Carbon dioxide Capture and Storage as a Clean Development Mechanism project activity

A review of the regulatory framework with emphasis on specific issues related to *additionality* in CCS project activities and *sustainable development* in non-Annex I countries

Student number: 187035

Supervisor: Christina Voigt

Words: 14 920

JUS399
Master Thesis

Faculty of Law

UNIVERSITY OF BERGEN

06.12.2013

List of contents

List of abbreviations

CBDRRC	The Principle of Common But Differentiated Responsibilities and Respective Capabilities
CCS	Carbon dioxide Capture and Storage
CDM	The Clean Development Mechanism
CDM EB	The Clean Development Mechanism Executive Board
CER	Certified Emission Reduction
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	Carbon dioxide
COP	Conference of the Parties
DOE	Designated Operational Entities
EB	Executive Board
EIA	Environmental and socio-economic impact assessment
EU	European Union
EU ETS	European Union Emission Trading System
GHG	Greenhouse gas
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
JF	Joint Fulfilment
JI	Joint Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
UNCLOS	United Nations Convention on the Law of the Sea
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

1.1 Actuality and scope

Fossil fuels are currently meeting 80% of our energy supply with subsequent emissions of CO_2. In addition to the vast amount of fossil fuel usage, the global population is likely to rise up to ±9 billion by 2050. Even if countries make good on all current policy commitments to tackle climate change and other energy-related challenges, global energy demand in 2035 is projected to rise by 40% – with fossil fuels still contributing 75%[1]. Too much CO_2 in our atmosphere is very likely leading to global warming, which is causing climate change. The world's leading scientists have warned that unless the rise in average global temperature is kept below 2°C, devastating and irreversible climate change is very likely to occur.

On the 30th of September 2013, the Intergovernmental Panel on Climate Change (IPCC) released the first part of its fifth assessment report (AR5). The key message of the report is that there is over a 95% chance that the observed rise in global surface temperature and associated indicators has been due to man-made activities. Moreover, this is extremely likely to have resulted from human influence. In particular, the report indicates that atmospheric concentrations of CO_2 have increased to unprecedented levels, growing by 40% since pre-industrial times, resulting primarily from fossil fuel emissions[2].

It should be noted that global warming is a global and not a local issue; hence measures to reduce the emissions should be solved on a global level. Carbon dioxide capture and storage (CSS) is a technology that makes it possible to capture CO_2 without being released into the atmosphere, and permanently store it in the ground. CCS is essential for the mitigation of CO_2 emissions from large-scale fossil fuel use – not only for power generation but also for energy intensive industry. CCS is currently the only technology that can substantially reduce CO_2 emissions from fossil fuels, while ensuring security of energy supply.

The conclusions from the IPCC AR5 do not seem to be in line with the unwillingness recognised by several governments to push through policies to address the problem. Actions are required and new policy interventions are necessary. CCS is on the critical path with no margin for delay – this has been further strengthened in the last IPCC AR5; hence CCS, including CCS in the Clean Development Mechanism (CDM), is becoming even more central decarbonisation tools in the fight against climate change. CDM is a project-based mechanism stated in the Kyoto Protocol Article 12 that allows Annex I countries to participate in emission reduction projects in non-Annex I countries, with the purpose of earning credits and assisting in achieving sustainable development.

The decision to include CCS as a project activity in the CDM was made by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) in December 2011, and has yet to be tested in practice. This thesis will give a review of the newly adopted

[1] International Energy Agency, "Resources to Reserves 2013; Executive Summary" (2013)
[2] Intergovernmental Panel on Climate Change Working Group I, Fifth Assesment Report (2013)

CMP decision, the CCS modalities and procedures, which regulates the implementation of CCS in non-Annex I countries. The deployment of CCS activities raises specific legal issues in general and in relation to the CDM. The thesis seeks to highlight and analyse issues regarding the additionality of CCS projects, and if or how a CCS project can contribute to sustainable development in non-Annex I countries.

1.2 Sources of Law

The research question in this thesis is primary regulated by international environmental law. When analysing a legal source in order to apply it on a specific issue, it is important to recognise the legal status of the source.

It is a common consensus that the Statute of the International Court of Justice Article 38 states the sources of international law. Article 38 (1) stipulates three main sources of international law; conventions, customs and general principles. Judicial decisions and theory is considered as a subsidiary source. The international law system is based on a horizontal system, with equally valid sources. This distinguishes from the national law system we have in Norway, as this is based on a hierarchical system. Article 38 does not represent an exhaustive list of all sources in international law[3].

The primary source applied throughout this thesis is the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to the UNFCCC. These are international agreements between the parties that have ratified them. The UNFCCC and the Kyoto Protocol are considered hard-law, and therefore legally binding for the parties. However, it is important to recognize that soft-law plays a significant role in international environmental laws. Soft-law is not legally binding, but can be seen as a political agreement or an incentive stated in a document[4].

UNFCCC Article 7.2 states that the Conference of the Parties (COP) is the supreme body of the Convention. They shall make "the decisions necessary to promote the effective implementation of the Convention". Further the Kyoto Protocol Article 13 states that the COP shall serve as "the meeting of the Parties to this Protocol" (CMP). Parties of the UNFCCC that are not parties to the Kyoto Protocol may only participate as observers, and cannot participate in decision making under the Kyoto Protocol cf. Article 13.2.

The COP/CMP-decisions are regarded as soft law. Although they are not legally binding, they represent an agreement produced in formal circumstances, such as the annual COP meetings. Through these conferences the parties can negotiate and make decisions based on evidence and experience. This gives flexibility and dynamic character to these decisions, which can make them more adaptive then legally binding sources. As a result, these decisions will play an important role in the development of international environmental law[5].

[3] Ruud, Morten (2006) p.70-73 "Folkerettens Kilder"
[4] Ibid.
[5] Kim, Rakhyun E. (2013) p.10

In this thesis the CMP-decisions CDM modalities and procedures 3/CMP1 and CCS modalities and procedures 10/CMP7 is used to analyse the research question. These decisions are political agreements and guidelines for the parties to the Kyoto Protocol. They will be used to evaluate how a CDM project should be implemented and carried out. It is important to recognise that they are not legally binding, and will therefore have less weight as a source than the legal text of the UNFCCC and the Kyoto Protocol.

Other sources of law will also be applicable to the research question, such as, legal regimes that may be relevant for CCS activities; these can be international, regional or national.

Relevant literature, law journals, published writings, reports and other electronic sources are used to discuss the research question. These sources are used as support, and are regarded as subsidiary sources.

1.2.1 Challenges

CCS was approved as a valid CDM project activity in December 2011. There has not been implemented any CCS projects in the CDM yet, and there are still uncertainties that need to be considered by the CMP. Since no project has been tested in practice, there is no practical experience to evaluate or compare with. In this context, some parts of the thesis is based on an analysis of the legal texts of the UNFCCC and the Kyoto Protocol, CDM modalities and procedure, CCS modalities and procedures, and general experience from other CCS projects. This is used to evaluate possible outcomes for CCS in the CDM. Hence, some of the arguments are hypothetical considerations based on the different sources outlined above.

Climate change negotiations are to a large extent based on political considerations and compromises, which influence content and language used in sources referred to in this thesis. The latter leads to uncertainties and challenges that may impede the considerations, and will in some extent make it difficult to conclude with one specific solution.

It is acknowledged that it is not possible to review all relevant issues regarding the CCS in the CDM. The basis and the framework for CCS in the CDM are more generally described, and further some specific issues linked to additionality and sustainable development is discussed in more detail, as this represent general challenges with the legal framework for CDM projects in the Kyoto Protocol Article 12.

1.3 Outline for the thesis

The purpose of the thesis is to review the inclusion of CCS as a project activity in the CDM. In order to do this, it is important to describe and give an overview of the framework for CCS and the CDM respectively.

- Chapter 2 provides an overview of the CCS technology.
- Chapter 3 presents an overview over background, legal framework and purposes of the CDM.

Further the knowledge from these two chapters will be used to analyse the research question, which is a combination of CCS and the CDM.

- Chapter 4 presents general legal challenges with the CCS technology, and different ways to implement a CCS project in the CDM. In this context specific issues arise, and Chapter 4.3 seeks to analyse how these issues are addressed in the CCS modalities and procedures.
- Chapter 5 seeks to evaluate whether CCS project activities can be additional, and special challenges in relation to additionality.
- Chapter 6 considers the impacts CCS projects might have on sustainable development in a global perspective. The chapter further investigates if and how a CCS project can assist in achieving sustainable development in non-Annex I countries.
- Chapter 7 summarises and concludes on the selected issues analysed throughout the course of the thesis.

2. Carbon dioxide Capture and Storage (CCS)

2.1 The CCS technology

CCS is a technology that makes it possible to capture the CO_2, and store it permanently in the ground without being released to the atmosphere.

The CO_2 can be captured from burning fossil fuels or energy intensive industries such as steel, cement, refineries and chemical industry. The technology to be utilised on power plants can capture up to 90% of the CO_2 from these processes[6]. The CCS technology can involve different combinations of capture, transport and storage, which lead to a wide range of different CCS project types[7].

2.2 The CCS chain

A CCS chain normally consists of three elements; capture, transport and storage.

The first element captures the CO_2 that are supposed to be released as a result of the combustion of fossil fuels or as a result of different processes in the energy intensive industry. There are several technologies available in order to capture CO_2 and separate it from other components before compressed and prepared for transport[8].

Transportation is the second element in the CCS chain. The CO_2 can either be transported by ship or by pipeline. Transporting CO_2 in pipelines is a well-known and rather mature technology. In the United States thousands of kilometres of onshore pipelines transporting CO_2 have been installed and are today in operation[9]. The CCS project at the Snøhvit field in Norway has also years of experience with offshore pipeline. If the CO_2 are transported by ship, the quantities of CO_2 are smaller due to storage capacity on the ships.

[6] CCS association "What is CCS"
[7] Philibert, Cedric (2007) Section 6.
[8] International Energy Agency "Technology Roadmap: Carbon Capture and Storage"(2013) p.13
[9] Global CCS Institute, "The Global Status of CCS: 2012,"(2012) Section 7.

The third element in the chain is the storage of CO_2. Safe storage is a prerequisite for CCS, and the process involves the CO_2 being injected in a geological storage site. Normally it is stored between one and three kilometres underground or below sea-bed if stored offshore. It is important that the geological site is suitable for storage, to secure the CO_2 to be stored safely and prevent seepage of the CO_2. The CO_2 is injected under high pressure. Once the CO_2 is injected, it is trapped in formations such as saline aquifers or depleted oil and gas fields[10]. It should be notified that the CO_2, due to the high pressure, will be in the so-called dense phase; meaning that the CO_2 is in a liquefied condition and not in a gas phase.

