainable development benefits. However the attractiveness of CCS credits also depends on the acceptance of CCS in the respective country and may change over time. CCS credits for CSR purposes might be more attractive in a country which considers CCS an important climate change mitigation option as e.g. Norway.

The share of voluntary offsets by NGO's and individuals has significantly decreased in 2008, possibly because of the economic crisis and negative media publicity¹³ to 1% and 2% respectively (Hamilton et al. 2009). European buyers purchased 53 % of all certificates on the voluntary market in 2008. However, American buyers made the USA the single country with the highest demand (39%) and the highest supply of credits (28%). This might be explained with the non-existence of a large US compliance market (Hamilton et al. 2009).

Market share of CCS credits

CCS credits were only traded on the US market in 2008.¹⁴ The globally transacted CCS credits increased from 0.3 MtCO₂ in 2007 to 2.65 MtCO₂ in 2008 (Hamilton et al. 2009). This led to an increase of the market share of transacted CCS credits on the OTC market from 1 % to 5.2% globally which equals an increase of 5 % to 18.3 % in the US (Hamilton et al. 2009).

Conclusions

The review has shown that the market for credits generated from CCS is limited to the US. At this point in time Enhanced Oil Recovery (EOR) is the only source for CCS credits. This can be explained by low costs for the generation of credits due to the benefit on enhancing fossil recovery. The value of carbon credits generated from these projects is, however, with \$2.58

¹³ The major concern is how to proof the effectiveness and legitimacy of the carbon offset product. E.g. the U.S. Government Accountability Office released a report titled, "Carbon Offsets: The U.S. Voluntary Market Is Growing, but Quality Assurance Poses Challenges for Market Participants" which lead to negative media attention and mixed replies by the environmental community.

¹⁴ Hamilton et al. 2009 examined the market situation until 2008.

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/tCO₂-eq amongst the lowest on the carbon market. This can probably be explained by a low demand for the credits, which in turn can be explained by the fact that credits on the voluntary carbon market are often bought by companies with the aim to improve their image. Using credits that enhance fossil use simultaneously to reducing emission are not well fit for such purpose though, because companies using such credits become vulnerable to criticism. Other options for the generation of CCS credits besides EOR (through e.g. capture and storage from coal fired power plants) are however currently too expensive to be viable for financing through the carbon market. We can conclude that the two key factors that will determine future opportunities for CCS on the voluntary carbon markets are:

1. Ability to generate carbon credits through CCS at low costs; this will depend on availability of technology
2. Demand for CCS credits on the voluntary market, this will depend on the acceptance of the technology by carbon credit buyers

8 Discussion of coverage and gaps within CCS actions by the various initiatives

The bilateral and multilateral partnerships included in this evaluation are presented in Table 5-18-1 and Table 6-18-2. In the column to the right it is summarized what exactly is done on the milestones of the CCS roadmap.

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Table 8-1: IEA CCS roadmap *technology* milestones addressed by the partnerships

| Technology milestones | | | Focus of partnerships | |
|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2010 – 2020 | 2020-2030 | 2030 - 2050 | | |
| <ul style="list-style-type: none"> - Prove technologies at large scale | <ul style="list-style-type: none"> - Reduce CO₂ capture energy penalty | <ul style="list-style-type: none"> - All power plants operating over 45% efficiency (low heating value, including CO₂ capture) | <ul style="list-style-type: none"> - Commercial systems with gas separation membranes | <p>Bilateral:</p> <ul style="list-style-type: none"> - COACH: coal gasification for appropriate poly-generation schemes with CCS - NZEC: coal fired power generation - FEP: feasibility of CCS with direct coal liquefaction (DCL), desktop R&D and on site R&D: DOE funds cooperative work between West Virginia University and Shenhua Group Corporation - Joint Coordination Group on Clean Coal Technology (JCG): on site R&D: post-combustion capture pilot project, IGCC trial, desktop R&D: general research collaboration - CCS-EOR cooperation: on site R&D/ deployment: CCS capture and CCS storage in EOR field <p>Multilateral:</p> <ul style="list-style-type: none"> - APP: research on different capture technologies, cooperation around various capture pilots - CSLF: Foster collaborative research, development, and demonstration (RD&D) projects reflecting Members' priorities. - GCCSI: funding and support program for large scale CCS projects in the critical stages of project development and implementation. - IEA Clean Coal Centre: support for relevant R&D through providing archives and data bases + financial support - EGCFE: a.o. capture readiness |
| <ul style="list-style-type: none"> - Identify industrial applications | <ul style="list-style-type: none"> - Demonstrate H₂ combustion with high-efficiency CCGTs | <ul style="list-style-type: none"> - Reduce capital costs by further 10% | <ul style="list-style-type: none"> - Continue to reduce energy penalty | |
| <ul style="list-style-type: none"> - Demonstrate retrofit at 85% capture | <ul style="list-style-type: none"> - Widespread availability of commercial plant (new and retrofit) | <ul style="list-style-type: none"> - Demonstrate chemical looping for coal and gas, pressure and electrical swing | | |

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| | | | | |
|------------------------------------------------|---------------------------------------|------------------------|--|--|
| | | absorption, cryogenics | | |
| - Fund R&D for biomass CO ₂ capture | - Reduce capital cost by at least 10% | | | |

With respect to the technology milestone, most of the collaboration efforts within bilateral partnerships are directed towards R&D and preparatory steps for large-scale demonstration plants. Bilateral initiatives with China mainly focus on CCS for coal-fired power plants. This is not surprising since coal-fired plants are at the heart of China's energy supply, and China's reliance on coal will become even stronger over the next decades (IEA 2010). The identification of industrial applications and biomass CCS is outside the scope of the initiatives.

Multilateral initiatives often do not carry out technical research themselves, but have a function of governing or facilitating the progress made in this field and identifying new research areas. They serve as platforms for the exchange of knowledge and for identification and prioritization of research topics. The CSLF for example seeks collaboration and knowledge exchange on CCS projects worldwide by 'recognizing' CCS projects. Proposals for recognition can be submitted to the CSLF and are evaluated by the CSLF Technical Group. Collaborative projects of any type consistent with Article 1 of the CSLF Charter may be recognized by the CSLF. This specifically includes projects that include the following:

- Information exchange and networking;
- Planning and road-mapping;
- Facilitation of collaboration;
- Research and development;
- Demonstrations; or

The GCCSI also closely follows the deployment of large scale CCS projects and reports on the status of these projects.

