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## Conflicts over carbon capture and storage in international climate governance

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## **Conflicts over carbon capture and storage in international climate governance**

### **Abstract**

In the Paris Agreement, ambitious emission targets are accompanied by insufficient mitigation measures. It lacks, in particular, strategies on how to reduce the use of fossil fuels. In this context the distinctive prospect of carbon capture and storage (CCS) – reducing emissions, albeit using fossil fuels on a large scale – is of particular interest. CCS technologies promise to solve the climate problem independent of drawn-out political disputes and without changing production and consumption patterns. Conflicts about CCS put the fundamental debate on the agenda, whether a comprehensive transformation of social structures is (un-)necessary and (un-)desired in order to solve the ecological crisis. Therefore, in this paper CCS-conflicts are analyzed with a broader perspective including their effects on general struggles about international climate governance. The key research question is to what extent established social practices and structures become politicized – i.e. challenged. Based on the presented empirical findings, I discuss two theses: First, that the future of climate governance is contingent on decisions about the continued use of fossil fuels. Second, that CCS-conflicts have an explosive force that could lead to massive cracks within the paradigm of *ecological modernization* and thus could politicize international climate policy.

### **Keywords**

Carbon capture and storage (CCS); climate governance; climate politics; ecological modernisation; fossil fuels; techno-fix

## **1. Introduction**

The success of international climate governance so far has been very limited. Global greenhouse gas emissions keep rising (IPCC, 2014, p. 6f). Carbon prices are at such a low level that carbon markets don't provide any incentives for reducing emissions. Furthermore, the ecological crisis<sup>1</sup> does not rank very high on the political agenda anymore since various economic crises determine day-to-day-politics. The willingness to adopt, implement, and finance environmental protection measures has declined in industrialized countries within recent years (Klein, 2014, p. 110). On top of that, the Paris Agreement – adopted at the climate summit in 2015 – does not include binding emission targets. Since the failure of the 2009 climate summit in Copenhagen, expectations regarding the negotiations within the United Nations Framework Convention on Climate Change (UNFCCC) have been scaled down. Overall, trusting politicians to manage the ecological crisis is at a low level. Against this background, more and more actors enhance the development of techno-fixes – technological solutions that promise to solve symptoms of complex problems without changing social structures (Methmann et al., 2013). In this context, CCS technologies are of particular interest as they are based on the established centralized fossil energy infrastructure (IPCC, 2005, p. 12).

“With CCS it is entirely possible for fossil fuels to continue to be used on a large scale.”

(Rajendra Pachauri, the then-chair of the Intergovernmental Panel on Climate Change on the occasion of presenting the fifth assessment report)<sup>2</sup>

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<sup>1</sup> The term 'ecological crisis' refers to the recognition that we are facing not just a few more environmental problems (like climate change or the loss of biodiversity), but that these problems reveal that our relationship with nature is in crisis (Brand, 2010, p. 143). It implies the assumption that conventional reactions (of established institutions) are not able to solve ecological problems (anymore). The term 'socio-ecological crisis' or 'crisis of societal relationships with nature' would be more accurate. But in order to increase the compatibility with different scientific and political debates, I use the common term 'ecological crisis'.

<sup>2</sup> Online: [www.theguardian.com/environment/2014/nov/02/rapid-carbon-emission-cuts-severe-impact-climate-change-ipcc-report](http://www.theguardian.com/environment/2014/nov/02/rapid-carbon-emission-cuts-severe-impact-climate-change-ipcc-report), last accessed 22 July 2016.

The distinctive prospect of CCS – reducing emissions, albeit using fossil fuels on a large scale – increased in value with the Paris Agreement which aims at achieving “a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century” (UNFCCC, 2015, p. 21). As the countries agreed on rather ambitious climate targets without presenting serious policy plans on how to significantly reduce the use of fossil fuels, CCS – being an artificial sink – could become even more important. That is why organizations like the *International Energy Agency* appraise the Paris Agreement as a signal to step up efforts to develop and deploy CCS technologies<sup>3</sup>:

“The headline message is to limit warming to ‘well below’ 2.0 C (by 2100) and pursue 1.5 C, thus needing more mitigation activities, including more CCS. [...] IEAGHG and our partners at COP [Conference of the Parties; T. K.] were happy to play our modest role in providing information to support the high level agreement (see our blogs from COP), but we all played a bigger role in our work over the years, such that the IPCC and UNFCCC now recognise the need and viability of CCS.” (online: [www.ieaghg.org/publications/blog](http://www.ieaghg.org/publications/blog), last accessed 22 July 2016)

Actually, CCS technologies become more and more important in the political consultancy by the Intergovernmental Panel on Climate Change (IPCC). In its latest *Assessment Report*, CCS and BECCS<sup>4</sup> technologies are receiving much greater attention as compared to previous reports (Petersen, 2014). In the Summary for Policymakers of the third Working Group's contribution, the discussion of CCS technologies starts with the following assessment:

“Carbon dioxide capture and storage (CCS) technologies could reduce the lifecycle GHG emissions of fossil fuel power plants (medium evidence, medium agreement).” (IPCC, 2014, p. 22)

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<sup>3</sup> Online: [www.bellona.org/news/climate-change/2015-12-paris-climate-deal-unites-world-in-a-common-goal-of-slashing-emissions-for-the-first-time](http://www.bellona.org/news/climate-change/2015-12-paris-climate-deal-unites-world-in-a-common-goal-of-slashing-emissions-for-the-first-time), [www.ieaghg.org/publications/blog](http://www.ieaghg.org/publications/blog), last accessed 22 July 2016.

<sup>4</sup> BECCS stands for the application of carbon capture and storage at bio-energy power plants. In this article I don't discuss BECCS because it is even less mature than CCS. Furthermore I focus on CCS as I develop the argument that the future of climate governance is contingent on decisions about the continued use of fossil fuels (and in this regard, BECCS is of less importance).