There are raised some concern of the risks related to seepage of the stored CO_2. After the carbon dioxide is stored underground, the intention is that it stays there permanently. If the CO_2 seeps out, it can cause damage to the local ecosystems and people, and the CO_2 will be released into the atmosphere[11]. The leakage may be smaller seepage over a longer period, which may pollute the ground soil, and affect the biodiversity in the soil. The second option is a major escape of CO_2 from the formation over a shorter period of time. Although this is unlikely to take place, a consequence may be that people and animals in proximity suffocate due to the lack of oxygen[12].

The risk of seepage differs from the various geological formations the CO_2 is stored in. The highest risk is probably during the injection phase and over the next several decades. The risk is depending on several factors and to prevent leakage there is a need for a comprehensive and careful planning and monitoring of the process[13].

The IPCC have estimated that for appropriately selected and managed geological reservoirs, more than 99% of the injected CO_2 is “very likely” to remain in place over the 100 first years of storage. Further, it is “likely” that the carbon dioxide is safely stored over the 1000 next years[14-15].

Leakage during transport is also a risk associated to CCS projects. Transportation of CO_2 is the most mature element in the CCS chain, and there is significant experience from CO_2 pipelines in the United States and in Norway[16]. But it is important to take all precautionary steps, in order to mitigate the risk of a leakage during transportation.

2.3 Norway and CCS

Norway has been seen as a front runner with regards to CCS. In 1991 the Norwegian Government introduced a CO_2 tax on “the burning of petroleum and discharge of natural gas in connection with petroleum activities on the continental shelf (…)”[17] to reduce emissions

[10] CCS association, "What Is CCS"
[11] Riley, Nick (2010) p.173
[12] Tjershaugen, Anders CICERO (2005)
[13] Philibert, Cedric (2007) Section 3.2
[14] Intergovernmental Panel on Climate Change "IPCC Special Report on Carbon Dioxide Capture and Strorage" (2005)
[15] The term "very likely" corresponds to a probability of between 90-99% and "likely" corresponds to a probability of between 66-90%.
[16] International Energy Agency "Technology Roadmap: Carbon Capture and Storage" (2013) p.16
[17] Act relating to tax on discharge of CO_2 in the petroleum activities on the continental shelf, § 1

offshore. Statoil, a Norwegian energy company, partly owned by the Norwegian state, started in 1990 with the choice of the conceptual solution for the Sleipner West gas and condensate field in the North Sea, when it was still at the planning stage. The CO_2 tax was one of the reasons for Statoil's plans to separate the CO_2 offshore and inject it into geological layers deep beneath the Sleipner platform[18]. Statoil have also CCS projects at Snøhvit (Norway), In Salah (Algerie) and previously at Mongstad[19] (Norway)[20].

In the Agreement on Norway's climate policy from 2012, the Government presented an action plan for the Norwegian efforts to promote CCS as a mitigation measure internationally. The main objective is a more rapid dissemination and employment of CCS internationally[21].

Norway has been a supporter of the implementation of CCS projects in the CDM, and views this as an important tool to spread and implement the technology in an effective and environmental sound manner. Norway seeks to combine political goals on development and climate mitigation, in order to promote a more environmental friendly development. The government want to assist developing countries in the improvement of climate adaption and decarbonisation strategies[22]. The inclusion of CCS in CDM is important to create economic incentives projects, and a common framework that secure a high environmental integrity on projects in non-Annex I countries[23].

3. The Clean Development Mechanism

3.1 United Nations Framework Convention on Climate Change

In 1992, the United Nations agreed on an international convention (UNFCCC) to cope with the challenges of climate change. The preamble of the UNFCCC states that climate change "(…) is a common concern of humankind". The main goal of the UNFCCC is to find a way to limit the increasing global temperature and to manage impacts the rising temperature likely would have on the environment. Furthermore, to try and adverse the effects of climate change. UNFCCC is an attempt to find a way to understand and address climate change. It has near universal membership with its 195 parties[24]. UNFCCC has several crucial Articles; some listed below.

Article 2 describes the ultimate objective of UNFCCC. It aims to stabilise greenhouse gas (GHG) concentrations at a level that prevents a dangerous anthropogenic interference with the climate system. There is no specific timeframe for the goal to be reached; this will depend on the following aspects. Firstly, to allow ecosystems adapt naturally to climate change. Furthermore to ensure that food production is not threatened, and enables economic development to proceed in a sustainable manner.

[18] Statoil "Sleipner Vest" (2013)
[19] The CCS project at Mongstad was stopped by the Norwegian Government in September 2013
[20] Ministry of Petroleum and Energy "Change in direction of commitment to Carbon Capture and Storage" (2013)
[21] Meld. St. 21 (2011-2012) Chapter 3
[22] Meld. St.14 (2010-2011) Chapter 5
[23] Meld. St.9 (2010-2011) Chapter 2
[24] United Nations, "Background on the UNFCCC: The International Response to Climate Change"

Article 4 states different commitments for the parties to fulfil, in order to reach the goals of the UNFCCC. For example develop regional programs to measure mitigation to climate change[25] and promoting sustainable development[26]. The parties to the UNFCCC are divided into two groups of annexes. Annex I contains a list of the developed countries and countries with economies in transition (Annex I countries) that are party to the UNFCCC. Further the non-Annex I countries are the parties that are defined as the developing countries[27].

The different commitments are based on the principle of common but differentiated responsibilities and respective capabilities (CBDRRC) stated in *Article 3.1*. The UNFCCC takes into account that not all parties are capable of meeting commitments in the same way. According to the principle of CBDRRC, Annex I countries should take the lead in combating climate change. The reason for the different commitments is noted in the preamble of the UNFCCC, "(…) the largest share of historical and current global emissions of greenhouse gases have originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs".

The Annex I countries must take responsibility for what their industrial growth have caused, by fulfilling commitments under UNFCCC. At the same time the non-Annex I countries should be given the possibility to develop on the same reasons as the Annex-I countries have had in the past[28].

The principle has two elements; firstly it entitles all parties to participate in international measures to address the changing climate. Secondly, different commitments on adoption and implementation for the different states, taking into account their diverse circumstances and capacities. This includes their historical contribution, and future developmental needs[29].

3.2 The Kyoto Protocol

On December 11th 1997 the parties to the UNFCCC agreed on a new protocol, the Kyoto Protocol. The Kyoto Protocol sets a quantified emission limitation and reduction obligations to the Annex I countries of the Kyoto Protocol in order to promote sustainable development, cf. Article 2.

On February 16th 2005, the Kyoto Protocol entered into force[30]. A global cap that would reduce the overall GHG-emissions with at least 5% below 1990 levels was set for the first commitment period cf. Article 3.1. The first commitment period lasted from 2008 to 2012. On December 8th 2012 the Conference of the Parties decided on a second commitment period from January 1st 2013 to 31st December 2020[31].

[25] UNFCCC art 4.1 litra b
[26] UNFCCC art. 4.1 litra d
[27] See Figure 1
[28] Bugge, Hans Chr (2011) p.83
[29] Honkonen, Tuula (2009) Section 1.1.1
[30] United Nations "Kyoto Protocol" (2013)
[31] CMP in 1/CMP.8 (2012)

In order for the Annex I countries to meet their reduced emissions targets, the Kyoto Protocol sets out four different flexible mechanisms. These mechanisms are market based tools and have the advantage of promoting a technology-neutral and cost-effective reduction of GHG emissions.

According to the Kyoto Protocol Article 17 the Annex I countries can participate in an emission trading regime. This means that parties that have excess emission units can sell units to other parties who are in the risk of exceeding their allocated amount. Further the Annex I countries can reduce their emission through a project in another Annex I country, cf. The Kyoto Protocol Article 6. This mechanism is called Joint Implementation (JI). JI is of interest for countries that have an economy in transition, such as Eastern Europe inclusive Russia. Another way to fulfil their commitments is to reduce emissions together, through Joint Fulfilment (JF) which is regulated in Article 4 of the Kyoto Protocol. EU is committed to reduce its overall emissions by a given percentage, but the JF allows the EU and its member states to fulfil their commitments jointly (usually referred as the "EU bubble"), through differentiated commitments for the respective member states.

The CDM is a project-based mechanism that allows Annex I countries and investors to invest and participate in mitigation projects in non-Annex I countries. Annex I countries can earn so-called certified emission reduction (CER) credits through projects, which can be used to meet their quantified emission limitation and commitments under the Kyoto Protocol. The mechanism is the first of its kind in an international context, as an environmental investment and credit scheme[32].

3.3 CDM in The Kyoto Protocol

Article 12 of the Kyoto Protocol establishes the legal framework for the CDM.

The purpose of the CDM is outlined in the Kyoto Protocol Article 12.2 as a way to contribute to the ultimate objective of the UNFCCC Article 2. It is also a way to support Annex I countries achieve compliance with the quantified emission limitation and reductions that they have committed to in the Kyoto Protocol Article 3. Further the CDM shall assist the non-Annex I parties in achieving sustainable development.

If a CDM project is successful, implemented and operated in accordance with the requirements for the project, Annex I investors and participants in the project will receive CERs. One CER is equal to one tonne CO_2 equivalent, and can be used to meet their reduction target in the Annex I country. These credits can also be traded or sold in a valid emissions trading scheme[33].

The mechanism is supervised by a CDM Executive Board (CDM EB) cf. the Kyoto Protocol Article 12.4. The CDM EB is given authority and guided by the COP. For registration of

[32] United Nations "Clean Development Mechanism (CDM)" (2013)
[33] Ibid.

CDM projects and issuance of CERs the CDM EB is the contact point for the project participants[34].

CERs are awarded on the basis of the result for each CDM project. There are three conditions that need to be fulfilled before CERs are issued:

1. All parties must be voluntary involved in the project cf. the Kyoto Protocol Article 12.5 (a)
2. There must be proven "Real, measurable, and long-term benefits related to the mitigation of climate change", cf. the Kyoto Protocol Article12.5 (b)
3. Reductions must be additional to any emission that would occur in the absence of the project activity cf. the Kyoto Protocol Article 12.5 (c). The project must reduce GHG-emission that would not be reduced in the absence of the CDM-project.

3.3.1 CDM modalities and procedures

At the 7th COP meeting in Marrakesh, Morocco, in 2001, the modalities and procedures for the CDM was adopted[35]. Chapter 3 in the Marrakesh Accords and its annex plus appendixes sets out more detailed rules for the project design and implementation of the project.

The CDM modalities and procedures contain different sections with rules on approval and registry of the projects, participation requirements, validation and registration. Further, it gives more specific guidelines on how to monitor the additionally of the project. It also contain rules on verification, certification and how issuance of CERs is done.

3.4 CDM in practice

In October of 2013, there were 7366 registered CDM projects, and 1,400,387,921 issued CERs[36]. More than half of CDM projects have been implemented in China, further India host almost one fifth of the registered projects[37]. With approximately two third of the projects hosted in two countries, the allocation of projects seems to be somewhat unbalanced. Favourable political and economic environment for foreign investments, large GHG-reduction potentials, efficient institutions and well-developed regulations are probably the main drivers for this development[38]. It may be questioned if investments in these two countries are at the expense of other investments in the least developed countries, that might be in greater need for assistance to development and growth through such projects. However, this will not be further elaborated in this thesis.