Table 8-2: IEA CCS roadmap *regulatory* milestones addressed by the partnerships CCS

| Regulatory milestones | | Focus of partnerships | |
|--------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2010 – 2020 | 2020-2050 | | |
| - Regulatory frameworks in place for CCS demonstration | - Comprehensive regulatory frameworks in place for commercial deployment | - Continue to review and refine legal and regulatory frameworks in all regions as CCS experience increases | <p><i>Bilateral:</i></p> <ul style="list-style-type: none"> - COACH: regulatory issues is a cross-cutting issue, identification of regulatory barriers for development and implementation of CCS - emphasizing appropriate solutions - STRACO₂: is designed to support the development of a regulatory framework for CCS in the European Union and to research possibilities of using EU CCS regulation as a best practice study for CCS regulation in China. <p><i>Multilateral:</i></p> <ul style="list-style-type: none"> - APP: regulatory infrastructure development - MEF: Develop comprehensive legislative and regulatory frameworks that address, among other things, long-term storage and financial liability - GCCSI: Supporting national government in the development of regulatory frameworks - IEA: through reports - IEA GHG: through reports |

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Very few bilateral initiatives carry out regulatory studies. One of the reasons might be that regulatory frameworks are very country-specific and cannot easily be transferred to other countries. Our research finds that the regulatory work of existing bilateral initiatives is limited to general studies on the identification of issues to be solved if large-scale implementation of CCS should take place.

In multilateral partnerships the legal and regulatory framework is often dealt with in two ways. Either reports are written on regulatory issues (IEA GHG, IEA) or national governments are supported in their development of regulatory framework (GCCSI). The objectives with regard to regulatory issues are often not further specified than 'develop regulatory framework'.

Table 8-3: IEA CCS roadmap *finance* milestones addressed by the partnerships CCS

| Finance milestones | | Focus of partnerships |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 2010 – 2020 | 2020-2050 | |
| - Provide an average of USD 3.5 – 4 billion annually for CCS demonstration projects | - Continue to monitor and adapt CCS financing strategies as experience increases | <i>Multilateral:</i> - GCCSI: funding and supporting large-scale CCS projects in the critical stages of project development and implementation. |
| - Provide USD 1.5 – 2.5 billion annually for CCS demonstration in non-OECD countries | | |

The actual financing of CCS pilot, demonstration or large scale projects and the arrangement of funds is only covered to a very limited extent by current bilateral initiatives. Only some bilateral initiatives finance R&D efforts. Some initiatives, such as the EU NZEC project, have evaluated potential sources of financing for their planned large scale projects. However, there seem to be no projects that finance large scale implementation.

There is only one multilateral initiative that is involved in project financing, the GCCSI. The Australian government committed AU\$100 million annual funding for the Global CCS Institute. Approximately AUD \$50 million per annum will be made available to support a substantial portfolio of CCS projects around the world.

Table 8-4: IEA CCS roadmap *public acceptance* milestones addressed by the partnerships

| Public engagement milestones | | | Focus of partnerships |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2010 – 2020 | 2020-2030 | 2030 - 2050 | |
| - Provide greater governmental resources | - Develop and apply a toolkit of best practice public engagement techniques to CCS demonstration projects | - Refine public engagement strategies in all regions as CCS experience increases | Bilateral: - South Africa CCS centre: awareness and public outreach (generally planned) - CAGS: awareness building through Study tour for policy maker and business leader Multilateral: - GCCSI: facilitating engagement with GCCSI (Foundation) Members, industry and governments in promotion of CCS - EGCFE: social perceptions and acceptance |

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Public acceptance studies are also not one of the main topics in bilateral initiatives. That effort is transferred to capacity-building events such as technical workshops, summer schools, symposia etc. It seems that awareness-building activities are often directed at policy makers and business leaders and not yet to local residents who might face the implementation of CCS in their surroundings.

In general, multilateral initiatives are not involved in developing (local) communication strategies. Public engagement is part of their programme and they look into public perception.

Summary of partnerships

Bilateral agreements primarily focus on technology related issues and much less on the other aspects such as regulatory and public acceptance issues. Since most of the bilateral initiatives studied here are between China and one other country, the focus is even more narrow and limited to research on coal-fired power plants.

Multilateral initiatives mostly serve a function of a platform to exchange knowledge and to set priorities for research. Usually there are strong collaborative partnerships with other multilateral initiatives, e.g. GCCSI has strong linkages with the Energy Agency (IEA), Carbon Sequestration Leadership Forum (CSLF), World Bank, Asian Development Bank, Clinton Foundation and The Climate Group.

Conclusions on identified gaps

Generally, an increase in international collaboration on CCS can be observed in recent years through new multilateral institutions such as the Global Carbon Capture Institute or new bilateral partnerships such as the U.S. – China Clean Energy Research Center. However, there is still significant room for further international efforts to advance the collaboration for CCS when one compares the ongoing actions with the IEA Roadmap. One interesting observation we made in our research was that there was hardly any information on the budget of the partnerships available. This which makes it hard to judge how committed the partnerships actually are.

With respect to the technology milestone, our analysis identified a lack in research collaborations on industrial and biomass projects but also within the upstream sector. Especially with respect to the industry sector, this is not well aligned with the development path suggested in the IEA Roadmap. Within the roadmap, 35 out of 100 projects to be developed by 2020 are in the industry and another 27 in the upstream sector (IEA 2009). Within the partnerships evaluated here a strong research focus on coal fired power plants was observed, though. An increase in collaboration in the industrial as well as the upstream sector could increase the interest in countries where the power sector doesn't play such a relevant role, such as Saudi Arabia.

With respect to the regulatory milestone, the IEA roadmap calls for the development of near term regulatory approaches to address CCS demonstration projects as well as the frameworks for the large scale deployment of CCS. According to the roadmap, non-OECD countries are supposed to have amended existing legal and regulatory frameworks for the demonstration of CCS between 2010 and 2015. Currently bilateral and multilateral partnerships support this aim only through general studies on the identification of issues to be solved if large-scale implementation of CCS should take place, but not through support in the national implementation of CCS frameworks.

Furthermore, the current partnerships mainly support financing of R&D efforts. Financing of large scale projects is lacking in both the bilateral and multilateral partnerships examined. This is

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contrasted by the IEA roadmap, which calls for an average annual investment in CCS of USD 1.5 billion to USD 2.5 billion from 2010 to 2020 in non-OECD countries (IEA 2009). At the same time, developed countries have pledged fast start financing under the UNFCCC of 30 billion US\$ for the period 2010 to 2012 for mitigation and adaptation and 100 billion US\$ yearly by 2020 for mitigation. The current fast start finance pledges by Annex I countries suggest that these will be channelled through bilateral and multilateral channels¹⁵.

With respect to public acceptance issues, multi- and bilateral partnerships are currently not involved in developing (local) communication strategies. The IEA calls for the development of a CCS public engagement and communication toolkit by 2011. Partnerships between countries could for instance play an active role in disseminating this toolkit once developed and in learning from each others experiences.

Last but not least there seems to be a strong focus on China within the partnerships evaluated. However there is a large potential for CCS within other regions in the world. Furthermore, within the climate negotiations some industrialized countries (e.g. the EU) have already stated regional preference for regions other than China (World Resource Institute 2010).

¹⁵ See <http://www.faststartfinance.org>

9 Ways forward - Future pathways for CCS

In this last section we identify three potential ways forward for the world wide diffusion of CCS. The future paths presented are a result of the analysis in the previous sections and the expert judgement of the authors. They are non-exclusive and can be combined with each other.