The appraisal of the current state of research (“medium evidence, medium agreement”) foreshadows the potential conflict inherent to CCS. In general, CCS technologies are still far from being commercially feasible on a large scale with only very few exceptions (regarding the case of Norway cf. Krüger, 2015, p. 236ff). Nevertheless, already the hope for CCS technologies has had a great influence on the disputes about climate and energy policies – both on international as well as on regional and national scale in many countries (Markusson and Shackley, 2012, p. 36; Meadowcroft and Langhelle, 2009a, p. 267ff). The short-term effect is that new power plants are legitimized by labeling them as “CCS-ready”<sup>5</sup>. Regarding long-term considerations, CCS technologies contain the already mentioned promise that it is possible to keep using fossil fuels while stabilizing the greenhouse gas concentration in the atmosphere. This is very appealing to many actors as fossil fuels stand for economic growth, prosperity, and the modern development model. Particularly, energy companies and governments of countries with fossil fuel reserves count on CCS in order to pursue established ways to maximize profits and wealth.

“The temptation that CCS offers is the extension of the fossil-fuel era by perhaps a few 100 years.” (Spreng et al., 2007, p. 853)

In the light of alleged practical constraints and path dependencies, CCS is regarded by a pro-CCS discourse coalition<sup>6</sup> as an irreplaceable bridging technology in the transition to a low-

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<sup>5</sup> The term “CCS-ready” is supposed to indicate that a new power plant is designed for a subsequent installation of CCS technologies. However, it is ambiguous which criteria a power plant has to meet in order to be approved as CCS-ready. De facto CCS-ready means in many cases that there is the space that would be needed for technologies capturing the CO<sub>2</sub>. In addition, the proximity of a possible storage location or possible transport routes is crucial.

<sup>6</sup> The development and application of CCS technologies is accompanied by political struggles. The positions in these struggles can be grouped into two opposite (typecast) discourse coalitions: a pro-CCS coalition and an anti-CCS coalition. These coalitions are quite heterogeneous regarding their members and they are not necessarily the effect of intentional and strategic alliance building. But even if the actors don't perceive themselves as part of a coalition one can nevertheless detect patterns of argumentation and action that shape the discourse (for the term discourse coalition cf. Hajer, 1995, p.65). The pro-CCS coalition is formed by governments, international climate and energy institutions, fossil fuel industry, modest NGOs (with affinity to technical solutions), as well as scientists that are involved in CCS research. The anti-CCS coalition consists of environmental research institutes, environmental groups, climate activists, local citizens' initiatives, as well as individual scientists. For a

carbon economy. For them, a scenario of a large-scale application of CCS seems to be more realistic than a structural change of production and consumption patterns.

This position is objected by an anti-CCS discourse coalition (see footnote 6) that points to a twofold risk: first, the storage of CO<sub>2</sub> in geological formations contains environment and health risks; second, technological developments can only be planned and predicted to a limited degree. This concerns the use of CCS itself as well as its role as a bridging technology. According to the anti-CCS discourse coalition, it is unpredictable whether at all – and, if so, when – a large-scale deployment of CCS will be technically, economically, and politically feasible. In this context, the anti-CCS discourse coalition highlights the uncertainty of political and social factors that have great influence on the shaping of energy infrastructures which are usually underestimated in the scenarios and prognoses of technical developments and future energy systems (Hansson, 2012, p. 75ff). The neglected political and social factors are a significant source of uncertainty with regard to the probability of large-scale deployment of CCS as well as the notion that a particular technology could be a bridge towards an energy system in which the very technology itself is no longer needed. On the contrary, the large investment required for the construction of a specified infrastructure as well as the established legal and financial frameworks make the dismantling of this technology unlikely (Meadowcroft and Langhelle, 2009a, p. 279). Thus, there is the potential of reinforcing the so-called carbon lock-in (for a detailed discussion of the lock-in effect and possible ways of escaping it cf. Unruh, 2002). Stabilizing or even expanding the fossil energy infrastructure continues to deteriorate the conditions for subsequent transformation processes. With respect to this twofold risk the scientists Daniel Spreng, Gregg Marland, and Alvin M. Weinberg define the development and deployment of CCS technologies as a “Faustian Bargain”:

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discussion of the coalitions cf. Markusson and Shackley, 2012, p. 36f; Meadowcroft and Langhelle, 2009a, p. 267ff.

“CSS appears to be a classic Faustian Bargain. But, as in Faust’s initial bargain, it need not mean that our soul is left to the devil. It should mean that we accept the challenge of continual striving and vigilance, striving for more durable answers to global climate change and vigilance in assuring that stored carbon is not subsequently released to the climate system.” (Spreng et al., 2007, p. 854)

This pointed elaboration – of both the specific appeal and the twofold risk of CCS – illustrates the controversial nature of the dispute. Nevertheless, the interest (of very different players) in CCS technologies remains strong.

In conflicts about CCS, the question comes to a head: how fast and to what extent is a change of social structures absolutely necessary and an appropriate response to the ecological crisis. CCS technologies represent the quest for risky techno-fixes. However, this way of dealing with unintended secondary effects of industrial modernity is under pressure from demands (by different actors, e.g. environmental movements, NGOs, critical scientists, and politicians) for a reflexive modernity or for fundamental alternatives to the modern growth-based development model (Brand, 2010, p. 143). Therefore, CCS-conflicts are a particularly appropriate object of investigation regarding re- and depoliticizing processes in international climate governance – in other words, regarding the question to what extent established social practices and structures are being challenged. This has to be discussed against the background of the dominant paradigm in global environmental policy which can be grasped as *ecological modernization*.

## 2. The Paradigm of Ecological Modernization

The concept of ecological modernization goes back to the struggles about environmental politics in the last century (for the entire section cf. Krüger, 2015; see also Hajer, 1995; Mol et al., 2009). In context of the diagnosis of an ecological crisis in the political and scientific public of the 1970s, the assumption of a contradiction between environmentalism and

economic growth was established. The environmental movements took the growing ecological problems as a symptom for a general social crisis and criticized the development model of modernity (Görg, 2003, p. 135). But since the 1980s, an increasing dominance of the concept of ecological modernization can be observed. It holds on to the object of economic growth, but complements the modern development model with a sustainability component. The eco-modern notion rejects breaking with the established social structures but aims at restructuring them. It does not problematize modernity but calls for an ecological modernization of modernity.

The eco-modern concept recognizes that there are unintended secondary effects of the modern urge to dominate nature (e. g. climate change and the loss of biodiversity). Therefore, ecological modernization attempts to make these secondary effects predictable and controllable via tools like risk assessment, risk prevention, monitoring, and risk management – which is why one could call it a strategy of *reflexive domination of nature* (Görg, 2003). Nevertheless, it perpetuates an appropriation of nature that subsumes nature to the alleged needs of society (especially, of the economy).