The Kyoto Protocol is a practical expression of the CBDRRC. By reducing GHG-emissions through binding reducing targets, Annex I countries takes the leading responsibility in mitigation climate change. Through the CDM, Annex I countries can reduce their emissions in non-Annex I countries, where it is more cost-efficient.

[34] United Nations, "EB Meetings"
[35] 3/CMP.1
[36] United Nations, "Project Activities" and "Distribution of registrered projects by Host Party" (2013)
[37] Ibid.
[38] Shen, Wei (2011) Section 1

The CDM have been criticised for allowing Annex I countries to continue their domestic business as usual, by reducing emissions abroad. Some non-Annex I countries have raised concerns in this regard. It could be argued that because Annex I countries are primarily responsible for the climate changes; they should take the leading responsibility by taking domestic actions to reduce emissions, before reducing emissions in non-Annex I countries[39].

Article 12.3 (b) of the Kyoto Protocol states that CERs should "contribute" to compliance in Annex I countries. This is an expression of the supplementary principle, which means that use of the mechanism should be supplemental to actions in Annex I countries. "Supplemental" is up to the parties to decide. The Norwegian parliament has decided to reduce 2/3 of the emissions in Norway[40]. The CDM project should be in addition to measures done at home; hence, it is not possible to reduce the whole quantified emission reduction through the CDM. This can reduce some of the concerns raised above.

3.5 The term sustainable development

The Kyoto Protocol Article 12 outlines that achieving sustainable development is one of the key purposes of the CDM. Consequently sustainable development has to be addressed and defined. There are many different definitions, interpretations and understandings of the term sustainable development.

There have been several analyses and attempts to defining sustainable development over the years, and there is no common international interpretation of what sustainability implies. It has been expressed that, "One of the reasons we disagree about climate change is because we understand development differently"[41]. The lowest "common multiple" may be that sustainable development can be regarded as something desired to be achieved. However, even this definition it is not obvious – and different interpretations of the phrase exists. The desire may be viewed differently among stakeholders such as economists, environmentalists, investors or governments.

There is no definition either in UNFCCC or in the Kyoto Protocol; this can make the desire to achieve sustainable development even more difficult.

The World Commission on Environment and Development has presented one of the most used and well-known definitions; "Development that meets the need of the present without compromising the ability of future generations to meet their own needs".[42] The definition emphasise a development that can last, not only for today's population but as well for future generations. It is built on three principles involving economic, social and environmental sustainability[43].

[39] Honkonen, Tuula (2009) Section 3.1.2.2.2.3
[40] Innst.nr 145 (2007–2008) Part I
[41] Hulme, Mike (2009) p.251
[42] World Commision on Environment and Development, "Our Common Future" (1987)
[43] Honkonen, Tuula (2009) Section 1.1.2.1

In this context, it is appropriate to draw a link to the principle of intergenerational equity cf. UNFCCC Article 3.3. The principle states that the future generations should receive the planet in the same condition as it was for the present generation.

For some people and societies this can be too much to ask. If they do not have the possibility to fulfil their own needs in the present, we cannot expect them to live in a way that will ensure the needs of the future generations. This is the principle of intragenerational equity stated in UNFCCC Article 3.2. In countries where peoples day to day concerns regards poverty, lack of access to clean water, food and health care, it would be unfair to expect them to fulfil the needs for the future generations.

3.6 CDM and additionality

A condition to get a project verified is that the reduction of emissions is "real, measurable and long-term" and additional to what would occur in the absence of the project cf. the Kyoto Protocol Article 12.5 (b) and (c). If the reduction of the GHG-emissions would have occurred nonetheless, CDM would not contribute to global emissions reductions; hence CERs issued would not represent a contribution to the global GHG reductions.

To prove that a project is additional it must be determined if the project would have taken place without the CDM. The project must provide an investment that would not occurred without the project, this is referred to as financial additionality[44]. Furthermore, the project must go beyond "business as usual".

Comparing the project to what would happen without the project can demonstrate the additionality of a project. According to the CDM modalities and procedures paragraph 44 and 45, a baseline shall be establish to do so. The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by source of GHG that would occur in the absence of the proposed project activity. The project participants must choose a baseline methodology for the project activity, and take guidance from the Executive Board (EB) into account cf. CDM modalities and procedures paragraph 48.

4. CCS in the CDM – Regulatory Framework

4.1 Introduction

In December 2011, at the 17th COP meeting in Durban, CCS was included as a valid CDM activity. After being debated at the COP meetings for several years, a set of modalities and procedures was presented at the seventh meeting of the CMP.

CCS as a project activity in the CDM allows Annex I countries to carry out CCS projects in non-Annex I countries. These projects are distinct compared to other typical CDM projects: with CCS the CO_2 is captured and permanently stored. The CO_2 is produced, but it will not be released into the atmosphere. This distinguishes CCS projects from other CDM projects. An

[44] Voigt, Christina (2009)

example can be a solar energy project, where there are not released CO_2 while producing energy.

Questions have been raised towards CCS. Issues relating to CCS in general will also be relevant to CCS in the CDM. Issues in relation to international conventions, how to implement a CCS project, and specific issues addressed in the CCS modalities and procedures will be highlighted in the following.

4.2 CCS international legislation

Several legal challenges have been identified with the establishment of CCS as a climate mitigation tool. A global legal and regulative framework has not yet been established. Many international frameworks are relevant to CCS, but there are few identifying and describing specific legal issues with CCS.

The most relevant legal frameworks are addressed in the following; such framework or parts of it, represents an opportunity for demonstration and deployment of CCS, while others may represents hurdles, barriers and show-stoppers for this technology.

4.2.1 Transboundary movement of CO_2

A primary challenge with CCS relates to the transport of the CO_2. If the storage site is located in a different country than where the CO_2 is captured, it must be moved between boundaries. This transboundary movement of CO_2 is not legal under the existing frameworks. Another question arising in relation to transport of CO_2, is the legal status of CO_2. Several international frameworks address the treatment and movement of waste.

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LC) covers the deliberate disposal at sea of waste or other matters from vessels, aircraft and platforms. The LC does not explicit mention CO_2, and there have been some discussion if it falls within the definitions in the LC. Especially in regards to the term "industrial waste", no consensus has yet been reached. The LC prohibits any disposal of "industrial waste" into the sea[45].

In 1996, a Protocol to the Convention (London Protocol) was agreed, with the purpose of modernising and updating the original Convention. Dumping of all wastes is prohibited, except from a so-called "reverse-list" in Annex I, with possible acceptable wastes. In 2006 an amendment to add CO_2 streams for storage purposes to the "reverse list" was accepted. CO_2 streams from CO_2 capture processes for storage may now be considered for storage below the sea-bed.

Article 6 of the London Protocol prohibits "the export of wastes or other matter to other countries for dumping or incineration at sea". The article has been interpreted by the parties as

[45] United Nations "Transboundary Carbon Capture and Storage Project Activities" (2012) p.6

prohibiting export of CO_2, for a contracting party for injection into sub-seabed geological formations[46].

In 2009, the contracting parties made an amendment to Article 6 in order to solve the problem of transboundary movement of CO_2. The provision would make it possible to move CO_2 if only the export state is a party to the Kyoto Protocol, and can potentially be used in relation to CCS projects[47]. However, in accordance with the London Convention Article 21, the amendment needs to be accepted by two thirds of the contracting parties to enter into force. Currently only two parties (Norway and the United Kingdom of Great Britain and Northern Ireland) have ratified the amendment.

This means that transboundary movement of CO_2 is currently prohibited under the London Protocol. It is uncertain if the amendment will be ratified in order to allow movement in the future. This leaves the status regarding the legal issue of transboundary movement under the LC unsolved. However, the International Energy Agency has presented different options for the Article 6 barrier as described in the IEA working paper[48].

The European Union has developed a comprehensive framework on CCS. The CCS Directive[49] from 2009 aims to ensure that the CCS technology is deployed in an environmentally safe manner within the EU and to fight climate change cf. Article 1.

Article 24 of the CCS Directive refers to the issue of transboundary transport of CO_2, transboundary storage sites or transboundary storage complexes. It states that the competent authorities in the member states shall jointly meet the requirements of the CCS Directive and relevant Community legislation. This however, does not give any guidance on how the problem of transboundary CCS projects should be resolved. It more or less leaves it up to the member States to agree on the specifics of the project.

Also The Basel Convention[50] and The Bamako Convention[51] relates to the control of hazardous waste. If CO_2 falls under the definition of "hazardous waste", the transportation of it will be subject to these agreements. This can restrict the transboundary movement of CO_2 in relation to CCS projects. The question is uncertain, and has not been properly addressed under these conventions.

4.2.2 Deployment of transboundary CCS activities

The United Nations Convention on the Law of the Sea (UNCLOS) establishes a framework for the protection of the world's oceans and marine environment, which also include seabed

[46] International Energy Agency "Carbon Capture and Storage and the London Protocol: Options for Enabling Transboundary CO_2 Transfer"(2011) p.8
[47] United Nations, "Transboundary Carbon Capture and Storage Project Activities" p.7
[48] International Energy Agency, "Carbon Capture and Storage and the London Protocol: Options for Enabling Transboundary CO_2 Transfer."
[49] Directive 2009/31/EC
[50] The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
[51] The Bamako Convention on the Ban on the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa

and subsoil. UNCLOS does not expressly mentions CCS activities, but may have an impact on this kind of activity.

Article 77 states that the costal state has exclusive rights to explore and exploiting their natural recourses on their continental shelf[52]. Further, according to Article 81, the states have the authorisation to regulate drilling on their continental shelf. In relation to CCS projects, this means that another state must get permission to undertake injections and storage in the jurisdiction of another state.

According to Article 79.1 "All states are entitled to lay submarine cables and pipelines on the continental shelf (…)". The costal state must consent with the course of the pipelines cf. art 79.3, but may not impede them. This gives the parties relatively wide discretion to lay pipelines for transport of CO_2 in relation to CCS activities[53].

The part of the sea that is beyond national jurisdictions can create a barrier to CCS activities. No state can claim sovereignty over any part of the "Area"[54]. This may limit exploration of suitable geological storage sites, and injection in them. It generally means that CCS activities involving storage in international waters are precluded[55].

4.2.3 Environmental impact assessment and public information

Different conventions may require environmental impact assessment and public information with regards to activities that may cause harm to the environment. These conventions may also relate to CCS projects.

The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) may trigger requirements for CCS activities. CCS activities are not on the list of activities that require an environmental impact assessment in Appendix I. But Appendix III paragraph I contains general criteria to assist in the determination of the activity is "(…) likely to have a significant adverse transboundary impact". The parties to the convention would be obligated to determine whether the criteria set out in Appendix III would apply for the CCS project, and require an environmental impact assessment[56].