9.1 Develop a sophisticated technology mechanism (under the UNFCCC or other body)

A first option to enhance international cooperation on CCS is the establishment of a sophisticated technology mechanism. This would have a clear added value over the current situation where there is no coordinating entity¹⁶.

Such a mechanism could potentially address some of the shortcomings of current activities as identified in this paper, by:

- Addressing open issues related to CCS in a coordinated manner
- Provide a common voice for the coordinated roll out of CCS
- Identify financing sources for further development
- Addressing questions that need international attention, but that are currently not addressed internationally (e.g. leakage/ seepage)
- Set internationally accepted standards for CCS storage sites
- Create international information campaigns on CSS

Such mechanism could improve coordination of work among the initiatives and avoid double work. Furthermore, it could help steer financial resources towards where they are most needed. Caution has to be given to the design of such a process in order safeguard that it has an added value and will be able to contribute effectively towards achieving the above mentioned functions. .

Such a mechanism could be implemented within the framework of the UNFCCC or outside such a framework. Both design options have advantages and disadvantages, as will be discussed below.

Technology Mechanism under the UNFCCC

A CCS technology mechanism could be integrated into the currently existing framework on technology cooperation under the UNFCCC. This can be done through integrating it into the currently discussed Technology Executive Committee and Climate Technology Centres (see Section 5.1.1.2.2). The already existing Expert Group on Technology Transfer (EGTT) or if agreed the Technology Executive Committee could supervise such mechanism.

A body under the UNFCCC would have the clear advantage that a framework is already in existence with the EGTT. Further it could achieve a high international acceptance by all stakeholders as within the UNFCCC as all stakeholders would have to agree with it. Another advantage would be that it would be closely linked to the UNFCCC process.

An integration of such a mechanisms into the UNFCCC bears also some disadvantages though. Its creation and implementation would be prone to often times slow processes of the current UNFCCC decision procedures. This could not only lead to a delay in the implementation, but also to a weak framework that would not address all aspect properly as they would all have to be

¹⁶ Although the GCCSI could potentially play such role in the future

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agreed upon. The implementation issues with CCS under the current framework could reappear here as well.

Technology Mechanism under another regime

Alternatively the technology mechanism could be implemented within a completely new body or under another currently existing body. Potential current partnerships that could establish such a mechanism include the Global CCS Institute, the Major Economies Forum or the G20 (see also Chapter 5). A clear disadvantage of including it into a current body is that many of these bodies only comprise a limited number of member countries. An advantage is that already pre-existing structure could be used.

A clear advantage over a body within the UNFCCC is that only those countries could join that are interested in CCS, and thus a coalition of the willing could be formed. In that way such a body is easier and faster to implement and could be potentially more effective in addressing the most important issues. It would also be independent of the slow UNFCCC processes and that way be able to take important decisions faster. It can therefore be concluded that a near-term demonstration of CCS can only be achieved outside of the UNFCCC. A disadvantage is that the body is likely to have less international acceptance. Some might argue that such a body can be considered to be biased as only countries with a vested interest in CCS will be included.

9.2 Bilaterals accounted as fast track financing under the UNFCCC

A second option for a future pathway could increase bilateral actions that can be accounted for as “fast track financing” under the UNFCCC¹⁷. Under the Copenhagen Accord Annex I countries agreed to make 30 billion USD of fast start financing available from 2010 – 2012 and even increase this afterwards (see Section 5.1.1.2). While it is unclear how the money will flow, current financial pledges from countries suggest that large amounts will flow through bilateral and multilateral initiatives (World Resource Institute 2010). As identified in Chapter 8, there is currently a number of bilateral partnerships and multilateral institutions with respect to CCS but these do not deal with the financing of CCS.

Under such a bilateral partnerships between two countries (one developed and one developing) funding would be provided by the developed (Annex I) country. The Annex I country can count this contribution towards its finance pledge. The actions undertaken could range from concrete R&D projects to policy programmes or the design of a regulatory framework.

The advantages of setting up such partnerships would be that more funding could be made available for CCS in developing countries. Since bilateral initiatives include only two partnering countries, they are easy to implement. One could even imagine using the current bilateral partnerships as identified in Chapter 6 and adding an international finance component to them.

There are some risk and downsides to this concept as well. Up-front investments will have to be made with the uncertainty whether they will be in the end accounted towards the financial pledge. For instance, there might be strong sustainability criteria defined by the countries providing the financial support which might exclude CCS from being eligible. Other actions (e.g. renewables) might be preferred as their sustainable development benefit is higher and CCS might be seen as

¹⁷ This could also be referred to as a CCS NAMA

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diverting the resources from these options. Furthermore, USD 30 billion are only a small amount of the financial resources which are needed for investments into combating climate change. Financing made available in this manner might therefore not be sufficient to support large scale CCS projects.

9.3 Bilateral crediting initiatives

Yet another option is to increase bilateral actions that produce new types of carbon credits. Currently there are already some initiatives being developed with this in mind. Japan and China have proposed a bilateral carbon crediting mechanism (Point Carbon 2010). Japan sees this as a possibility to go beyond the CDM market, which they regard as being too complex. Other countries are thinking of similar trading schemes. It remains unclear what role CCS could play in such mechanisms, though. The design of these mechanisms can however draw upon experiences and lessons learned from the CDM and the voluntary market.

Advantages of such an approach are that actions can be taken soon. There is no need to wait until an international agreement is achieved. The crediting programmes can be implemented on a bilateral basis, and thus help to develop methodologies which might then be used for a potential carbon market system in the future. A disadvantage of bilateral crediting is that rules and modalities will vary from one initiative to the other, thus leading to a fragmented way of how carbon reductions are accounted for.

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Appendix I: Evaluation of bilateral and multilateral approaches

The appendix includes overview table of the for the Bilateral partnerships (9 tables) and multilateral partnerships (9 tables) evaluated in this study.

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Table 0-1: Overview of bilateral approaches (part 1)