Instead of challenging hegemonic structures and the involving balances of power, the eco-modern concept is characterized by a *technocratic* approach. It is based on the assumption that ecological problems can be detached, analyzed, and solved in isolation without transforming society as a whole (Hajer, 1995, p. 25).

Corresponding to the rejection of general social criticism, *incrementalism* is the favored development path (Hajer, 1997, p. 113). Eco-modern governance aims at expanding and optimizing existing structures. The notion of taking small steps forward to find solutions for complex social problems is predominant. Structural upheavals are avoided.

Solutions are expected to be the outcome of *scientific and technological progress*. The skepticism towards technology and progress – which characterized the ecological movements in the 1970s – was transformed into the eco-modern quest for perfecting technological



development. The aspired scientific and technological innovations are supposed to result in an ecological-economic double benefit which increases security and growth.

When it comes to comparing different technologies and policy instruments, the main criterion is their cost-cutting contribution to achieve concrete (detached) environmental targets (Huber, 1993, p. 54). Policy instruments only count as realistic and practical if they are compatible with the *primacy of microeconomics* by avoiding present or future costs or by serving as a driver of growth. Possible alternative criteria like social aspects (e. g. issues of justice), integrated ecological aspects (that attach intrinsic value to nature), or democratic aspects (e. g. co-determination rights regarding energy production and distribution) only play a subordinate role.

The critique of growth – articulated in the 1970s and recently revived in the degrowth movement – got integrated into the eco-modern notion of *sustainable growth*. The stated opposition between environmentalism and economic growth is transformed into the synthesis of sustainable growth by assuming that the two objectives don't clash but can be harmonized (Huber, 2011, p. 279). The eco-modern concept even goes so far as understanding economic growth as a condition of efficient environmentalism and vice versa.

In the 1990s, the concept of ecological modernization became the guiding principle for environmental policy-making – both at the international level and at the national level of most industrialized countries (Hajer, 1995, pp. 26, 30, 100).<sup>7</sup> There is a broad discourse coalition – including most governments of the Global North, so-called green companies, as well as most NGOs, environmental groups, and ecological think-tanks – that supports the eco-modern core demands *Sustainable Development* and *Green Economy*.

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<sup>7</sup> Its effect, however, is limited as environmental policy is still subordinated to economic targets. The dominance of the eco-modern concept is restricted to the field of environmental policy. It is not forming society as a whole.

### 3. Research Design

With its focus on de- and re-politicizing effects, this article contributes to the discussion of CCS-conflicts against the background of their broader social contexts that is urgently needed (Bäckstrand et al., 2011, p. 278; de Coninck and Bäckstrand, 2011, p. 368f). Therefore I link a microanalytic study of a specific dispute with a broader perspective on conflicts about the appropriate response to the ecological crisis – focusing on the conflicts about and within the eco-modern paradigm (following up the discussion of the relationship between ecological modernization and CCS in Hansson, 2008). The primary investigation scope of my empirical research was the UNFCCC negotiations (the international climate negotiations within the framework of the *United Nations*) about whether CCS should be included in the Clean Development Mechanism (CDM) of the Kyoto Protocol (for details on the CDM and what I call the CCS-CDM-dispute see section 5). However, the target was not an isolated examination of the CCS-CDM-dispute. Instead, I was interested in the implications for power struggles over the processing of the ecological crisis.

My findings are based on an discourse analysis of negotiation protocols as well as written submissions of countries and observer organizations<sup>8</sup> concerning the CCS-CDM-dispute (for a detailed discussion of my methodical approach cf. Krüger, 2015, p. 64ff). Thus, I could trace the course of the negotiations and the positions of actively involved players. In order to grasp indications for unofficial stances and bargaining, I complemented the analysis with information, assessments, and interpretations from scientific studies, publications of observer organizations and two expert interviews<sup>9</sup>. Based on this overview, I examined in detail the positions and roles of single actors who had a big impact on the dispute – namely the

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<sup>8</sup> In addition to the government delegations, a large number of NGOs, (business) associations, UN organizations, and international organizations like the *Organisation for Economic Co-operation and Development* (OECD) participate in the UN climate negotiations with observer status.

<sup>9</sup> My interview partners were Heleen de Coninck and Manfred Treber. Heleen de Coninck was one of the *Coordinating Lead Authors* for the *IPCC Special Report on CCS*. In addition, she followed the CCS-CDM-dispute in the UNFCCC negotiations as a scientific observer. Manfred Treber took part in these negotiations on behalf of the observer organization *Germanwatch*.

governments of Brazil and Norway, the European Union (EU), as well as the observer organizations *International Emissions Trading Association* (IETA) and *Greenpeace*. In this step of research, I analyzed their stances against the background of their general energy and climate policies as well as their energy system and fossil resources (in the case of the governments and the EU) or their overall policy approach as well as their lobby interests (in the case of the observer organizations). Furthermore, a special focus was placed on the political consulting of the IPCC which had a great influence on the CCS-CDM-dispute. In light of the empirical findings, conclusions were drawn with regard to the status quo of power struggles in international climate governance.

In the following, I will present some of the key results. First, I briefly introduce CCS technologies and give an overview on the activities of the main stakeholders that are involved in the development and deployment of CCS (4). Afterward I discuss the CCS-CDM-dispute against the background of the struggles about and within the eco-modern paradigm in international climate policy (5). This is followed by an assessment of the status quo of CCS' political significance (6). After that, I consider possible re- and/or depoliticizing impacts of CCS-conflicts (7). Finally, two theses are deduced from the main empirical results. First, that the future of climate governance is contingent on decisions about the continued use of fossil fuels. Second, that CCS-conflicts have an explosive force that could lead to massive cracks within the eco-modern discourse coalition and thus could politicize international climate policy (8).

#### **4. Development and Deployment of CCS Technologies**

The abbreviation CCS includes the following components:

- 1) The capture of CO<sub>2</sub> at fossil power plants or other industrial sites with high CO<sub>2</sub> emissions,
- 2) the transport of the captured CO<sub>2</sub> in pipelines or ships to suitable storage sites,

- 3) in which the CO<sub>2</sub> is supposed to be stored permanently,
- 4) which has to be monitored for a very long period.

Therefore, CCS is not one specific technology but a combination of different technologies. The initial ideas for the development of CCS as a climate protection strategy go back to the 1970s. However, it was not until climate change became a political priority in the 1990s that interest in CCS increased. In the 2000s, the research and development of CCS technologies intensified once again (Evar et al., 2012, p. 19ff).