Further, The Convention on Access to Information, Public Participation in Decision-making and Access to Environmental Matters (Aarhus Convention) can set requirements to its parties concerning a CCS activity. Article 1 of the Aarhus Convention aims to require environmental information made available by public authorities. Article 6 decides that activities listed in Annex I and other activities that may have a significant effect on the environment shall be informed to the public. Further article 7 requires the parties to provide opportunities for public participation in the preparation of policies, programmes and plans in relation to the

[52] UNCLOS art. 76
[53] United Nations, "Transboundary Carbon Capture and Storage Project Activities" p.11
[54] "Area" means the seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction cf. art 1.1 (1)
[55] United Nations, "Transboundary Carbon Capture and Storage Project Activities." p.11
[56] Ibid. p.12

environment. These articles could trigger such public information in relation to CCS projects, and require that information of the CCS project are made public available.

4.2.4 Summary

International conventions and treaties do to a large extent not specific address CCS project activities. That said, such frameworks may influence both demonstration and deployment of CCS, which creates uncertainty. A clarification on legal issues can contribute to accelerate the deployment of CCS, remove barriers and create incentives to invest in these projects. There is a need for a comprehensive legal framework on CCS activities. The inclusion of CCS projects activities in the CDM represents an opportunity to align international legal and regulatory standards on how to carry out these projects.

4.3 The implementation of a CCS project activity in the CDM

The Global CCS Institute underlines in its report[57] that in order for CCS to play a role in reducing global CO_2 emissions on a significant scale, it will need to be deployed in both developed and developing countries. Furthermore, 70 % of CCS deployment will need to occur in non-OECD countries in order to achieve global emission reduction targets by 2050. Most non-OECD countries are non-Annex I countries under the Kyoto Protocol. At least 19 developing countries are currently engaged in CCS-related activities, mostly at the early stage of scoping out the opportunities and potential for CCS.

There are several ways of implementing a CCS project. The "straight forward" approach is when the capture, transportation and storage are done within the national borders of one non-Annex I country.

As previous described, some legal issues arise regarding transboundary CCS projects. In the preamble of the CCS modalities and procedures it was agreed that the question of CCS projects involving transport from one country to another, or involve geological storage sites that are located in more than one country, should be considered at the eight CMP session. It was however decided at the eight session that more relevant experience on CCS projects in the CDM would be beneficial; hence, the consideration of this issue was postponed till 2016[58].

The issue has been addressed in a Technical Paper[59] in order to support the Subsidiary Body for Scientific and Technological Advice (SBSTA) under the COP, to considerate the question. There are outlined possible scenarios involving transboundary movement, e.g. capture in Party A and storage in Party B, or capture in Party A, transport through Party C and storage in Party B. These different scenarios raise different legal questions concerning the international framework regarding CCS, and in relation to the CDM rules.

[57] Global CCS Institute "The Global Status of Ccs: 2012" Chapter 5
[58] Subsidary Body for Scientific and Technological Advice, "FCCC/SBSTA/2012/L.21" (2012).
[59] United Nations, "Transboundary Carbon Capture and Storage Project Activities."

4.4 Modalities and procedures for CCS as a CDM project activity

4.4.1 Introduction

The modalities and procedures for carbon dioxide capture and storage in geological formations as a clean development mechanism project activity[60] (CCS modalities and procedures) contain detailed provisions on how the project should be implemented. The framework is supplemental to the CDM modalities and procedures, and creates additional rules on specific CCS issues. These modalities and procedures provide the structure for performing a CCS project in the CDM.

Specific issues arise in the context of CCS in the CDM. Potential seepage of CO_2 and how the liability should be allocated are issues, which has been considered. Furthermore an issue has also been linked to what kind of requirements and assessments the parties should fulfil in relation to the project activity.

The CCS modalities and procedures, and how the framework identifies these specific CCS issues are reviewed in the following sections. It will be referred to the "host Party" as the non-Annex I country where the project is physically located in, and "project participant" as a Party involved that intends to participate, or a private and/or public entity authorized by the designated national authority of a Party involved to participate in a CDM project activity[61].

4.4.2 Participation requirements (for parties and institutions involved)

The CCS modalities and procedures acknowledge that special experience on CCS projects is needed to validate and verify these projects. It is a requirement that the Designated Operational Entities (DOE) must have "(…) all appropriate experience relevant to CCS". The DOE is an independent auditor, accredited by the CDM EB. The DOE validates project proposals and verifies whether implemented projects have achieved planned emissions reductions cf. CDM modalities and procedures Section E.

Section F paragraph 8 sets out requirements on participation in CCS project activities. The host Party must submit an expression that they allow CCS activities in their territory, to the UNFCCC secretariat. Further, they have to confirm that there are established national laws and regulations in accordance with the requirements in Paragraph 8 litra A to F.

The high requirements on national legislation are special for CCS projects. One reason for this can be the lack of a comprehensive international framework on CCS, and to secure that the project is in accordance with the host Party's legal system. These laws and regulations will be an important legal source when implementing the project.

Further the validation and registration rules are set out in section G paragraph 10 – 13. The DOE shall confirm that the participation and project requirements are met. Paragraph 11 litra

[60] 10/CMP.7
[61] Executive Board, "Glossary CDM Terms" (2009)

C and D relates to the host Party's choice to accept the allocation of liability and the obligation to address a net reversal of storage.

The verification and certification of the project is performed by determining if the project is in accordance with the requirements set out in Section paragraph 16 litra A to H. According to paragraph 17, the verification and certification shall continue to the storage site has been terminated.

4.4.3 The risk of seepage

One specific issue relating to CCS projects are the risk of the CO_2 seeping out from the geological storage site. This issue has been a key challenge for the negotiations of CCS in the CDM and for public acceptance of CCS. If seepage occurs after CERs are issued and used, the global emissions will in principle increase, if not compensated for otherwise; hence this issue is taken into account in the CCS modalities and procedures.

Seepage is defined as "a transfer of carbon dioxide from beneath the ground surface or seabed ultimately to the atmosphere or ocean" in Section A paragraph 1 litra g. Further a "net reversal of storage" of CO_2 means according to litra l:

(i) "For a verification period during the crediting period, the accumulated verified reductions in anthropogenic emissions by sources of greenhouse gases (GHGs) that have occurred as a result of a registered CDM project activity are negative (i.e. the seepage from the geological storage site of the CCS project activity exceeds the remainder of the emission reductions achieved by the CCS project activity)"

(ii) "For a verification period after the end of the last crediting period, seepage has occurred from the geological storage site of the CCS project activity"

Issuance of CERs are regulated in Section J. The issuances of CERs must be in accordance with Appendix D, and issued on a pending account in the CDM registry. Litra A to C in paragraph 21 gives certain obligations in addition to usual issuance of CERs. Litra B states that 5 per cent of the CERs shall be issued to a reserve account of the CDM registry. Paragraph 22 opens for the project participants to request the CERs on the reserve account to be forwarded to their registry accounts. This can be completed after the storage site has been terminated.

This reserve account is established with the purpose of make up for any net reversal of storage. If the verification report detects seepage, then the parties are obligated to cancel the CERs issued for the project, up to the amount of the seepage. Firstly, from the reserve account, secondly from the pending account, and finally from the holding accounts. If this does not cover the level of net reversal, the project participants must compensate by cancelling the respective number of other compliance units cf. Section K paragraph 24.

If the project participants do not comply with the requirements as described, the outstanding amount can be cancelled on the account of the national registry to the parties included in Annex I, cf. paragraph 26. If the host Party has accepted, in the letter of approval, to address

the net reversal of storage, the host Party must meet the obligations. If the host Party has not accepted this obligation, it must be fulfilled by other Annex I countries which holds the CERs issued from the project in their national accounts cf. paragraph 28.

CCS activities consist of two verification phases. A crediting period, the period when the CO_2 are injected which enable CERs to be earned, and a second phase in the period after the last crediting period until monitoring of the storage site has been terminated. According to paragraph 49 in the CDM modalities and procedures, the crediting period lasts for a maximum of seven years with allowances, with renewal two times. This means that a CCS project can earn CERs for 21 years. Any seepage that occurs in this period will be deducted from the number of CERs for this period. Seepage after this period will be addressed by the reserve account[62].

4.4.4 Project requirements

As described in Chapter 2.2 the risk of seepage is estimated to be very low if the geological storage site is carefully selected and monitored. This underlines the importance of the selection, characterisation and monitoring of the geological storage site.

Appendix B section 1 and 3 outlines comprehensive requirements on these procedures. Section 1 paragraph 1 to 5 regulates how the storage site should be evaluated, describes different steps to characterise the proposed storage site, and what kind of data and information that should be used when performing this.

Section 3 demands a careful monitoring plan to assure the environmental integrity and safety of the storage site cf. paragraph 10 litra A. Other objectives with the monitoring are, among others, to ensure that the CO_2 is behaving as predicted to minimise risk of seepage or other adverse impacts cf. litra C and to determine reductions in GHG emissions as a result of the project cf. litra G. Paragraph 11 outlines how the objectives in paragraph 10 shall be met during the operational phase, closure phase and post-closure phase[63].

Paragraph 16 decides the time frame on the monitoring of the storage site. It starts prior the injection activities, continues frequently during and beyond the crediting period, and cannot be terminated earlier than 20 years after the last crediting period, or after the issuance of CERs has ceased. The monitoring can only be terminated if no seepage has been observed the last 10 years, and if the evidence indicates that the CO_2 will be completely stored in the long term.

Moreover, the project participants must establish financial provisions according to Section 4 in Appendix B. Paragraph 18 defines why there should be financial provisions and paragraph 19 outlines what these provisions shall cover. The type and level of the financial provision must be described in the project design document, i.e. before the project is validated. The financial provisions shall be transferable to the host party in compliance with the laws and

[62] Dixon, Tim (2013) Section 4.4
[63] Defined Section A litra C, D and F

regulations or in the case of insolvency of the project participants cf. paragraph 21. A CCS project is a large, costly and complex chain; hence, it is essential that financials and necessary permits are in place before the project starts.

4.4.5 Liability

One key issue in these projects is how the liability should be allocated. "Liability" is defined in Section A litra J as "the legal responsibility arising from the CCS project activity or the relevant geological storage site." Further, the definition includes "all obligations related to the operation of the storage site". This includes actions to stop or control any seepage of CO_2, and to restore the long-term environmental quality significantly affected by a CCS project activity cf. litra K. The definition omits the obligations arising from a net reversal of storage during the project phase outlined in Section K.

Paragraph 22 in section 5 states that the allocation of liability obligations during the different phases shall clearly be stated in the project design document, i.e. agreed before the project is approved. It is the host Party's national legislations that address the local liability outlined in Section 5. A lot of discretion is given to the host Party when developing these liability rules. No minimum standards for the determination of the liability regime are given in the decision. The host Party's laws and regulations shall apply to liability matters cf. paragraph 23.

According to Paragraph 24 the liability shall reside at the project participants during the operational phase and until the transfer of long-term liability goes to the host party. The transfer of liability shall happen when the monitoring of the storage site has been terminated in accordance with paragraph 16, and when the conditions set out in the letter of approval and relevant laws and regulations have been complied with. In other words, the project participants are liable until the project is terminated, no sooner than 20 years after the end of the last crediting period.