| name | participating countries | member type | participating members | aim (vision; mission statement) |
|------------------------------------------------|--------------------------|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooperation Action within CCS China-EU (COACH) | EU - China | industry, research institutes, universities, etc.. | COACH project groups 20 partners (R&D, Manufacturers, Oil & Gas Companies, etc...), 12 for Europe and 8 for China: IFP, SINTEF, BGS, GEUS, KTH, AIET, RIPED, TPRI, IGC/CAS, ACCA21, Zhejiang University, Tsinghua University, ATANOR, SHELL, STATOILHYDRO, BP, GREENGEN, ALSTOM, AIR LIQUIDE, Schlumberger - EPS | "The COACH project aims at establishing broad cooperation between China and the EU in the field of CCS (CO2 Capture and Storage). It will prepare the ground for implementation in China of large-scale polygeneration energy facilities with options for coal based electric power generation as well as production of hydrogen and synthetic fuels. For these facilities, CO2 capture and geological storage (including use for enhanced oil or gas recovery) constitute an inherent and decisive prerequisite." |
| Near Zero Emissions Initiative (NZEI) | EU (UK) + Norway - China | industry, research institutes, universities, etc.. | 10 EU partner (AEA, Alstom Power, British Geological Survey, BP, Cambridge University, Doosan Babcock, Heriot Watt University, Imperial College, Shell, Schlumberger) and 19 Chinese partner (ACCA21, Chinese Academy of Sciences (Institute of Geology and Geophysics), Centre for Energy and Environmental Policy (CEEP), China University of Petroleum Beijing, China University of Petroleum Huadong, Department of Environmental Sciences and Engineering at Tsinghua University (DESE TU), Department of Chemical Engineering at Tsinghua University (DCE TU), Department of Thermal Engineering at Tsinghua University (DTE TU), Energy Research Institute (ERI), Greengem, Institute of Engineering Thermophysics, Chinese Academy of Sciences (IET), North China Electric Power University (NCEPU), BP Tsinghua University Clean Energy Research and Education Centre, Thermal Power Research Institute (TPRI), 3E Institute Tsinghua University (WP2 Leaders), Wuhan University (WHU), Zhejiang University (ZJU), PetroChina, Jilin Oilfield | "The agreement has the objective of demonstrating advanced, near zero emissions coal technology through carbon capture and storage (CCS) in China and the EU by 2020" |

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Table 0-2 Overview of bilateral approaches (part 2)

| name | participating countries | member type | participating members | aim (vision; mission statement) |
|-----------------------------------------|-------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STRACO2 | EU - China | research institutes, universities | <p>EU partners: Bureau de Recherches Géologiques et Minières (BRGM) , DEVELOPMENT Solutions Europe Ltd. (DS) , Mälardalen University (MU) , Netherlands Organisation for Applied Scientific Research TNO , The Royal Institute of Technology (Kungliga Tekniska Högskolan) (KTH) , The World Business Council for Sustainable Development (WBCSD)</p> <p>Chinese partners: The Administrative Centre for China's Agenda 21 (ACCA21) , The Institute of Engineering Thermo-physics, of the Chinese Academy of Science (IET) , The Institute of Policy and Management of the Chinese Academy of Sciences (IPM)</p> | "The STRACO2 Project is designed to support the ongoing development and implementation of a comprehensive regulatory framework in the EU for Carbon Capture and Storage (CCS) technologies for zero emissions applications. It also aims at building a basis for EU-China cooperation on CCS." |
| U.S.-China Clean Energy Research Center | US - China | industry, research institutes, universities, etc.. | <p>Joint Steering Committee: will consist of representatives of the U.S. Department of Energy, Ministry of Science and Technology and National Energy Agency of the People's Republic of China and other relevant ministries, departments and agencies of either government as jointly determined by DOE, China's Ministry</p> | " The Center will facilitate joint research and development of clean energy technologies by teams of scientists and engineers from the United States and China, as well as serve as a clearinghouse to help researchers in each country." |
| Fossil Energy Protocol | US - China | ministries | DOE and China's Ministry of Science and Technology | Promote cooperation in fossil energy RD&D |

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Table 0-3: Overview of bilateral approaches (part 3)

| name | participating countries | member type | participating members | aim (vision; mission statement) |
|---------------------------------------------------------|-------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Climate Action Partnership (CAP) | Australia - China | industry, | CSIRO, ? | - |
| Joint Coordination Group on Clean Coal Technology (JCG) | Australia - China | - | - | The Australia-China Joint Coordination Group on Clean Coal Technology (JCG) was established to facilitate and enhance the development, application and transfer of low emissions coal technology between Australia and China. The JCG builds on existing bilateral and multilateral initiatives which support Australia-China cooperation on low emissions coal technology, including the Asia Pacific Partnership on Clean Development and Climate. |
| China Australia Geological Storage of CO2 (CAGS) | Australia - China | institutions (research and government) | Partners: Geoscience Australia, Ministry of Science and Technology (MOST), The Administrative Centre for China's Agenda 21 (ACCA21), Chinese Academy of Sciences China University of Petroleum, China Geological Survey | "We aim to help accelerate the development and deployment of geological storage of carbon dioxide in both China and Australia. We are doing this by helping to develop China and Australia's technical skills in the area of geological storage of carbon dioxide through a number of capacity building and research programs." |
| CCS- EOR cooperation | Japan - China | institutions (research and government), companies | Lead: Research Institute of Innovative Technology for the Earth (RITE) (Japan); China National Petroleum Corporation (CNPC) (China); other members include Toyota Motor Company and JGC Corp | |
| smaller initiatives - exemplary chosen | | | | |
| - | UK - India | | | |
| South Africa CCS Centre | Uk- South Africa | gouvernement | DECC partially funds the center | |

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Table 0-4: Overview of bilateral approaches (part 4)

| name | relevance of CCS in the partnership | organisational structure | Main Fields of cooperation (with respect to CCS) | current Activities |
|------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooperation Action within CCS China-EU (COACH) | high (CCS solely) | organized in 6 workpackages (4 content), each workpackage has a China - EU co-leadership | <p>research 2: inventory study on capture technologies (WP 2), Geological storage and large scale Use of CO2 (WP 3)</p> <p>feasibility: evaluation based on the Tianjin project</p> <p>roadmap: Recommendations & Guidelines for Implementation (WP 4)</p> <p>knowledge exchange: Knowledge sharing & capacity building (WP 1)</p> <p>regulatory: aid with legal framework development , issues were adressed</p> <p>capacity: Capacity building workshops</p> <p>Societal: societal anchorage</p> <p>policy: funding, issues were addressed</p> | <p>Phase I:</p> <p>WP1 Knowledge sharing and capacity building workshops, information exchange, dissemination, mobility scheme and education (Spring School on CCS in China)</p> <p>WP2 Capture technologies inventory study, optional technologies, concept study coal based plants, polygeneration, benchmarking, CO2 transfer conditions</p> <p>WP3 Geological storage and large scale use of CO2 storage selection criteria, GIS mapping of geology and point sources for CO2 , assessment study geological storage capacity in selected Bohai basin</p> <p>WP4 Recommendations and guidelines options for Chinese European demonstration projects, recommendations for future work, strategic cooperation and knowledge transfer opportunities" (http://www.ccs-conference.com/programme/Overview%20Lectures/8_Hetland.pdf)</p> |