CCS technologies are supposed to capture and store about 85-95 percent of the CO<sub>2</sub> that is emitted at the specific industrial site (IPCC, 2005, pp. 4, 27; Viebahn et al. 2007). The application of CCS technologies consumes energy and leads to a loss of efficiency. Discounting the CCS-induced emissions (that are generated by capturing, transporting, injecting, monitoring, and the additional extraction of fossil fuels that is needed to provide the extra energy for these activities), the reduction of the emitted CO<sub>2</sub> amounts to a maximum of 65-90 percent – provided that the storage is secure and permanent. Thereby, the input of resources increases by up to 40 percent per kilowatt hour.

The players involved in developing or financing CCS projects aim at commercial application starting in 2020, or at the latest by 2030 (Evar et al., 2012, p. 18). For various reasons, it is not yet clear whether this target is realistic and whether CCS technologies will be deployed on a large scale at all. In this context, both the costs of CCS technologies and the achieved degree of technological maturity play a decisive role. Other important factors are future economic incentives to avoid emissions, the price of fossil fuels, the further expansion of renewable energy and the public acceptance of CCS projects in regions with potential storage sites.

With regard to the costs of CCS technologies, the forecasts vary extremely (Hansson and Bryngelsson, 2009). In principle, it is accurate that CCS can only be commercially profitable with high financial incentives for avoiding emissions (IPCC, 2005, p. 10f). CCS projects (regarding research, development, and application) are – in large part – publicly financed

(Evar et al., 2012, p. 25). The countries with the greatest financial commitments so far are (in alphabetical order): Australia, Canada, France, Great Britain, Japan, Norway, the United States, and – some way behind – Germany and Spain. In addition, the European Union (EU) finances many projects. In relation to its gross national product, Norway is the country with the highest subsidies for CCS. In absolute terms, the US is far ahead. On the part of private actors, it is primarily the energy companies (in particular the oil and gas industry) that work on the research and development of CCS technologies, preparing their business model for future climate protection regulations and/or rising prices in carbon markets.

Apart from the energy corporations, there are a number of additional organizations that advocate CCS technologies in the fields of research, development, and lobbying (de Coninck, 2008). Among those are the Norwegian environmental NGO *Bellona Foundation*, the intergovernmental organization *Carbon Sequestration Leadership Forum*, the international *Global CCS Institute* that was initiated by the Australian government, the research program *Greenhouse Gas R&D Programme* of the *International Energy Agency*, the *International Emissions Trading Association*, and the *International Petroleum Industry Energy Conservation Association*.

There are many different projects demonstrating various aspects of CCS – mostly on a small scale. But so far, there are only a few large-scale projects that include the entire CCS chain. The exact number depends on the definition of “large-scale”, but even the lobbying organization *Global CCS Institute* counts no more than fifteen large-scale CCS projects in operation (online: [www.globalccsinstitute.com/projects/large-scale-ccs-projects](http://www.globalccsinstitute.com/projects/large-scale-ccs-projects), last accessed 22 July 2016) – including the Project *In Salah* (in Algeria) where the injection of CO<sub>2</sub> is suspended due to monitored fractures (White et al., 2014). Eleven of the listed projects use the

captured CO<sub>2</sub> for *Enhanced Oil Recovery*<sup>10</sup>. The first and only large-scale CCS project that captures CO<sub>2</sub> from a power plant is the *Boundary Dam Carbon Capture and Storage Project* (in Canada), which has been in operation since the fall of 2014.

## 5. The Dispute about CCS in the International Climate Negotiations

The Clean Development Mechanism is part of the flexible mechanisms of the Kyoto Protocol. The CDM enables *Annex B countries*<sup>11</sup> to fulfill their reduction commitments with projects in *Non-Annex B countries*. CDM-projects are supposed to support a sustainable development in the host country. In return *Certified Emissions Reductions* (CERs) are credited to the participating *Annex B country*. These CERs are then deducted from the reduction targets. That is why the CDM is called an offset mechanism. Apart from the carbon market within the UN regime, the CDM plays a decisive role in regional carbon markets (the biggest is the European Union Emissions Trading System, EU ETS) and the growing market for voluntary compensations of emissions in which state institutions, development finance institutions and corporations are taking part. That is why UNFCCC statistics forecast a continuous increase in CDM-generated CERs, even though the commitment period of the Kyoto Protocol expired in 2012 (online: [cdm.unfccc.int/Statistics/Public/CDMinsights/index.html](http://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html), last accessed 22 July 2016). Furthermore, the Paris Agreement states that countries can use offsetting mechanisms to fulfill their emission targets (UNFCCC, 2015, p. 23). In this context, a new mechanism is introduced, which has a broader scope than the Kyoto mechanisms. It is neither restricted to

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<sup>10</sup> *Enhanced Oil Recovery* (EOR) means the injection of CO<sub>2</sub> in oil fields. This procedure increases the pressure and, therefore, allows more crude oil to be extracted. The oldest project that the *Global CCS Institutes* lists on their website is *Val Verde Natural Gas Plants* that has operated since 1972 – a time where EOR wasn't used for climate reasons. There also weren't monitoring programs nor precautionary measures to ensure the permanent storage of the CO<sub>2</sub> (Evar et al., 2012, p. 21).

<sup>11</sup> The term *Annex B countries* stands for the countries of the Global North (so-called 'industrialized' and 'transition countries') that accepted emissions targets for the period 2008-2012 as per Article 3 and Annex B of the Kyoto Protocol. *Non-Annex B countries* refers to the countries of the Global South (so-called 'developing countries') that have ratified the Kyoto Protocol but are not listed in the Annex B, hence didn't commit themselves to emissions targets.

project-type activities nor is it restricted to certain host countries. All in all, the Paris Agreement fosters market-based approaches (Wuppertal Institute for Climate, Environment and Energy, 2015).

The Kyoto Protocol defines which kind of projects qualify as CDM. From 2006 to 2010 there has been a controversial debate within the UNFCCC negotiations whether CCS should be included in the CDM or not. In preparation for the negotiations the IPCC was instructed to write a report on CCS. This *IPCC Special Report on Carbon Dioxide Capture and Storage* (IPCC SRCCS) was published in 2005 and provided the conceptual basis for the CCS-CDM-dispute (de Coninck and Bäckstrand, 2011; Meadowcroft and Langhelle, 2009b, p. 6f). In 2010, at the climate summit in Cancún, it was decided to provisionally include CCS in the CDM. This decision was confirmed 2011 at the summit in Durban (for a detailed description of the development cf. Krüger, 2015, p. 215ff).