However, the host Party is not obligated to accept this long-term liability for the geological storage site[64]. But by not accepting this transfer of liability, their attractiveness to host CCS projects may be compromised, as it is less likely that a Annex I country will invest in a project where they are to be responsible for the long-term liability.

4.4.6 Assessment requirements

As previously noted, there are risks involved with the implementation of CCS projects, such as the impacts on environment, property and human health. The CCS modalities and procedures require two different assessments in order to address and reduce these potential impacts.

A risk and safety assessment is descried in Section 2 paragraph 6. This assessment is undertaken to evaluate "the integrity of the storage site and potential human health and ecosystems in proximity to the proposed CCS activity". Paragraph 7 give detailed

[64] Dixon, Tim (2013) Section 4.5

descriptions of what the risk and safety assessment should consider, while paragraph 8 explains what the assessment shall do. Paragraph 9 describes different steps the project participants must take to assess the potential risk of CCS in a geological storage site. The assessment is comprehensive, and shall cover the full CCS chain, as well as the surrounding environment. It shall also assess possible local impacts, property, public health and global environment effects, cf. paragraph 8 litra D.

Further, Section 6 in the Appendix B requires an environmental and socio-economic impact assessment (EIA). This kind of assessment should address possible impacts that the project might have on the environment, including social and economic aspects. In other CDM projects EIAs are only required if the project participants or the host Party consider that the project may have significant environmental impacts cf. CDM modalities and procedures paragraph 37 litra A. This does not apply mutatis mutandis to CCS projects cf. CCS modalities and procedures Section G paragraph 9. This means that there are required an EIA for each CCS project activity. The EIA should include a "detailed description of the planned monitoring and remedial measures to address any environmental and socio-economic impacts indentified" cf. paragraph 10 litra D. This should be done in accordance with the host Party's requirements and procedures. Rigid standards on how to carry out an EIA could be seen as a interference with the host Party's sovereignty.

Section G paragraph 26 sets out a minimum of requirements to what the EIA should analyse, hereunder; air emissions, solid waste generation, and water use associated with current CCS technologies. It is also a requirement that the EIA shall include at least a comprehensive analysis of the environmental and socio-economic impacts cf. paragraph 28. Further, the principle of use of best available techniques is stated in paragraph 27. This is to protect the environment, at a local level and as a whole in the best possible way. Local stakeholders[65] should also be invited to assess the project activity according to paragraph 29.

The risk and safety assessment include local impacts on the environment surrounding the CCS facility, and should be used to inform the EIA. This assessment will therefore supplement the EIA, and address impact near the CCS facility.

4.4.7 Summary

The CCS modalities and procedures provide a comprehensive framework on what the parties must prepare and fulfil in order to implement a CCS project activity in the CDM. The CCS modalities and procedures addresses specific issues related to CCS activities.

To ensure safe storage, comprehensive site selection procedures, risk management plans and careful management of the storage site must be in place. If storage sites are carefully selected it will help reduce the long-term seepage risk[66]. The framework addresses this issue by setting high requirements on selection, characterisation and monitoring of the storage site.

[65] Defined in CDM modalities and procedures paragraph 1 litra E as "public, including individuals, groups or communities affected, or likely to be affected, by the proposed clean development mechanism project activity"
[66] Philibert, Cedric "Carbon Capture and Storage in the Cdm" (2007)

The issue related to the net reversal of storage is identified by establishing a reserve account for CERs and a procedure for cancelling CERs that corresponds with the amount of leaked CO_2. This will make up for any seepage from the storage site. The allocation of liability is addressed in the framework, and secures that potential liability issues are solved before the project starts.

Further two different assessments are required to address and possibly avoid potential impacts on the environment, property, human health related to the implementation of a CCS facility.

The CCS modalities and procedures presents clarifications on many issues related to CCS projects, and obligates the project participants to take these issues into account when preparing and implementing a CCS project activity. But there are still some outstanding issues that needs to be addressed by the parties; an additional global reserve account for CERs, transboundary CCS projects and a possible dispute resolution mechanism cf. the Preamble of the CCS modalities and procedures.

5. CCS in the CDM – Additionality

5.1 Introduction

According to the Kyoto Protocol Article 12.5 litra C, reductions in emissions must be "additional to any that would occur in the absence of the certified project activity". It is important to have a baseline methodology that determines if a project has been additional. An approved methodology suitable for the specific project type must be used to establish a reasonable baseline. It is used to compare with the reduction the project has resulted in.

For a CCS project to be additional, the baseline must show that the CO_2 captured and stored would otherwise been released into the atmosphere.

5.2 Challenges – beyond business as usual?

The Executive Board have provided tools for demonstration and assessment of additionality to help detecting additionality. These tools include barrier analysis, and qualitative and quantitative assessments of different potential options with an indication of why non-projects are more likely[67]. It is important that the additionality is demonstrated, in order to ensure that the project do not lead to increased emissions.

An aspect of monitoring additionality is to ensure that the project is beyond business as usual. The relevant question to ask is if the project would be implemented without the CDM. However, the answer to this question is somewhat hypothetical, and based on a subjective approach.[68]

[67] McMorris, John (2008) p. 62-63
[68] Monceau, Tanguy du (2011) Section 5.1.1

A CCS project can lead to emission reductions that would not occur if there where no such CCS facility. From a scenario of a production installation without vs. with a CCS facility it seems quite clear that the project would lead to additional emission reductions. The question is whether the CCS project activity would be implemented without the CDM.

Today, CCS is considered as a new and expensive technology. Globally not many full-scale CCS facilities are in operation, or even in the developing phase yet. The implementation of CCS facilities has proven to be difficult, even in industrialised countries, because of different show-stoppers, such as legal framework, high costs and public acceptance. These factors indicates that the incentive to implement a CCS project in a non-Annex I country without the CDM is rather low.

A possible scenario for a CCS project to be implemented in a non-Annex I country beyond the CDM could be if a company from a country not Party to the Kyoto Protocol, invests in a CCS project. For example a company from the United States which are not a Party to the Kyoto Protocol. An incentive to implement a CCS facility without CDM could be to produce carbon neutral energy, which could be more attractive on the energy market. This is also a possible scenario for a company that are bound by the reduction targets in the Kyoto Protocol, but do not want to implement the project as a CDM activity.

However, due to the high price of implementing, and possible low revenues and profits from these projects, such a scenario seems less likely. The CDM provides a possibility to earn CERs from the project that may make it more attractive and profitable to implement a CCS project through the mechanism. However, it is important to address the possibility for a company implementing a CCS project without the CDM, especially as the current prices on CERs are low and CCS hopefully will become more profitable in the future.

5.3 Challenges – net reversal of storage and long-term liability

One special concern to CCS projects additionality is the risk of seepage. To secure the additionality of these projects there have been established a reserve account for the net reversal of storage, and specific rules on how the issue should be addressed in the CCS modalities and procedures. Five per cent of the issued CERs shall be forwarded to this account. If any seepage occurs, the amount equivalent to the leaked volume of the net reversal of storage should be cancelled. This will make up for any released CO_2 and the global emissions will not increase, hence, the project will fulfil the additionality requirements.

The establishment of the specific procedures to make up for any seepage and to secure additionality, may also impose some financial and risk barriers to the implementation of the project.

The CCS modalities and procedures Appendix B Section 4 requires certain financial provisions to be established before the project starts. These shall cover inter alia the cost associated with the obligations in an event of seepage. As outlined in Chapter 4.3.3, this should be carried out by making up the amount of seepage with the same amount of CERs.

However, it will be difficult to predict the amount of possible seepage and the value of CERs in the future. To ensure that it will cover the cost if seepage occurs, this can result in an unreasonable financial provision compared to the value of the project activity. Such demanding requirements on financial provisions in relation to an event that is unlikely to happen may be regarded as an unreasonable burden for the project participants, and make it less attractive to invest.

After the project is terminated, the long-term liability is transferred to the host Party if the host Party has accepted this obligation. In that case, it is up to the host Party to make up for the released CO_2 if seepage occurs after the termination, in order to secure the additionality of the project. Exactly how they should do this is not addressed in the CCS modalities and procedures. The host Party must establish national laws and regulations on how to address an event of seepage.

It may be seen as a burden for a non-Annex I country to be liable for any seepage that might occur after the project is terminated, and not in correspondence with the CBDRRC principle. However, before the project is terminated all factors must indicate that the CO_2 will be safely and permanently stored. The special report from IPCC states that if the storage site is carefully planned and monitored, the risk of leakage is very low. The CCS modalities and procedures contain detailed rules on selection and monitoring of the geological storage site, and this is the project participant's responsibility to fulfil. Also financial provisions for support after the transfer of liability shall be provided cf. CCS modalities and procedures Section 4 paragraph 18. This may relief some of the burden for the long-term liability for the non-Annex I country.

A way to help the non-Annex I country in case of any seepage after the project is terminated, can be establishing an international fund. A fund for these events would give financial support to make up for the leaked CO_2. It can be a security not only for the non-Annex I country, but also for the global society as it can help make up for the released emissions.

There is a proposal of an additional global reserve account to be considered by the CMP in the preamble of CCS modalities and procedures. This reserve account can help offset cost in relation to an event of seepage[69]. However, establishing a global reserve or fund may create an additional barrier to the implementation on these projects. The requirements to participate and implement a CCS project in the CDM is already very demanding, and with a reserve account in addition to the 5 per cent reserve account may be seen as a burden for investors to invest in the project.

[69] Global CCS institute, "Submission to UNFCCC" (2012)

6. CCS in the CDM – Sustainable development

6.1 CDM and sustainable development

Article 12.2 of the Kyoto Protocol affirms that helping non-Annex I countries in achieving sustainable development is one of the purposes of the mechanism. There is no clear guidance on how Annex I countries can assist in achieving sustainable development through CDM projects. The interpretation of Article 12.2 may be regarded as sustainable development is a prerequisite for having a CDM project approved, but it may also be regarded as a supplementary advantage to the project's activity.

The preamble of the CDM modalities and procedures affirms that it is "the host Party's prerogative to confirm whether a clean development mechanism project activity assist it in achieving sustainable development"[70]. Further the host Party must confirm that the project will contribute to sustainable development in the letter of approval according to Paragraph 40 (a) in the CDM modalities and procedures.

The project must be compatible with the host Party's national regulations and guidelines on sustainable development[71]. It seems to be left to the host Party to define sustainable development, and if the specific project actually achieves such development.

Some countries, like Costa Rica, have developed criteria for sustainable development in CDM-projects. Any CDM-project in Costa Rica has to be compatible with their national environment and development strategies, and promote biodiversity conservation, forest preservation, reduce air and water pollution, enhance income opportunities and technology transfer, just to mention some of the requirements[72]. This is an example of a non-Annex I country specifying how projects can assist to sustainable development in their country.

Other countries may have less ambitious political incentive to adopt national climate change and environmental regimes. Short-term economic drivers, as an example, may be regarded as the prioritised and most important driver; hence such countries may essentially focus on the short-term economic aspect of the sustainable development.