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Table 0-5: Overview of bilateral approaches (part 5)

| name | relevance of CCS in the partnership | organizational structure | Main Fields of cooperation (with respect to CCS) | current Activities |
|---------------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Near Zero Emissions Initiative (NZEI) | high (CCS solely) | <p>- three phase approach: " - Phase 1 has explored options for demonstration and build capacity for CCS in China. - Phase 2 will carry out further development work on storage and capture options leading to - Phase 3, which will construct a demonstration plant by 2015. " - Phase 1 is divided into 5 WP: - WP1: knowledge sharing and capacity building - WP2: Future Energy Technology Perspectives - WP3: Case studies for CO2 Capture - WP4: CO2 Storage potential - WP5: Policy Assessment and Roadmap</p> | <p>research 2: Case Studies for CO2 Capture and transport(WP3) (Phase I), Carbon Dioxide Storage Potential (WP4)(Phase I) capacity: build capacity for CCS in China (Phase I) policy: policy assessment (WP5) knowledge: knowledge transfer between Chinese and UK parties (Phase I) roadmap: future energy technology perspectives (WP2) (Phase I), Roadmap (WP5) deployment: demonstration plant by 2015 (Phase III)</p> | <p>- Completed Phase 1: "two year work programme to help build capacity for CCS technology in China, develop stronger links between Chinese and British experts, study a range of options for CCS and coal-fired power generation in China", lasted from 2007 - 2009 phase I contained: - information dissemination through websites and publications (e.g. suitability assessment, socio economic assessment of CCS) - capacity building workshops - desktop studies: feasibility study capture technologies, CO2 storage potential, review international CCS policy legislation, etc... - stakeholder survey CCS in China</p> |
| STRACO2 | high (CCS solely) | <p>eight Work Packages (WP): 1. Total Project Management and Coordination 2. Stakeholder Consultation and Dissemination 3. Safety and Liability 4. Site qualification and certification 5. Financing of, and economic incentivisation mechanisms for CCS 6. Cross-cutting issues 7. International dimension 8. Overall consolidating activities</p> | <p>regulatory: guideline to support regulatory development (EU study with applicability chapter for China) policy: WP 5 looks at financing alternatives (EU study with applicability chapter for China)</p> | <p>- completed report on regulatory issues with respect to CCS; report was focused on the EU but included a section on applicability to China for each of the sections identified</p> |

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Table 0-6: Overview of bilateral approaches (part 6)

| name | relevance of CCS in the partnership | organisational structure | Main Fields of cooperation (with respect to CCS) | current Activities |
|---------------------------------------------------------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U.S.-China Clean Energy Research Center | medium (CCS as one technology) | - Joint Steering Committee: high level review and guidance - Joint Advisory Panel: link to science community - cooperative agreements for 3 core areas considered, one of which is clean coal including carbon capture and storage | feasibility: planned feasibility studies of IGCC, storage site selection research 1 + 2: planned joint research of Clean energy technologies by scientists and engineers (general) knowledge: joint ventures, participation in each others research projects | - feasibility studies (IGCC plant: US trade and development agency, CCS chain) - participation in each others research projects (- joint ventures (goal gasification) |
| Fossil Energy Protocol | medium (CCS as one technology) | Five Annexes (bold: relevant to CCS) – Annex I: Power Systems – Annex II: Clean Fuels – Annex III: Oil and Gas – Annex IV: Energy and Environmental Technologies – Annex V: Climate Science | feasibility: of CCS with direct coal liquefaction (DCL) research 1+2: DOE funds cooperative work between West Virginia University and Shenhua Group Corporation knowledge: through workshops | - joint research projects - workshops/ symposia |
| Climate Action Partnership (CAP) | high (CCS solely) | - | deployment: CSIRO supports two trials | a demonstration project for post-combustion capture (3000 tonnes/year) at a pilot plant in Beijing owned by Huaneng, together with the Thermal Power Research Institute, as previously mentioned. |
| Joint Coordination Group on Clean Coal Technology (JCG) | high (solely CCS) | - | research 1: post combustion capture pilot project, IGCC trial, research 2: general research collaboration capacity: capacity building on geological storage knowledge: stock taking of projects in China and Australia | - joint implementation of pilot plant - workshops??? |
| China Australia Geological Storage of CO2 (CAGS) | high (solely CCS) | - | research 1: storage facilities (saline aquifers) capacity: workshops and a summer school societal: awareness building through Study tour for policy maker and business leader knowledge: researcher and student exchange | - workshops (technical) - summer school - joint research |

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Table 0-7: Overview of bilateral approaches (part 7)

| name | relevance of CCS in the partnership | organisational structure | Main Fields of cooperation (with respect to CCS) | current Activities |
|-----------------------------------------------|--------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| CCS- EOR cooperation | high (solely CCS) | | research 1/ deployment: CCS capture and CCS storage in EOR field knowledge: technical exchange through e.g. workshops | - joint research/ implementation - workshops |
| smaller initiatives - exemplary chosen | | | | |
| - | | | capacity: workshops in the country | |
| South Africa CCS Centre | | | research 1 + 2: support research (generally planned) feasibility: assessment of storage potential to create a storage atlas (ongoing) societal: awareness and public outreach (generally planned) capacity: Human capacity development (generally planned) | - development of a storage atlas |

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Table 0-8: Overview of bilateral approaches (part 8)

| name | link/ source | funding - budget (if available) | funding - type (if available) | period | CCS chain part addressed |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| Cooperation Action within CCS China-EU (COACH) | http://www.co2-coach.com/ ; http://www.ccs-conference.com/programme/Overview%20Lectures/8_Hetland.pdf http://www.nzec.info/en/assets/Presentations-Nov-09/Session-1/Francois-Kalaydjian-Compatibility-Mode.pdf | | public and private (public: partly funded by the EU) | Phase I: 2006 - 2009 still to be determined: Phase II: 2010 - 2011 (Design) Phase III: 2012 - 2015 (implementation) | all (Capture, transport, Storage) |
| Near Zero Emissions Initiative (NZEI) | http://www.nzec.info ; http://www.upstreamonline.com/live/article216294.ece ; http://www.nzec.info/en/assets/Presentations-Nov-09/Session-1/Bill-Senior-and-Lin-Gao-Compatibility-Mode.pdf | - Phase 1: up to £3.5 million from DECC | public and private (public: UK government) | | all (Capture, transport, Storage) |
| STRACO2 | http://www.euchina-ccs.org/work%20plan.php | financed by the EU's FP7 | | | storage |
| U.S.-China Clean Energy Research Center | http://www.whitehouse.gov/the-press-office/us-china-clean-energy-announcements http://www.energy.gov/news2009/documents2009/U.S.-China_Fact_Sheet_CERC.pdf ; http://www.pi.energy.gov/documents/RFI-CERC.pdf ; https://www.fedconnect.net/fedconnect/?doc=DE-FOA-0000324&agency=DOE http://www.energy.gov/news2009/documents2009/US-China_Fact_Sheet_Coal.pdf | - for the whole center at least \$150 million over five years split evenly across countries (amount allocated to CCS is unclear) - estimated funding from US gov for cooperative agreement on clean coal and CCS : \$12,5 million http://www.grants.gov/search/synopsis.do;jsessionid=xrMjL2xGjthJ3nZWpw0nG6FWkV0KMkpmQLG3x7y2JtNt1DzhHnsD!-1872048146 | public and private (unspecified) | launched in 2009 | planned all (Capture, transport, Storage) |