In the following, I discuss the submissions of the CCS-CDM-dispute as well as the IPCC SRCCS that was very influential and is cited in 39 out of the total 49 submissions (for a detailed analysis cf. Krüger, 2015). The documents are archived by the UNFCCC and accessible to the public (online: [cdm.unfccc.int/about/ccs/index.html](http://cdm.unfccc.int/about/ccs/index.html), last accessed 22 July 2016). I analyzed all documents that were submitted until the climate summit in 2010. Between 2006 and 2010, fourteen governments (including the European Union, EU) participated actively in the CCS-CDM-dispute. It is striking that in most of these countries, CCS plays an important role in the national climate and energy policy. This is the case for Australia (which handed in 3 submissions), Brazil (3), Canada (2), European Union (4), Indonesia (1), Japan (2), New Zealand (2), Norway (4), Qatar (1), Saudi-Arabia (3), and South Korea (1). Only the governments of Bangladesh, Switzerland, and Venezuela provided one submission each without being involved in developing CCS technologies.

Further submissions were handed in by the following observer organizations<sup>12</sup>:

- the five environmental NGOs: *Bellona Foundation*, *Forum for Utvikling og Miljø* (ForUM), *Greenpeace*, *SustainUS*, and the WWF;
- the four research institutes and think-tanks: *International Risk Governance Council* (IRGC), *Institute for European Environmental Policy* (IEEP), *South African Centre for Carbon Capture and Storage* (SACCS), and the *Indian Institute of Management Indore*;
- and the seven energy corporations and trade associations: *Carbon Capture and Storage Association* (CCSA), *Eskom*, *EURELECTRIC*, *International Chamber of Commerce* (ICC), *International Emissions Trading Association* (IETA), *International Petroleum Industry Environmental Conservation Association* (IPIECA), and the *World Coal Institute* (WCI; since 2010, it is called *World Coal Association*, WCA).

The composition of the protagonists in the CCS-CDM-dispute is biased if one takes into account that besides the seven energy corporations and trade associations another two research institutes (SACCS and the *Indian Institute of Management Indore*) have a commercial interest in CCS (Krüger, 2015, pp. 222f) and one environmental NGO (*Bellona Foundation*) is one of the earliest and most committed advocates of CCS.

Before going into the details of the various positions on CCS, I want to elaborate the underlying assumptions regarding climate policy that characterize the negotiations in general. One can state that the CCS-CDM-dispute is carried out within the framework of ecological modernization. Table 1 shows the positions of the negotiating parties regarding basic eco-modern assumptions. These assumptions represent the consensus that shapes the UN climate regime. They are drawn on regularly in order to increase the legitimacy of one's own position. For that purpose, important authorities like the IPCC, the United Nations Framework

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<sup>12</sup> Greenpeace, IETA, and WCI handed in two submissions, the other observer organizations one each.



Convention on Climate Change (UNFCCC), and the Kyoto Protocol are cited. Regarding the objective of climate policy, article two of the UNFCCC is cited very often (see Table 1). The definition of the ultimate objective being the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system” (UNFCCC, 1992, p. 9) postulates a global and purely ecological (instead of social-ecological) interpretation of the climate problem.

Thereby, locally and socially differing causes and effects are not taken into account. The same applies for the qualitative differences regarding the causes of emissions that may derive from sources as diverse as air traffic, small peasant farming, or the burning of fossil fuels. This narrowing of a detached ecological problem (greenhouse gas concentrations in the atmosphere) suggests a *technocratic* solution in which related ecological and social issues are excluded.

Only *SustainUS* – a rather small youth organization from the US, which is probably the actor with the least influence of the protagonists in the CCS-CDM-dispute – pleads for an amendment of the UNFCCC-objective. The organization states that climate policy will only be successful if it promotes social justice and compliance with human rights. The setting of these goals that go beyond an ecological modernization have an impact on the assessment of instruments.

As *SustainUS* claims a just transformation towards a society that is less (or not at all) dependent on fossil fuels, the organization takes a clear stand for renewable energies and against CCS technologies. Table 1 shows that this is a remarkable restriction regarding mitigation technologies as nearly all other submissions in the CCS-CDM-dispute propose a broad *portfolio of technological options* that are supposed to meet the target of stabilizing greenhouse gas concentrations in the atmosphere. The notion of a *portfolio*, that is based on *scientific and technological progress*, is formative within the UN climate regime and goes back to the reports of the IPCC (Krüger, 2015, p. 212). It is an *incremental* approach that does

not favor certain policy instruments and technologies due to their structure-changing characteristics. Instead, a variety of technological innovations are meant to be developed simultaneously and combined flexibly.

The selection of technology options (to form the portfolio) is geared towards the *primacy of microeconomics*. In many submissions, it is proposed to opt for a *portfolio of options* that achieves the defined climate targets (e. g. of one country) at lowest costs (see Table 1). From this it is deduced that the application of CCS technologies is primarily dependent on the possibility of lowering their costs. In this context, carbon price levels are repeatedly referred to which would make CCS projects profitable. Thereby, the long-term existence and relevance of carbon markets is presumed. In contrast, *SustainUS* prioritizes issues of justice as well as the prevention of ecological and health risks over cost efficiency. Furthermore, the organization proposes a decentralized energy supply that is supposed to lead to social and ecological improvements in the long run.

Accordingly, *SustainUS* states that it is far from certain that the global supply of primary energy will continue to be dominated by fossil fuels (see Table 2). *SustainUS* claims to reduce the dependency on fossil fuels. Such a transformation is supposed to be initiated by appropriate political, financial, and institutional actions. The focus is on creating a decentralized energy infrastructure based on renewable energy sources.