Another factor that can influence the sustainability of the project is requirements set by the CER buyers. Eventually, many of the credits earned from the projects will be sold on the carbon market. If the buyer set quality requirements on CERs, it can influence the way projects are carried out. CDM is a market-based mechanism, and the market might have an influence on different projects. If the market demands CERs from projects with high sustainable development criteria, it is more likely that sustainability would be ensured.

A proposal from the European Parliament on high quality CERs was done in 2008. This proposal contained different standards to CERs eligible in the European Union Emission Trading System (EU ETS). One of them was that the CERs originating from projects with

[70] 3/CMP.1
[71] Huq, Saleemul (2005) p. 231
[72] Ibid.

"clear sustainable development benefits" and "no significant negative environmental of social impacts". Also Norway has requirements on CERs to be utilised in Norway, such as, CERs should be from projects that satisfy sustainable goals, at the same time as it supports the development of the international carbon market and Norwegian climate goals[73].

By requiring high quality CERs the buyers can influence what kind of projects being attractive to them. Such demand from the specific CER buyers may lead to development of subjective and individual requirements. This is also reinforced by the fact that the requirements from EU and Norway do not explain what kind of "sustainable development benefits" they may prioritise. This makes it difficult to determine which contributions are appreciated, and may lead to further uncertainty and different understanding of sustainable development.

Host Parties may still establish specific requirements in order to achieve a sustainable development. On the other hand, without a firm definition of "sustainable development" the CER-market may develope with different "qualities" of CERs. This may undermine the integrity of the CDM and the confidence to the CER-market. As a potential consequence, this may weaken the acceptance of CCS as a project activity, and undercut the deployment of CCS projects in the CDM.

Determining the requirements in the term "sustainable development" is a complex, difficult and to a large extent a subjective task. With no specific guidelines in the legal text of UNFCCC nor Kyoto Protocol it can be difficult to prove that a CDM project have assisted in achieving sustainable development.

6.2 Can CCS contribute to sustainable development globally?

Today 80% of the world's energy is from fossil fuels, and it is expected that fossil fuels will continue to contribute to the global energy demand by 75% in 2035[74]. This illustrates the need to meet the global energy requirements without causing more damage to the global climate.

CCS has been presented as one important decarbonisation tool to meet the increasing energy demand. Positioning CCS as a technology may make fossil fuel a part of the long-term energy mix, rather than a "bridging fuel". This may leave an impression that it does not significantly promote sustainable development. The non-renewable resources will before or later cease, which is not sustainable for the future generations.

Renewable energies have also been presented as a tool to assist meeting the increasing energy demand without causing more damage to the global climate. As renewable energies are based on sources such as wind, water and solar, it will not go on the expense of the future generations ability to meet their energy demand. The use of renewable energy is therefore a sustainable way to produce energy.

[73] Ministry of Finance "Hvilke kvoter ønsker finansdepartementet å kjøpe" (2013)
[74] International Energy Agency "Resources to Reserves 2013; Executive Summary."

CCS projects will reduce the emission from fossil fuel, but it can also maintain the global fossil fuel dependency, and furthermore encourage the industry to continue producing non-renewable resources at the expense of the development of renewable energy[75]. CCS projects may take the focus away from important renewable energy projects, and prevent the progression of renewable energy sources.

It have been predicted that if CCS facilities are widely used, it can dominate the portfolio of the CDM in the long-term[76]. This could be a concern as 70 % of the projects implemented through the CDM are renewable energy projects[77]. However, the practical implementation of CCS in the CDM is likely to be lower than the technical potential. Some of the reasons for this are high implementation costs, and the fact that the prices for credits in the international carbon market, for the time being, are low[78].

Fossil fuels will most likely dominate the global energy supply in the years to come. CCS technology provides a possibility to help secure the global energy supply without releasing CO_2 to the atmosphere. This implies that CCS can be a necessary contribution to sustainable development globally as it represents a possibility to help meeting the global energy demand without releasing CO_2 into the atmosphere.

6.3 Can CCS contribute to sustainable development in non-Annex I countries?

6.3.1 Introduction

In Doha 2012, at the 70th meeting of the CDM Executive Board, a tool project participants can use for describing co-benefits for sustainable development was approved. The sustainable development tool was adopted in response of requirement from the Kyoto Protocol parties[79]. The tool can help project participants to detect if the project helps assisting in achieving sustainable development. The tool is voluntary, and produces a sustainable development description report. It is stated in the introduction of the tool that it does not impact the Party's prerogative to determine whether the project activity assist in achieving sustainable development.

The tool divides the sustainable development assessment into three dimensions; environmental, social and economic. Further there are different criteria and indicators that will help the project participants to monitor if their project benefits to sustainable development in the host Party. The tool consists of three steps based on the three dimensions, with different questions for the project participants to submit[80].

In the following, the three dimensions will be used to consider if a CCS project can assist in achieving sustainable development. No CCS projects have been implemented in the CDM yet,

[75] Philibert, Cedric "Carbon Capture and Storage in the CDM" Section 2.4
[76] Ibid.
[77] UNEP Risoe Centre "Percentage share of the total number of projects in the CDM categories" (2013)
[78] Philibert, Cedric "Carbon Capture and Storage in the Cdm" Section 2.4
[79] The CDM Executive Board "CDM-EB70"(2012).
[80] CDM Executive Board "CDM Sustainable Development Tool" (2012)

and the factors of sustainable development will differ from how the host Party interprets the term. The following analyse will therefore assess if CCS projects can assist in achieve sustainable development in non-Annex I countries from a general approach, with emphasis on possible local impacts and if it can contribute at a local level.

6.3.2 Environmental

To preserve and promote biodiversity and ecosystems, is one important aspect of sustainable development. The question if CCS facilities can have any effect on the local environment arises in this context. Important indicators can be found by monitoring air, land, water and natural resources.

The placing of the facility and infrastructure can affect the biodiversity, ecosystems and land used for food production. If the transportation route is built through for example one or several cornfields, this might be at the expense of food production and lost livelihood for farmers. There is also the possibility of relocation of local communities, or parts of it, in order to achieve a safe and suitable infrastructure. Submarine pipelines can effect and threaten vulnerable ecosystems in the sea; the same goes for pipelines onshore. In these scenarios habitats and ecosystems can be affected, and there is a risk of reversed biodiversity.

The risk and safety assessment required in the CCS modalities and procedures, should address potential damage related to the CCS facility including the surrounding environments. Furthermore, it shall give guidelines on how the facility in the best way could be located, taking into account potential consequences for the environment. The assessment is comprehensive, and recognises many of the events outlined above. A thoroughly EIA is also required. It is important to identify the impacts a CCS project might have on, among others, the local communities, ecosystems, water recourses and the society. This may help reduce the possibility that local environments are damaged, and address possible outcomes of the CCS project.

The risk of CO_2 leakage is an issue relating to CCS projects. If the stored CO_2 leaks out of the storage site or during the transportation, it can result in damage on the groundwater, soil condition and plant growth[81]. Furthermore, if people are exposed to a high concentration of CO_2 it is potentially life-threatening, and if exposed to very high concentrations, death is possible.

The world's first CCS leak experience "QICS"[82] in Scotland was completed in 2012. The purpose of the project was to investigate what a leakage of CO_2 could do to the marine environment. Experience from the project shows that some animals seem to react negatively to the increased CO_2. But other animals, such as crabs, seem to be attracted or unaffected by the CO_2 bubbles[83-84]. There is a risk that ecosystems can be affected if leakage of CO_2 occurs.

[81] Al-Traboulsi, Manal (2013) p.268
[82] "Quantifying and Monitoring Potential Ecosystem Impacts of Geological Carbon Storage"
[83] QICS Project (2013)
[84] The Guardian "World's First Ccs Leak Experiment Completed in Sea Off Scotland" (2012)

There have not yet been many experiences on what kind of damage leakage can lead to. This might be because of the low numbers of active CCS projects in the world. It is important to recognise the possibility of damage to soil, water, air and ecosystems in event of a leakage. In the worst-case scenario it could lead to large reversed effects on the biodiversity. However, the risk of leakage from the storage site is small according to the IPCC special report; hence, the risk of environmental damage from seepage is low.

6.3.3 Social

There might be an increased need for employees with the implementation of a CCS project. This can create new job opportunities. The capture facilities may need resources to run the capture plant, as well as storage site needs to be monitored frequently after injection. This can give a secure job situation for several years.

Also more short-term jobs related to the building and construction of the facility and infrastructure may be needed. These building processes will take several years, and can give valuable experience. This can be a good contributor to the growth of local communities.

With more workplaces, there is a possibility for a more stable economic situation. Especially long-term jobs can create a safe income for the employees. If the project is implemented in a community where the unemployment rate is high, more job opportunities are essential to increase the welfare of the citizens. This can contribute to poverty alleviation. By creating more jobs and securing reliable salaries for employees, there will hopefully be a reduction in the poverty level.

With a new and more advanced technology flow integrated through the project activity, it can help reduce accidents and make the workplace safer. But this requires that the project participants take such an initiative to improve health and safety. A solution can be to integrate programs to secure the health and safety conditions for the workers. If this is done, the project activity can improve health and safety at the facility.

The required risk and safety assessment is not only concerning the geological storage site, but shall also assess “potential impacts on human health and ecosystems in proximity to the proposed CCS project activity” cf. Appendix B Section 2 Paragraph 6. A thorough assessment can also contribute to health and safety improvements.

6.3.4 Economic

The production of natural resources in a non-Annex I country can secure the energy supply and be economic beneficial for the country. Non-Annex I countries are not obligated to reduce their emissions as they do not have any commitments under the Kyoto Protocol. Implementing a CCS facility through the CDM on an existing fossil fuel facility will however be beneficial for the climate. But it will also make the energy produced cleaner. This energy can possibly be more attractive on the market. When the energy is produced in a more environmental friendly way, the incentives to buy e.g. fuel can be higher than fuel from a

power plant with no CCS facility. This might raise the attractiveness of the energy produced, and become economic beneficial for the country.

Investments flows in the non-Annex I country can lead to economic growth. Experience indicates that for CCS in industrial applications, it is more likely that investments will flow when the sector has a confident outlook[85]. A CCS facility makes it possible to reduce the carbon footprint from fossil fuel usage; this may give an incentive of a confident outlook for the energy produced at the facility. This can encourage investors to invest in these projects.

Further if the project is a governmental priority in the region, it can increase the investors' confidence in the project.[86] Because of the high requirements on national laws and regulations in these projects, it must be a governmental priority in order to make it possible to implement. The established regulations can create a safer ground for developing CCS projects beyond CDM. It can also decrease the potential of disputes, and make the investments less risky.