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Table 0-9 Overview of bilateral approaches (part 9)

| name | link/ source | funding - budget (if available) | funding - type (if available) | period | CCS chain part addressed |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------|-----------------------------------|
| Fossil Energy Protocol | http://www.nzec.info/en/assets/Presentations-Nov-09/Session-3/Scott-M.pdf ; http://fossil.energy.gov/international/International_Partners/China.html ; http://www.un.org/esa/sustdev/sdissues/energy/op/ccs_egm/presentations_papers/smouse_presentation.pdf | | | – Signed in 2000 for initial 5 years – Renewed in 2005 through 2010 | capture |
| Climate Action Partnership (CAP) | http://www.nzec.info/en/assets/Presentations-Nov-09/Session-3/Rick-Causebrook-1.pdf | | | | capture |
| Joint Coordination Group on Clean Coal Technology (JCG) | http://www.iea.org/papers/roundtable_sl/australia2_mar09.pdf ; http://www.co2crc.com.au/dls/announcements/07/Research_CO2CRC_AnRep0607.pdf | Australia's commitment: \$20 million to support low emission coal projects (not only CCS) | | | all (Capture, transport, Storage) |
| China Australia Geological Storage of CO ₂ (CAGS) | http://www.cagsinfo.net/publications.htm | Au\$2.86 million | | 2009-2011 | storage |
| CCS- EOR cooperation | http://www.zero.no/ccs/projects/japan-china-eor-project ; http://www.nzec.info/en/assets/Presentations-Nov-09/Session-3/Kojiro-Katsukura.pdf | total project costs 20 to 30 billion yen | | agreed on May 7th, 2008, start | all (Capture, transport, Storage) |

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Table 0-10: Overview of bilateral approaches (part 10)

| name | link/ source | funding - budget (if available) | funding - type (if available) | period | CCS chain part addressed |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|--------------------------------------------------------------------|--------|-----------------------------------|
| smaller initiatives - exemplary chosen | | | | | |
| - | http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/ccs/international/regional/regional.aspx#safrica | | | | all (Capture, transport, Storage) |
| South Africa CCS Centre | http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/ccs/international/regional/regional.aspx#safrica ; http://www.cefgroup.co.za/index.php?option=com_content&view=article&id=124:establishment-of-a-south-african-centre-for-carbon-capture-and-storage-ccs&catid=4:press-releases&Itemid=25 | | financed from local industry, government and international sources | | all (Capture, transport, Storage) |

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Table 0-11: Overview of multilateral partnerships (part 1)

| name | sub- division name (if available) | member type | participating members | relevance to CCS |
|------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Asia Pacific Partnership on Clean Development and Climate Change (APP) | Clean fossil energy task force | countries | Australia, Canada, China, India, Japan, Korea, and the United States | medium (one) |
| Major Economies Process on Energy Security and Climate Change (MEF) | | countries (membership) | 17 largest economies of the world: Australia, Brazil, Canada, China, the European Union, France, Germany, India, Indonesia, Italy, Japan, Korea, Mexico, Russia, South Africa, the United Kingdom, and the United States | medium (CCS one of 10 technology roadmaps) |
| Carbon Sequestration Leadership Forum (CSLF) | | countries (membership), all entities (stakeholder) | member: 23 countries and the European Commission: Australia, Brazil, Canada, China, Colombia, Denmark, European Commission, France, Germany, Greece, India, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Russia, Saudi Arabia, South Africa, United Kingdom, United States | high (solely CCS) |

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Table 0-12: Overview of multilateral partnerships (part 2)

| name | sub-division name (if available) | member type | participating members | relevance to CCS |
|---------------------------------------------|----------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Global Carbon Capture and Storage Institute | | countries and corporations (membership) | 215 members (20 countries) (see http://www.globalccsinstitute.com/downloads/The-Global-CCS-Institute-Foundation-and-Legal-Members.pdf?v=3) | high (solely CCS) |
| UN Industrial Development Organization | | countries | | medium (CCS Technology roadmap) |
| International Energy Agency (IEA) | | countries (membership), | - IEA: 28 member countries (Austria, Australia, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, South Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States) | medium (one technology), |
| IEA Greenhouse Gas R&D programme (IEA GHG) | | countries (membership), multinational cooperations (sponsorship) | - IEA GHG:19 member countries, the European Commission and the Organization of Petroleum Exporting Countries (OPEC), 21 multi-national industrial sponsors | high (solely CCS) |

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Table 0-13: Overview of multilateral partnerships (part 3)

| name | sub-division name (if available) | member type | participating members | relevance to CCS |
|------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| IEA Clean Coal Center | | countries (membership), multinational cooperations (sponsorship) | - member countries : Australia, Austria , Canada , EC, Germany , Italy, Japan, Korea , Poland, Rep. of South Korea, Spain, United Kingdom , United States. - member organisations: Anglo Coal , , ESKOM, , Netherlands Group, , Schlumberger, , Eletrobras , BHEL, SUEK , , Swedish Ind Group, , Danish Power Group, , Coal Assoc NZ, , Banpu , , Beijing Reseach Inst Coal Chemistry, , GCCSI, | medium(one technology) |
| G8 (Gleneagles meeting 2008) | | countries (membership), organisations (observers) | Canada, France, Germany, Italy, Japan, Russia, United Kingdom, United States (European Union is also represented) | low (indicated target of 20 full scale CCS demonstration by 2010) |
| World Bank | | countries ; worldbank is made up of two organisations: the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA) | 186 member countries | low (only started their work) |
| Asia Pacific Economic Cooperation (APEC) | Expert Group on Clean Fossil Energy (EGCFE) | countries and industry | 21 member countries (Australia, Brunei Darussalam, Canada, Chile, Chinese Taipei, Hong Kong, China, Indonesia, Japan, Malaysia, Mexico, New Zealand, Papua New Guinea, People's Republic of China, Peru, Republic of Korea, Russia, Singapore, Thailand, The Philippines, The United States, Viet Nam) | medium (dealt with in Expert Group on Clean Fossil Energy (EGCFE)) |

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Table 0-14: Overview of multilateral partnerships (part 4)