However, *SustainUS* is alone in this trust in formative politics that go beyond eco-modern governance. In general, comprehensive transformation processes are considered to not be feasible. Consequently, in nearly all submissions the current dominance of fossil fuels is projected into the future (see Table 2). The presumed dominance of fossil fuels is actually one of the main reasons put forward in favor of CCS. Social structures are consolidated as unchangeable constants. Mitigation options are assessed against the background of the prevailing power relations and the current production and consumption patterns. With these preconditions CCS is valued as an important instrument to reduce the emissions caused by

burning fossil fuels. Other negative consequences of the use of fossil fuels are not addressed.<sup>13</sup> Within this *technocratic* perspective, solutions are sought only for detached ecological problems – in the case of climate policy, the problem of an increased greenhouse gas concentration in the atmosphere.

As discussed above, within the eco-modern approach the objective of reducing emissions is supposed to be reached by a portfolio of technology options that is compatible with the *primacy of microeconomics*. So far the costs of CCS projects are very high and forecasts of future costs vary extremely. This is probably the reason why the issue of costs is ignored in some submissions. But when discussed, the protagonists are nearly all (except *Greenpeace*) optimistic about the potential of CCS to reduce mitigation costs – even if, initially, further financial incentives might be required (see Table 2). In these cases, reference is made regularly to IPCC's statement that “the inclusion of CCS in a mitigation portfolio is found to reduce the costs of stabilizing CO<sub>2</sub> concentrations by 30% or more” (IPCC, 2005, p. 12).

*Greenpeace* disagrees with this estimation. In the eyes of *Greenpeace*, it is obvious that CCS is not cost-effective so far, and the organization is skeptical when and to what extent this could change. This is one of the main reasons why *Greenpeace* is not assigning an important role to CCS technologies. *Greenpeace* interprets CCS-CDM projects as fossil fuels subsidies that are absurd, since more cost-effective and safer technologies are available in the form of renewable energies.

This conflict between renewable energies and fossil fuels is not considered in most submissions. Many protagonists – implicit or explicit – predict an increase of both forms of energy supply against a background of the growing energy consumption which is needed to guarantee economic growth (especially in the Global South). This is a strategy of *reflexive domination of nature*. On the one hand, an appropriation of nature that subsumes nature to the

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<sup>13</sup> The extraction of fossil fuels has, inter alia, the following implications: forced resettlement of entire communities, destruction of ecosystems, health impairments of the residents, increased risks, and ecological damages due to the extraction of non-conventional oil and gas sources.

alleged needs of society (especially, of the economy) is maintained. On the other hand, its secondary effects – greenhouse gas emissions – are addressed. The aim is to optimize the control of nature even though absolute control cannot be achieved. This assumption, that the geological storage of CO<sub>2</sub> is secure, underlies many of the submissions (see Table 2). Usually this position is legitimized by referring to probability statements from the IPCC (IPCC, 2005, p. 14). The risks associated with CCS are supposed to be managed by careful selections of suitable storage sites and accurate monitoring.

Such a risk-conscious handling is not enough for *Greenpeace*, *SustainUS*, and the Venezuelan government. For them, the danger of leakage is an incalculable risk that speaks against CCS or at least against its inclusion in the CDM. The reasoning of the Brazilian government is quite similar but focuses on regional contextual factors that – in its point of view – are crucial for an adequate handling of leakage risks. Sophisticated insurance system and government surveillance are necessary conditions for a safe application of CCS. In its opinion, only the industrialized *Annex B countries* have the required strong political, economic, and institutional structures. That's why the deployment of CCS in *Non-Annex B countries* in the near future is not secure, according to the Brazilian government. This reason is astonishing as Brazil is one of the very few countries of the Global South that is involved in developing CCS technologies.<sup>14</sup>

In the submissions that speak out for the inclusion of CCS in CDM, the only really dangerous risks mentioned are the risks of accelerated climate change. In this argument, the mitigation targets are supposed to be brought in line with the growth objectives in order to maintain a specific social development that is based on economic growth. Technologies that enable a

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<sup>14</sup> The initiative came from the state-controlled company *Petrobras*, that started two CCS pilot projects. Moreover, *Petrobras* coordinates a network of research institutes (CENPES) that are working on the development of CCS (Román, 2011, pp. 391, 396). After *Petrobras* already invested in CCS technologies it was promised support by the Brazilian government (Román, 2011, p. 391f). But so far there is neither a CCS-specific policy nor legislation nor financial support by the state (apart from the state being the largest shareholder of *Petrobras*).

low-carbon economy are considered to reconcile the trade-off. Thereby, development is equated with economic growth and economic growth with supplying primary energy. Every form of energy production that causes no or very little emissions is then considered sustainable. There is no doubt that CCS is part of the technologies that contribute to *sustainable growth* (see Table 2).

From the perspective of the Brazilian government this is only true for industrialized countries that – due to their high consumption of fossil fuels – are dependent on bridging technologies like CCS. However, in countries of the Global South, the deployment of CCS would create incentives for the increase of fossil energy production. Therefore, CCS cannot contribute to *sustainable growth* in these countries.

According to *SustainUS*, this applies to all CCS projects irrespective of location. After all, the organization defines sustainability as the switch from fossil fuels to safe and renewable energy production. *SustainUS* criticizes that CCS perpetuates the consumption of fossil fuels and, therefore, can't contribute to *sustainable growth*.

The Venezuelan government comes to the same conclusion but argues with the risks of CCS. In the light of leakage-risks one cannot act on the assumption of permanent emission reductions. But such a secured reduction is a basic requirement for classifying technologies as sustainable. Moreover, the Venezuelan government refers to the negative local consequences of leakages that are opposed to the notion of *sustainable growth*.

*Greenpeace* also argues with the local effects of CCS projects. It suspects an increase of energy and commodity prices as well as an increase in environmental damages. Furthermore, it assumes that CCS-CDM projects only create limited employment in the host countries. *Greenpeace*, thus, disagrees with the assessment that CCS could contribute to *sustainable growth* – unlike renewable energies.

At the end of this analysis of the submissions in the CCS-CDM-dispute, I want to return to the question of general positions on the concept of ecological modernization. Table 3 shows that nearly all protagonists relate positively to eco-modern governance.<sup>15</sup> It is just the position of *SustainUS* that is not in line with eco-modern assumptions. It is the only organization that applies criteria on mitigation technologies that go beyond the scope of ecological modernization. In summary, one can state that the endorsement of eco-modern governance is almost unanimous.