CCS projects are advanced and require significant resources to implement. The project can contribute to insight in "know-how" and different technologies related to CCS. However, this requires training and education in the relevant sectors, e.g. engineers and geologists. It can be raised a concern to the fact that the procedures are to advance, and therefore foreign workers with the relevant experience in practice will do the work related to the CCS facility. Local content might be especially challenging in the least developed countries, where education is a special privilege. A potential outcome can be that the CCS project contributes to a reduction in the GHG-emissions, but not to technology transfer and education. This can decrease the contribution to sustainable development through the project.

A solution can be to integrate education programs. If the project participants educate employees, the CCS project may contribute to raise the education level in the community. This would be essential not only for the specific project, but also for similar projects. A higher education degree may lead to additional economic and social growth. This might also important technology transfer, and help developing the industry in the country.

However, one crucial aspect of technology transfer is the fact that most technologies are protected with intellectual property rights. A challenge is that technology transfer may take place through licensing of a patented technology. This licensing takes place if the technology developer and the exploiter of the technology reach a licensing agreement. Some of these agreements may pose burdensome conditions for the exploiter of the technology, which in this context are non-Annex I countries[87]. It can be raised a concern if the technology really are transferred if it is protected by patent rights, that limits the use of the technology.

UNFCCC Article 4.5 states that one of the commitment for the Annex I countries are "(…) the transfer of, or access to environmentally sound technologies and knowhow" to developing

[85] International Energy Agency "Global Action to Advance Carbon Capture and Storage, a Focus on Industrial Applications: Tracking Clean Energy Progress" (2013)
[86] Ibid.
[87] Haugen, Hans Morten (2012) Chapter 8

countries. However, the UNFCCC does not address or mention the problem with protected technologies[88].

The protection of technologies may be a barrier to implementation of CCS projects beyond the CDM. CCS is a new technology, and the development of it has been, and is very expensive. This makes it likely that it is protected with intellectual property rights, and the developers owning the patent is not necessarily interested in "learning" it to developing countries. If this is the case, the technology is not really transferred, in that extent that the host Party can implement the technology beyond the project. Another consequence of a protected technology can be limited job opportunities for the local communities. Because of the protection of the technology there might be a higher number of foreign workers at the facility. This may compromise the creation of new job opportunities, as well as education in the relevant sector.

It should be noted that CCS represents a cost element and non-Annex I countries have no obligations to reduce their CO_2 emissions. This situation will probably not remain; hence clean energy production will be a necessity for all countries in the foreseeable future. CCS under the CDM should consequently be regarded over a longer period; hence CCS could reduce the cost of electricity and consumer bills. Evidence from the IEA shows that without CCS, the cost of meeting a 50% global CO_2 reduction target by 2050 would increase by 40%[89]. In other words; inclusion of CCS within a mix of low-carbon technologies is the lowest cost route to decarbonisation.

6.4 Summary

Currently there are no minimum requirements on how to assist in achieving sustainable development in the CDM. One reason might be the wide wording of the Kyoto Protocol Article 12.2. Another reason, might be to secure the host Party's sovereignty and prerogative to define sustainable development in their country.

The sustainable development tool is an important and helpful factor when assessing whether the project is sustainable. A project activity is often a good contribution in some areas, but less sustainable in others.

Globally, CCS can be seen as an important climate mitigation tool, in order to meet the increasing global energy demand, as well as reduce emissions from fossil fuel production.

Locally, CCS projects can have both positive and negative impacts on sustainable development in non-Annex I countries. If the project participants are willing to implement programs to engage the local community, it can lead to important improvements in the local communities. This can be done through technology transfer, education, work places and safer working conditions. In the long run, this can help reduce poverty and contribute to economic growth in the non-Annex I country. In relation to the environmental impacts there are some

[88] Ibid.
[89] Zero Emissions Platform "ZEP 2013 EIA World Energy Outlook press release" (2013)

concerns relating to the placing and building of the CCS facility and infrastructure. These concerns may however be reduced in some extent by a comprehensive environmental impact assessment. With pursuing a careful assessment and detecting negative impacts in an early stage of the project, it can help address and avoid some of these negative impacts.

7. Conclusions

This thesis has reviewed CCS projects in the CDM with emphasis on special issues related to additionality and sustainable development. CCS in the CDM is at an early stage. CCS as a project activity has wide attention, but still a very political flavour. It has been challenging to identify specific legal and regulative issues since this framework is still under development, and will depend on inter alia experience from concrete projects. A further development of CCS project in Annex I countries will also identify barriers which must be taken into consideration for CCS in the CDM.

A review of the CCS modalities and procedures shows that many challenges relating to CCS projects are addressed, and in some extent resolved. The regulatory framework presents comprehensive requirements for the participants to fulfil in order to implement a CCS project. This helps ensuring the integrity of the project, but comprehensive requirements may also represent a barrier for implementation of new CCS projects.

In order to ensure the additionality of the project, it is important to determine and assess whether the project would be implemented without the CDM. With the current status on CCS projects, this seems less likely. But it is important to recognise the possibility, to demonstrate that the project is beyond business as usual; hence additional.

The specific challenge relating to the risk of seepage and additionality of the project is solved with a reserve account and special procedures in an event of net reversal of storage. High requirements on financial provisions to address net reversal of storage may however be seen as a barrier for investors.

The project participants have to agree on the allocation of liability before the project starts. If it is decided that the long-term liability rests with the host Party after termination, they are responsible to make up for any released CO_2 if seepage occurs after termination, to secure the additionality of the project. A possible way to release some of this long-term liability burden can be by establishing a fund to give the host Party financial support in case of seepage.

CCS projects may contribute to sustainable development in non-Annex I countries. Uncertainties on the term sustainable development make it difficult to determine whether the project has contributed or not. The prerogative of the non-Annex I country to define their sustainable development give an opportunity to set very demanding or less demanding requirements for the sustainability in the country.

To maximise sustainable development benefits from projects, it requires willingness from the Annex I countries to offer important education, technology transfer, “know-how”, and safety

procedures through the project. Providing programs to educate employees can create a higher degree of education. Offering jobs in relation to the project can give a secure income, which might lead to poverty alleviation. The minimum standards non-Annex I countries set on sustainable development and the willingness from Annex I countries to offer solutions that will assist in achieving these standards, will be a crucial factor to make these projects more sustainable. In order to reach one of the main purposes with the Kyoto Protocol Article 12, to assist in achieving sustainable development, there is a need for cooperation and eagerness from both parties.

In general the inclusion of CCS in the CDM, and the CCS modalities and procedures are a clear indication that the COP and CMP recognises the technology as an important tool in climate change mitigation. The framework establishes an international standard for the implementation of CCS projects, which is an important milestone for the development of the CCS technology.

The inclusion of CCS in the CDM is a result of many years of negotiations between the parties to the Kyoto Protocol; hence, an expression of a common consensus that CCS projects in non-Annex I countries are an important contribution to combat climate change. It is yet to see how CCS projects in the CDM will be implemented and realised in practice.

References

International Conventions

Aarhus Convention	Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters Aarhus, June 25 1998
Bamako Convention	Bamako Convention on the Ban on the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa Bamako, January 30 1991
Basel Convention	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal Basel, March 22 1989
Espoo Convention	Convention on Environmental Impact Assessment in a Transboundary Context Espoo, February 24 1991
London Convention	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter London, November 13 1972
UNCLOS	United Nations Convention on the Law of the Sea Montego Bay, December 10 1982
UNFCCC	United Nations Framework Convention on Climate Change New York, May 9 1992

International Protocols

Kyoto Protocol	Kyoto Protocol to the United Nations Framework Convention on Climate Change Kyoto, December 11 1997
London Protocol	Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter November 17 1996

EU directives

Directive 2009/31/EC	Directive 2009/31/EC of the European Parliament and the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European

	Parliament and Council Directives 200/60/EC, 2001/80/EC, 2006/35/EC, 2008/1/EC and Regulation (EC) No 1013/2006

Norwegian Law

21.12.1990 No.72	Act Relating to tax on discharge of CO_2 in the petroleum activities on the continental shelf (Official Norwegian title: Lov om avgift på utlispp av CO_2 i petroleumsvirksomhet på kontinental sokkelen)

COP/CMP-decisions

CMP	The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol "Amendment to the Kyoto Protocol Pursuant to Its Article 3, Paragraph 9 " (The Doha Amendment) 1/CMP.8 (8 December 2012)
CMP	The Conference of the Parties sering as the meeting of the Parties to the Kyoto Protocol "Modalities and Procedures for a Clean Development Mechanism as Defined in Article 12 of the Kyoto Protocol" 3/CMP.1 (2001)
CMP	The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol "Modalities and procedures for carbon dioxie capture and storage in geological formations as clean development mechanism project activities" 10/CMP.7 (2011)

Norwegian White Papers

St. Meld Nr.21 (2011-2012)	Norsk Klimapolitikk (English translation: Norwegian Climate Policy)
St. Meld Nr.14 (2010-2011)	Mot en grønnere utvikling, om sammenhengen i miljø- og utviklingspolitikken (English translation: Towards a greener development, the coherence of environmental and development policy)
St. Meld Nr. 9 (2010-2011)	Fullskala CO_2-håndtering (English translation: Fullscale CCS)

Innst. S.nr. 145 (2007-2008) — Innstilling fra energi- og miljøkomiteen om norsk klimapolitikk (English translation: Setting from the energy and environment committee on Norwegian climate policy)

Literature

Bugge, Hans Chr — "Innføring i Internasjonal Miljørett." Chapter 3 In *Lærebok i Miljøforvaltningsrett* Oslo, 2011.

Haugen, Hans Morten — "Technology Transfer of Envrionmental Goods and Services:What Are the Lessons from the WTO and UNFCCC Negotiations?"Chapter 8 In *Technology and Human Rights - Friends or Foes?: Highlighting Innovations Applying to Natural Resources*, Dordrecht, 2012.

Honkonen, Tuula. — "Introduction." Chapter 1 In *The Common but Differentiated Responsibility Principle in Multilateral Environmental Agreements: Regulatory and Policy Aspects*, Austin, 2009.

Hokonen, Tuula — "Operationalization of CBDR in Multilateral Environmental Agreements." Chapter 3 In *The Common but Differentiated Responsibility Principle in Multilateral Environmental Agreements: Regulatory and Policy Aspects*, Austin, 2009.

Hulme, Mike — "Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity". Cambridge, 2009.

Huq, Saleemul and Hannah Reid — "Benefit Sharing under the Clean Development Mechanism." Chapter 12 In *Legal Aspects of Implementing the Kyoto Protocol Mechanisms: Making Kyoto Work*, edited by David Freestone and Charlotte Streck, Oxford, 2005.

McMorris, John — "Running a Carbon Project." Chapter II In *Climate Change: A Guide to Carbon Law and Practice*, edited by Paul Watchman, London, 2008.

Riley, Nick — "Geological Storage of Carbon Dioxide." In *Carbon Capture: Sequestration and Storage*, edited by Roy M. Harrison and Ronald E. Hester. Cambridge, 2010.

Ruud, Morten, and Geir Ulfstein — "Folkerettens Kilder." Chapter 4 In *Innføring i Folkerett*, Oslo, 2006.