| name | aim (vision; mission statement) | organisational structure | Fields of cooperation (with respect to CCS) |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Asia Pacific Partnership on Clean Development and Climate Change (APP) | <p>"Shared Vision of the Partnership</p> <p>The Partners have come together voluntarily to advance clean development and climate objectives, recognizing that development and poverty eradication are urgent and overriding goals internationally. By building on the foundation of existing bilateral and multilateral initiatives, the Partners will enhance cooperation to meet both our increased energy needs and associated challenges, including those related to air pollution, energy security, and greenhouse gas intensities, in accordance with national circumstances. The Partners recognize that national efforts will also be important in meeting the Partnership's shared vision."</p> | <ul style="list-style-type: none"> - policy and implementation committee - administrative support group - Sectoral Taskforces (8) <p>"The Policy and Implementation Committee (PIC) oversees the Partnership, guides the Task Forces, and periodically reviews their work. The Administrative Support Group, currently hosted by the United States, supports the PIC and Partnership broadly. Task Forces are led by Chairs and Co-Chairs, who oversee the public-private sector collaboration." under the Clean fossil energy task force, three out of 5 themes refer to CCS</p> | <p>research 1: pilot capture projects research 2: on whole CCS chain regulatory: regulatory infrastructure development feasibility: storage potential evaluation, application of mobile post combustion capture plant knowledge: facilitate large scale CCS deployment/ demonstration, facilitate general information/ knowledge exchange deployment: pilot CCS projects, Oxyfuel plant (30 MW) with CO2 transport and storage capacity: capacity building roadmap: e.g. a work plan for Oxyfuel plants</p> |
| Major Economies Process on Energy Security and Climate Change (MEF) | <p>- "spur development and deployment of low-carbon and climate-friendly technologies"</p> <p>- "The MEF is intended to facilitate a candid dialogue among major developed and developing economies, help generate the political leadership necessary to achieve a successful outcome at the December UN climate change conference in Copenhagen, and advance the exploration of concrete initiatives and joint ventures that increase the supply of clean energy while cutting greenhouse gas emissions."</p> | <p>Global Partnership for low-carbon and climate-friendly technologies that spans 10 technology partnerships led by different countries: CARBON CAPTURE, USE, & STORAGE led by Australia and United Kingdom</p> | <p>potential exemplary actions to be undertaken by member as of December 2009 (as proposed in the technology action plan)</p> <p>research 1/2: accelerate research in RD & D to reduce costs regulatory: Develop comprehensive legislative and regulatory frameworks that address, among other things, long-term storage and financial liability. policy: provide for government investment through public-private partnership; understanding of storage sites knowledge: Develop principles to facilitate knowledge sharing from publicly funded projects</p> |
| Carbon Sequestration Leadership Forum (CSLF) | <p>mission: "facilitate the development and deployment of such technologies via collaborative efforts that address key technical, economic, and environmental obstacles"</p> | <ul style="list-style-type: none"> - ministerial level partnership - two tiers/ task forces: - policy group - technical group | <p>the partnership recognizes projects in the following fields of cooperation :</p> <p>knowledge: identify pot. areas for multilateral collaboration (main focus) research 1/2: foster RD&D, asses regular progress on collaborative R&D project, asses potential areas of need for research (as part of running research projects) capacity: organization of capacity building activities (through annual meetings in developing countries)</p> |

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Table 0-15: Overview of multilateral partnerships (part 5)

| name | aim (vision; mission statement) | organisational structure | Fields of cooperation (with respect to CCS) |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Global Carbon Capture and Storage Institute | "...initiative aimed at accelerating the worldwide commercial deployment of at-scale CCS" | 'organisational structure not yet finalized: proposed structure as of 15-17 April 2009 - 5 divisions: 1) strategic projects 2) project framework 3) communications 4) partnership and alliances 5) Corporate http://www.globalccsinstitute.com/downloads/GCCSI%20FMM%20-%20Organisational%20Structure%20Overview.pdf | research 1/ deployment :Project Funding and Support Program (A\$50 million yearly) regulatory : supporting national government in the development of regulatory frameworks societal : facilitating engagement with GCCSI (Foundation) Members, industry and governments in promotion of CCS knowledge : communication of information, providing objective and authoritative carbon capture and storage information |
| UN Industrial Development Organization | | "carried out in partnership with the Norwegian Ministry of Petroleum and Energy and the Global Carbon Capture and Storage Institute, and will be implemented in cooperation with the International Energy Agency (IEA) and the IEA Greenhouse Gas Research and Development Programme" (climate - I) | road map : road map development capacity : through roadmap with a focus on developing countries |
| International Energy Agency (IEA) | ??? | IEA: since 2010: specialized department that manages CCS under the 'Directorate of Sustainable Energy Policy and Technology (SPT)' | knowledge : reports, etc... capacity : capacity building and outreach to non-IEA countries regulatory : through reports Policy : through reports |
| IEA Greenhouse Gas R&D programme (IEA GHG) | "The IEA Greenhouse Gas R&D Programme (IEAGHG) is an international collaborative research programme established in 1991 as an Implementing Agreement under the International Energy Agency (IEA). IEAGHG studies and evaluates technologies that can reduce greenhouse gas emissions derived from the use of fossil fuels. The Programme aims to provide its members with definitive information on the role that technology can take in reducing greenhouse gas emissions." | - IEA GHG: established under an implementing agreement under the IEA but independent from the IEA, Operating Agent is IEA Environmental Projects Ltd managing the research funds and delivering the work programme required | Research 2 : facilitates research knowledge : international conferences (GHGT), Summer school, reports (both IEA GHG) , Roadmap, networks on various topics (main topic) capacity : summer school regulatory : publications policy : publications |

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Table 0-16: Overview of multilateral partnerships (part 6)

| name | aim (vision; mission statement) | organisational structure | Fields of cooperation (with respect to CCS) |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IEA Clean Coal Center | | <ul style="list-style-type: none"> - established in 1975 - part of the IEAs programme of collaborative research and development - staff of 25 | <p>research 1 + 2: support for relevant R&D through providing archives and data bases + financial support</p> <p>knowledge: information provision to members (reports, reviews), networking, advisory services to government</p> |
| G8 (Gleneagles meeting 2008) | | | <p>policy: indicative targets for CCS demonstration plants</p> <p>roadmaps: together with the IEA</p> |
| World Bank | <p>"Our mission is to fight poverty with passion and professionalism for lasting results and to help people help themselves and their environment by providing resources, sharing knowledge, building capacity and forging partnerships in the public and private sectors."</p> | <p>made up of two organisations:</p> <ul style="list-style-type: none"> - International Bank for Reconstruction and Development (IBRD) - the International Development Association (IDA) | <p>capacity: workshops, CCS capacity building facility announced by Norway.</p> |
| Asia Pacific Economic Cooperation (APEC) | <p>"The EGCFE's mission is to encourage the use of clean fuels and energy technologies that will both contribute to sound economic performance and achieve high environmental standards. The EGCFE undertakes activities to concurrently enhance economic development and mitigate, at the local, regional, and global levels, the environmental impact (e.g., air emissions, water and waste management) related to the production, preparation, transport, storage, and use of fossil fuels. Considerable emphasis is given to developing and promoting options to mitigate local, regional, and global environmental impacts of fossil energy production and use."</p> | <ul style="list-style-type: none"> - established in 1989 - divided into two levels: 1) policy level (including leader, ministerial, etc. meetings) 2) working level (including various committees and expert/ working groups) - Expert Group on Clean Fossil Energy (EGCFE) started in 1993 | <p>EGCFE:</p> <p>feasibility: technology evaluation & demonstration, capture readiness</p> <p>regulatory policy: risk, finance,</p> <p>capacity: capacity building for assessment of geological storage potential</p> <p>societal: social perceptions and acceptance</p> |