But when it comes to the assessment of the relevance of CCS within the eco-modern portfolio, the positions are more diverse (regarding the argument that the most apparent critics of CCS are not based on ideology or values and therefore don't imply a questioning of the eco-modern paradigm cf. Hansson 2008, p. 292). Table 4 contains only protagonists that take a positive stand towards ecological modernization – thus, *SustainUS* is not listed. For most of them, CCS is an important option within the eco-modern portfolio that needs to be further fostered. The eco-modern approach suggests that all options should be developed as long as they contribute to stabilizing greenhouse gas concentrations in the atmosphere. In addition to this general support of mitigation technologies, CCS has a unique status of being compatible with the current centralized fossil energy infrastructure. In order to strengthen this argument of the unique status of CCS and its potential to reduce large amounts of greenhouse gas emissions, reference is made regularly to the IPCC report (IPCC, 2005, p. 12). In some of these submissions that argue in favor of CCS projects, critical issues (e. g. regarding risks or costs) are addressed, but only *Greenpeace* is seriously skeptical whether CCS meets eco-modern standards.<sup>16</sup>

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<sup>15</sup> Several protagonists are not listed in Table 3 as their submissions are so short or object-related that a classification on such an abstract level is not possible. WWF is in brackets because its submission contains only few general statements regarding climate policy in general. Still, a classification seems possible to me.

<sup>16</sup> Besides *Greenpeace* and *SustainUS* there are other actors that take a stance against the inclusion of CCS in the CDM. But neither the *Forum for Utvikling og Miljø* nor the Venezuelan government nor the

For *Greenpeace* – like for *SustainUS* – there is no doubt that safe and available renewable energies have absolute priority. In contrast to *SustainUS*, however, *Greenpeace* argues within the eco-modern framework (see Table 3 and 4). According to *Greenpeace*, further research is necessary to assess whether CCS technologies fulfill the eco-modern requirements regarding risk avoidance and risk awareness, or whether they in fact have to be classified as high-risk technologies whose (non-reflexive) *domination of nature* will fail. In addition, *Greenpeace* worries that the high levels of subsidies required in order to develop and deploy CCS could entail cutbacks in the promotion of renewable energies. As CCS is not cost-effective at all (compared to other mitigation options) at the present stage, *Greenpeace* states that CCS is not compatible with the eco-modern *primacy of microeconomics*. Overall, *Greenpeace* is skeptical about the relevance of CCS within the eco-modern portfolio.

The Brazilian government is also quite skeptical, especially regarding leakage-risks. Nevertheless, it sees a relevance of deploying CCS as a bridging technology in industrialized countries. Industrialized countries should be the first to use CCS as they have the necessary sophisticated insurance system and government surveillance that is needed to manage the risks. The Brazilian government is not excluding CCS projects in countries of the Global South in the long term. But for the time being, it restricts the relevance of CCS to application in industrialized countries.

## 6. The Status Quo of CCS' Political Significance

In the following I complement the analysis of the CCS-CDM-dispute with a broader view on the relevance of CCS within the climate governance in order to be able to grasp possible re- and depoliticizing effects of CCS-conflicts (discussed in section 7). It is not easy to evaluate the actual political significance of CCS as we face an ambivalent situation that is

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WWF discuss the general relevance of CCS on such an abstract level (whether it is a relevant option within the eco-modern portfolio or not). Therefore, they are not listed in Table 4. The position of the Brazilian government is covered later.

characterized by the cancellation of several CCS projects on the one hand and the strength of a CCS community that is lobbying successfully for CCS on the other hand.

In recent years, a couple of CCS projects in different industrialized countries were canceled (Andresen and Butenschøn, 2001, p. 350f; Markusson et al., 2012, pp. 223, 238, 243; Scrase and Watson, 2009, p. 178; Stephens and Liu, 2012, p. 146; Shackley and Evar, 2012, pp. 161ff). These projects were mainly canceled due to high investment costs and local protests. CCS projects can only be profitable with high taxes on CO<sub>2</sub>, high carbon prices or other strong incentives to avoid emissions. At present, these kind of incentives remain on a rather low level. Therefore, several CCS projects got postponed, implemented on a reduced scale or phased out. The other main parameter that has lead to the cancellation of CCS projects is the resistance of residents, environmental groups, and climate activists. To avoid similar setbacks in the future, some stakeholders intend to switch to offshore projects even though these involve higher costs (Román, 2011, pp. 396, 399; Shackley and Evar, 2012, p. 161ff).

In spite of the mentioned obstacles, there is a powerful CCS community with stakeholders in politics, economics, and research. In the course of increasing private and public investments in CCS, a growing international network of people emerged whose professional career is connected with the development of CCS (Stephens et al., 2011). This network, which forms the core group of the pro-CCS discourse coalition, includes representatives of energy corporations, trade associations, governments, universities, and research institutes, as well as a limited number of NGOs like the *Bellona Foundation* (Stephens and Liu, 2012, p. 146).

“It could be argued that compared to other energy technologies with climate mitigation potential CCS has among the highest levels of powerful, entrenched actors involved in a focused way in its advancement. The CCS innovation system therefore has an advantage in terms of resource mobilization, as compared to other low-carbon energy technologies.”

(Stephens and Liu, 2012, p. 148)



This community shares a positive perspective on CCS that is characterized by optimistic prognoses (regarding technological evolution) and a downplay of factors that speak against the deployment of CCS technologies (Shackley et al., 2007). Within the CCS community, the debate does not revolve around the question of whether CCS technologies should be developed and deployed at all, but around the question of how this could be best realized. Accordingly, risks are seldom interpreted as risks that emanate from CCS technologies. Instead, risks are generally interpreted as risks that could hinder the development and/or deployment of CCS (Stephens et al., 2011, pp. 386, 389). This community is quite successful in its campaign for CCS. It effectively pushed for support programs at national, EU, and international level. On top of that, the community achieved the integration of CCS into the Clean Development Mechanism (see section 5) – why this might be of great relevance for the CCS-conflicts as well as for the broader struggle on the future international climate governance is discussed in section 7.

To sum it up, CCS is quite significant when it comes to scenarios involving transition to a low-carbon economy without changing our lifestyles and our development model. Symptomatic of that trend is the already mentioned importance of CCS in recent IPCC reports. But when it comes to actually planned and realized CCS projects, one cannot discern a clear tendency. Investments in CCS remain stable but a CCS boom is still a long way off. The *Global CCS Institute* blames this on a lack of financial incentives and planning reliability. That is why the lobby organization demands binding reduction targets and/or stable carbon prices (Global CCS Institute, 2014).