Voigt, Christina "The Deadlock of the Clean Development Mechanism: Caught between Sustainability, Environmental Intergrity and Economic Efficiency." In *Climate Law and Developing Countries: Legal and Policy Challenges for the World Economy*, edited by Benjamin J. Richardson, Cheltenham, UK, 2009.

Reports

Global CCS Institute "The Global Status of CCS: 2012." (10.10.2012)

http://cdn.globalccsinstitute.com/sites/default/files/publications/47936/global-status-ccs-2012.pdf

Intergovernmental Panel on Climate Change "Working Group I countribution to IPCC Fifth Assesment Report, Climate Change 2013: The Physical Science Basis." Summary for Policymakers (27.09.2013)

http://www.climatechange2013.org/images/uploads/WGI_AR5_SPM_brochure.pdf

Intergovernmental Panel on Climate Change "IPCC Special Report on Carbon Dioxide Capture and Storage" Edited by Bert Mertz, Ogunlade Davidson, Heleen de Coninck, Manuela Loos, Leo Meyer (2005)

http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf

International Energy Agency "Carbon Capture and Storage and the London Protocol: Options for Enabling Transboundary CO_2 Transfer" (01.10.2011)

http://www.oecd-ilibrary.org/docserver/download/5kg3n27pfv30.pdf?expires=1385121328&id=id&accname=guest&checksum=0295C70D758D3BD96D2E9640C5CF433D

International Energy Agency "Global Action to Advance Carbon Capture and Storage, a Focus on Industrial Applications: Tracking Clean Energy Progress" (2013)

http://www.iea.org/publications/freepublications/publication/CCS_Annex.pdf

International Energy Agency "Resources to Reserves 2013", Executive Summary (2013)

http://www.iea.org/Textbase/npsum/resources2013SUM.pdf

International Energy Agency — "Technology Roadmap: Carbon Capture and Storage" (2013)
http://www.iea.org/publications/freepublications/publication/TechnologyRoadmapCarbonCaptureandStorage.pdf

Philibert, Cedric, Jane Elis and Jacek Podaski — "Carbon Capture and Storage in the CDM", International Energy Agency and Organisation for economic and co-operation and development, (22.11.2007)
http://www.iea.org/publications/freepublications/publication/CCS_in_CDM.pdf

World Commision on Environment and Development — "Our Common Future" Brundtland-commission (1987)
http://www.un-documents.net/ocf-02.htm#I

Published Writings

Al-Traboulsi, Manal et.al — "Potential Impact of CO_2 Leakage from Carbon Capture and Storage (CCS) Systems on Growth and Yield in Maize." In Plant and Soil, Issue 1-2, (2013) p. 267-281.

Dixon, Tim et.al — "CCS Projects as Kyoto Protocol CDM Activities" In Energy Procedia 37 (2013), p. 7596-7604

Monceau, Tanguy du and Arnaud Brohé — "Baseline Setting and Additionality Testing within the Clean Development Mechanism (CDM)." Briefing Paper (2011)
http://ec.europa.eu/clima/policies/ets/linking/docs/additionality_baseline_en.pdf

Kim, Rakhyun E and Brendan Mackey — "International Environmental Law as a Complex Adaptive System." In International Environmental Agreements: Politics, Law and Economics (2013): p.1-20.

Shen, Wei — "Understanding the Dominance of Unilateral CDMs in China: Its Origins and Implications for Governing Carbon Market" Working Paper 149, Tyndall Centre for Climate Change Research (2011)
http://www.tyndall.ac.uk/sites/default/files/twp149.pdf

UNFCCC documents

CDM EB	"EB 70 Summary" CDM-EB70 (2012) http://cdm.unfccc.int/Reference/EB_Summary/070/eb70_sum_en.pdf
CDM EB	CDM Executive Board "CDM Sustainable Development Tool" http://www.research.net/s/SD_tool_vers7. (Access date: 03.10.2013)
Executive Board	"Glossary CDM Terms" CDM-EB07-A04-GLOS Version 07.0 (2009) http://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf
Global CCS Institute	"Modalities and procedures for carbon dioxide capture and storage in geological formations as Clean Development Mechanisms (CDM) project activities" Global CCS Institute Submission to UNFCCC (26.03.2012) http://www.globalccsinstitute.com/publications/submission-united-nations-framework-convention-climate-change-unfccc-elaboration
Subsidiary Body for Scientific and Technological Advice	"Methodological issues under the Kyoto Protocol, Carbon dioxide capture and storage in geological formations as clean development mechanism project activites" FCCC/SBSTA/2012/L.21 (26.11-01.12.2012) http://unfccc.int/resource/docs/2012/sbsta/eng/l21.pdf
United Nations	"Transboundary Carbon Capture and Storage Project Activites" Technical Paper FCCC/TP/2012/9 (01.11.2012) http://unfccc.int/resource/docs/2012/tp/09.pdf

Electronic Sources

CCS Association	"What is CCS". (2011-2013) http://www.ccsassociation.org/what-is-ccs/ (Access date: 20.09.2013)
CICERO, Anders Tjershaugen	"FNs Klimapanel Gransker CO_2-Lagring" (09.12.2005)

http://www.cicero.uio.no/fulltext/index.aspx?id=3923.
(Access date: 10.10.2013)

Ministry of Finance "Hvilke kvoter ønsker finansdepartementet å kjøpe?" (11.10.2013)

http://www.regjeringen.no/en/dep/fin/Selected-topics/Sustainable-development/statens-kvotekjop-2/hvilke-kvoter-onsker-finansdepartementet.html?id=588016
(Access date: 21.11.2013)

Ministry of Petroleum and Energy "Change in direction of commitment to Carbon Capture and Storage" (20.09.2013)

http://www.regjeringen.no/en/archive/Stoltenbergs-2nd-Government/Ministry-of-Petroleum-and-Energy/Nyheter-og-pressemeldinger/pressemeldinger/2013/change-in-direction-of-commitment-to-car.html?id=735970
(Access date: 22.11.2013)

The Guaridan, Greg Jones "World's First CCS Leak Experiment Completed in Sea Off Scotland." (29.06.2012)

http://www.theguardian.com/environment/2012/jun/29/ccs-leak-experiment
(Access date: 15.10.2013)

QICS Project "Quantifying and Monitoring Potential Ecosystems Impacts of Geological Carbon Storage" (2013)

http://www.bgs.ac.uk/qics/home.html
(Access date: 15.10.2013)

Statoil “Sleipner Vest” (15.11.2011)

http://www.statoil.com/no/TechnologyInnovation/NewEnergy/Co2Management/Pages/SleipnerVest.aspx
(Access date: 22.11.2013)

UNEP Risoe Centre "Percentage share of the total number of projects in the CDM categories" (01.11.2013)

http://www.cdmpipeline.org/cdm-projects-type.htm#3
(Access date: 30.11.2013)

United Nations "Background on the UNFCCC: The International Response to Climate Change" (2013)

http://unfccc.int/essential_background/items/6031.php
(Access date: 02.09.2013)

United Nations "Clean Development Mechanism (CDM)" (2013)

http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php
(Access date: 03.09.2013)

United Nations "EB Meetings"

http://cdm.unfccc.int/EB/index.html
(Access date: 03.09.2013)

United Nations "Kyoto Protocol" (2013)

http://unfccc.int/kyoto_protocol/items/2830.php
(Access date: 03.09.2013)

United Nations "Project Activities" and "Distribution of registrered projects by Host Party" (31.10.2013)

http://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html
(Access date: 21.11.2013)

Zero Emissions Platform "ZEP 2013 EIA Energy Outlook press release" (13.11.2013)

http://www.zeroemissionsplatform.eu/news/news/1621-ccs-essential-in-light-of-key-iea-2013-world-energy-outlook-conclusions.html
(Access date: 02.12.2013)

Figures and tables

Table 1: List of Annex I and non-Annex I countries to the UNFCCC
(data from: http://unfccc.int/parties_and_observers/items/2704.php)

Annex I countries to the UNFCCC	Non-Annex I countries to the UNFCCC
Australia	Afghanistan
Austria	Albania**
Belarus**	Algeria
Belgium	Andorra
Bulgaria	Angola
Canada	Antigua and Barbuda
Croatia**	Argentina
Cyprus	Armenia **
Czech Republic**	Azerbaijan
Denmark	Bahamas
Estonia	Bahrain
European Union	Bangladesh
Finland	Barbados
France	Belize
Germany	Benin
Greece	Bhutan
Hungary	Bolivia
Iceland	Bosnia and Herzegovina
Ireland	Botswana
Italy**	Brazil
Japan	Brunei Darussalam
Latvia	Burkina Faso
Liechtenstein**	Burundi
Lithuania	Cambodia
Luxembourg	Cabo Verde
Malta	Cameroon
Monaco**	Central African Republic
Netherlands	Chad
New Zealand	Chile
Norway	China
Poland	Colombia
Portugal	Comoros
Romania	Congo
Russian Federation**	Cook Island
Slovakia**	Costa Rica
Slovenia**	Cuba
Spain	Côte d'Ivoire
Sweden	Democratic People's Republic of Korea
Switzerland	Democratic Republic of the Congo
Turkey**	Djibouti
Ukraine**	Dominica
United Kingdom of Great Britain and Northern Ireland	Dominican Republic
United States of America	Ecuador
	Egypt
*Observer State	El Salvador
** Party for which is a specific COP and/or CMP decision	Equatorial Guinea
	Eritrea
	Ethiopia
	Fiji
	Gabon
	Gambia

	Georgia Ghana Grenada Guatemala Guinea Guinea-Bissau Guyana Haiti Honduras India Indonesia Iran (Islamic Republic of) Iraq Israel Jamaica Jordan Kazakhstan** Kenya Kiribati Kuwait Kyrgyzstan Lao People's Democratic Republic Lebanon Lesotho Liberia Libya Madagascar Malawi Malaysia Maldives Mali Marshall Islands Mauritania Mauritius Mexico Micronesia (Federal States of) Mongolia Montenegro Morocco Mozambique Myanmar Namibia Nauru Nepal Nicaragua Niger Nigeria Niue Oman Pakistan Palau Palestine* Panama Papua New Guinea Paraguay Philippines Qatar Republic of Korea Republic of Moldova** Rwanda Saint Kitts and Nevis Saint Lucia Saint Vincent and the Grenadines Samoa San Marino Sao Tome and Principe

	Saudi Arabia Senegal Serbia Seychelles Sierra Leone Singapore Solomon Islands Somalia South Africa South Sudan* Sri Lanka Sudan Suriname Swaziland Syrian Arab Republic Tajikistan Thailand The former Yugoslav Republic of Macedonia Timor-Leste Togo Tonga Trinidad and Tobago Tunisia Turkmenistan** Tuvalu Uganda United Arab Emirates United Republic of Tanzania Uruguay Uzbekistan** Vanuatu Venezuela (Bolivarian Republic of) Viet Nam Yemen Zambia Zimbabwe *Observer State ** Party for which is a specific COP and/or CMP decision