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Table 0-17: Overview of multilateral partnerships (part 7)

| name | current Activities | link | budget allocated to (if available) | legal status (if available) |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------|
| Asia Pacific Partnership on Clean Development and Climate Change (APP) | <ul style="list-style-type: none"> - workshops (e.g. on capture technology) - enable workshop attendance (esp. Of developing country partners) - reports/ websites (e.g. user-based plant design guidelines) - pilot projects (research, in planning/ design phase and running) - research (on capture chemicals, pilot plants, etc...) - translations (e.g. of US regulatory guidelines into Chinese) | http://www.asiapacificpartnership.org/english/default.aspx | | announced in July 2005, launched in January 2006 |
| Major Economies Process on Energy Security and Climate Change (MEF) | <ul style="list-style-type: none"> - developed technology action plan for CCS including a "menu of opportunities for individual and collective action that may be undertaken voluntarily by interested countries, in accordance with national circumstances" | http://www.majoreconomiesforum.org | | |
| Carbon Sequestration Leadership Forum (CSLF) | <ul style="list-style-type: none"> - provide CSLF recognition for a wide array of projects - task force (policy/ technical) meetings - methodologies for storage potential - other misc. activities | http://www.fe.doe.gov/programs/sequestration/cslf/ ; http://www.csforum.org/ , de Coninck 2010 | | implemented in 2003 by the Administration of president Bush (United States) |

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Table 0-18: Overview of multilateral partnerships (part 8)

| name | current Activities | link | budget allocated to (if available) | legal status (if available) |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Global Carbon Capture and Storage Institute | <ul style="list-style-type: none"> - stock Taking of CCS projects around the globe (tracking and evaluating of CCS projects) - portfolio of supported CCS projects -defining CCS readiness - funding of other organisations work on CCS (e.g. IEA, IEA GHG) (de Coninck) | http://www.globalccsinstitut.com/ | -total yearly budget from Australian government: A\$ 100 million (Australian government committed over 4 years (time period?)) -yearly budget for "Project Funding and Support Program": app. A\$50 million | independent legal entity in July 2009, non-governmental |
| UN Industrial Development Organization | global technology roadmap for carbon capture and storage (CCS) for industrial processes | http://climate-l.org/2010/02/22/unido-launches-global-technology-roadmap-project-for-ccs/ ; de Coninck 2010 | \$ 500000 | |
| International Energy Agency (IEA) | (from 2003 onwards) : <ul style="list-style-type: none"> - various separate publications on CCS (e.g. Roadmap on CCS in 2009) - integration into main reports (IEA World Energy Outlook, IEA Energy Technology Perspectives) | http://www.iea.org/about/sp.t.asp#ccs | research funds provided by the members (budget unclear) | |
| IEA Greenhouse Gas R&D programme (IEA GHG) | <ul style="list-style-type: none"> - extensive publications: <ul style="list-style-type: none"> - monthly newsletter (greenhouse issues) - general publications (e.g. books,etc..) - technical reports - etc... - hosts various networks (11) | http://www.ieaghg.org/index.php?/2009120352/organisation.html ; | ??? | |

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Table 0-19: Overview of multilateral partnerships (part 9)

| name | current Activities | link | budget allocated to (if available) | legal status (if available) |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------------|
| IEA Clean Coal Center | with respect to CCS: - Reports (often in combination with other issues) | http://www.iea-coal.org.uk/site/ieacoal/home | annual turnover is around £1.75 million | non-profit making organisation |
| G8 (Gleneagles meeting 2008) | Declaration of G8 Leaders Meeting on Environment and Climate Change (July 2008): - international initiative on roadmaps with the IEA - support the launching of 20 large-scale CCS demonstration projects globally by 2010 | http://www.bmu.bund.de/files/pdfs/allgemein/application/pdf/g8_deklaration_environment_climate_change.pdf | | |
| World Bank | - organized a workshop on CCS in Washington DC end of 2009 on capacity building | de Coninck 2010; http://web.worldbank.org/WBSITE/EXTERNAL/EXTABOUTUS/0,,pagePK:50004410~piPK:36602~theSitePK:29708,00.html | | |
| Asia Pacific Economic Cooperation (APEC) | - workshops (e.g. Annual Clean Fossil Energy Technology and Policy Seminar, capacity building workshops) - studies (e.g. on capture readiness) | http://www.nzec.info/en/assets/Presentations-Nov-09/Session-3/Scott-M.pdf http://www.egcfe.ewg.apec.org/ | | |

Appendix II: The Voluntary Carbon Market – further information

Process of compensation

The process of voluntary compensation for a company that wants to reduce its carbon footprint is based on three stages:

1. Determination and calculation of emissions
2. Purchase of certificates
3. Deletion of certificates

The third step was designed according to the requirements of the EU ETS. Its objective is to avoid that the emission reductions are used again and double counted. Therefore, the provider of emission reduction certificates (service provider) secures the deletion of the certificates directly after the purchase through the client. A central registry makes sure that CERs and ERUs are used only once. This responsibility lays with the service provider for VERs.

Overview of standards in the voluntary market

According to the German Environmental Agency certificates should be additional, measurable, verified by an independent third party and their retirement should be proven in a registry. However, there is no common standard for the voluntary market and these requirements are interpreted differently in their implementation. The Voluntary Carbon Standard (VCS) was the most utilized standard in 2008 (according to the transaction volume) with 48%, followed by the Gold Standard with 12 % Hamilton et al. 2009. CDM or JI credits reached only 2 % of the market share on the voluntary market in 2008 Hamilton et al. (2009).

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Overview of selected Carbon Standards in the voluntary market

Adapted from: Deutsche Emissionshandelsstelle 2008; first climate 2008; Hamilton et al. 2009

- *Gold Standard*: The Gold Standard is a non-profit foundation, which defines “best practice” methodologies for CDM/JI and VER projects, which significantly contribute to sustainable development. It includes some additional requirements to the CDM/JI standard that shall ensure a sustainable development in the project country and long-term climate protection effects.
- *Voluntary Carbon Standard (VCS)*: The VCS is a global standard to ensure that projects are real, measurable, permanent, additional, third-party verified, unique, transparent and conservatively calculated.
- *Climate Action Reserve Protocols (CAR)*: The California Climate Action registry, a non-profit voluntary registry for carbon credits and standards-setting body, established in 2008. Available online at: <http://www.climateactionreserve.org>
- *American Carbon Registry Standard (ACR)*: The American Carbon Registry is a non-profit enterprise of Winrock International. It developed its own sets of standards, registers voluntary emission reporting, and offsets. Available online at: <http://www.americancarbonregistry.org>. All projects are third-party verified and need to comply with offset eligibility rules and additionality criteria.
- *CDM/ JI standards*: These credits are part of the flexible mechanisms of the Kyoto protocol and fulfil the requirements of the UNFCCC. The whole transaction needs to follow an adequate and accredited methodology. The main target is to ensure technology transfer to developing countries and at the same time supporting the fulfilment of reduction targets of industrialized countries (who signed Kyoto).
- *VER+ - standard*: TÜV Süd developed this standard for VER projects to secure compliance with the Kyoto requirements for CDM/JI projects, additionality compared with a “Business-as-usual” scenario, great flexibility of the methodologies and the registry of the projects in a “Blue registry” of TÜV Süd, according to UNFCC standards.