## **7. CCS-Conflicts and the Struggles about Future Climate Governance**

The role and relevance of CCS technologies is still contested and primarily negotiated in relation to concrete CCS projects. This much is clear: CCS technologies will only be supported by a broad discourse coalition if they are regarded by various actors as

comparatively cheap, safe, and compatible with the deployment of renewable energy. These criteria will not be met in the near future. Insofar as this is the case, statements on ways in which CCS-conflicts will impact international climate politics can only be very vague. In principle, three different typecast scenarios are conceivable:

- 1) CCS-conflicts could lose their severity if there are experiences with CCS projects that many actors evaluate as positive. Thereby, CCS technologies would be regarded as an important element of international climate governance.
- 2) If the number of canceled CCS projects remains at a high level, CCS technologies could lose much of their relevance. In this case, other mitigation options would become more attractive.
- 3) Escalating CCS-conflicts could lead to a polarization in international climate governance.

It is quite conceivable that the criticism of CCS technologies would abate (but of course never cease completely) if there were a number of demonstration projects that various actors consider to be cost-effective and safe. A possible compromise that is already visible on the horizon would be to focus on the deployment of CCS in so-called emerging countries (like China and India) that – to a large extent – cover their increasing demand for energy by new fossil power plants (Román, 2011, p. 393). This position is put forward by several experts from different backgrounds. In this context, the inclusion of CCS in the CDM is quite relevant as the CDM is a financing option for CCS projects in *Non-Annex B countries*. In the first scenario, CCS-conflicts would have depoliticizing effects on climate governance, as critics of CCS and the eco-modern paradigm would be marginalized. Disputes regarding (un-)desired changes to the fossil energy infrastructure could be resolved. The conviction that structural upheavals are unnecessary in order to solve the ecological crisis would become an almost unanimous agreement. The incremental and technocratic approach of eco-modern governance would be stabilized.

However, if the number of canceled CCS projects remains at a high level, the pro-CCS discourse coalition would diminish and lose much of its capacity to obtain the necessary financial resources and political support for further development and deployment of CCS technologies. Thus, scenario two would have (at least short-term) politicizing effects as it challenges the dominant eco-modern paradigm that is dependent on techno-fixes. The omission of CCS would lead to a dynamic process of searching for alternatives. Whether this opens up the scope for transformation processes would depend mainly on power relations (e.g. if there will be a strong and coherent discourse coalition – of NGOs, research institutes, climate activists, ecological oriented parties, as well as countries and/or groups that are rather strongly affected by climate change – that claims structural changes). Another influencing factor could be a momentum caused by natural disasters or other exceptional circumstances of any kind (Unruh, 2002, p. 323).<sup>17</sup>

In the third scenario, the escalation of CCS-conflicts would lead to a polarization in international climate politics. The eco-modern discourse coalition would probably split or lose some of its former supporters (like *Greenpeace*). The communication gap between the CCS community and the critical public (Stephens et al., 2011, p. 389) indicates that an escalation of CCS-conflicts is possible. Whether this communication gap actually leads to an escalation depends on the importance that is ascribed to the question of whether or not the fossil energy system is compatible with climate protection. The fundamental debate discussed above – whether a comprehensive transformation of social structures is (un-)necessary and (un-)desired in order to solve the ecological crisis – has been widely avoided. But ongoing conflicts on CCS are likely to put this general dispute on the agenda. Thus, in the third scenario, we would face a politicized situation in the sense that decisions are considered as

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<sup>17</sup> The example of Fukushima makes it clear that shocking events may or may not have a great influence on political decision-making – depending on the political circumstances. After the nuclear disaster, nuclear power plants worldwide were subjected to a security check. Even though significant safety deficiencies have often been identified, only in Germany and Japan were running nuclear power plants shutdown immediately.

contested choices between alternatives. The polarization that accompanies this dispute could lead to the radicalization of various actors – e.g. environmental NGOs – that so far operate rather moderately (within the dominant eco-modern framework) in order to reach compromises.

Under these conditions, CCS projects would presumably be realized mainly in places where the local opposition is assessed as low – for instance offshore and/or in countries with a comparatively marginalized ecological movement. If the opposition to CCS in *Annex B countries* will be too much of an investment risk, the CDM – as mentioned above – would be an important instrument in financing CCS projects in *Non-Annex B countries*.

An eco-modern climate policy that would hold on to CCS projects, despite their polarizing effects, would be a technocratic project of the elite based almost solely on output legitimacy. It would compensate dwindling support – to some extent – with coercion and repression. Escalated conflicts on CCS could lead to similar dynamics like those that followed the disappointment of the climate summit in Copenhagen. At that time, many NGOs and environmental groups reacted with an increased orientation towards more radical positions, protest-oriented work, and closer cooperation with grassroots activists. Such a broad discourse coalition against prevailing climate governance might promote antagonistic claims like *climate justice* or *Buen Vivir*.

## 8. Conclusion and Policy Implications

Regarding the primary research question of this study – to what extent are social practices and structures being challenged in and because of CCS-conflicts – we face an ambiguous situation. The variance of the typecast scenarios outlined above indicate that it is still unclear which re- and/or depoliticizing impacts the CCS-struggles will have on the broader struggles related to future climate governance. Any of the following is conceivable:

- 1) Stabilization of prevailing climate governance via a successful large-scale deployment of CCS;
- 2) Shifting of climate mitigation strategies triggered by the failure of CCS; or
- 3) Escalating CCS-conflicts that lead to a polarization in international climate politics.

If one relates these scenarios to the current dynamics in international climate governance – as discussed above in the introduction – one has to get one thing straight: The future of climate governance is contingent on decisions about the continued use of fossil fuels. The enduring dependence on fossil fuels is the Achilles' heel of eco-modern governance. The eco-modern consensus in international climate policy was only possible because the fossil energy infrastructure was not under debate.

Subsequently, many NGOs, environmental groups, and ecological think-tanks focused on the demand for efficiency enhancement and the promotion of technological innovations. These mitigation strategies do not directly limit the use of fossil fuels (the input side of the fossil industry) but regulate the resulting emissions (the output side) (Brunnengräber et al., 2008, p. 188ff). A broad agreement upon mitigation strategies focusing on the output side (such as emissions trading) was only possible because the assessment of the input side was set aside. There never was a consensus on the question of whether the regulation of the output side is directed on the transformation of the energy infrastructure or whether, in reverse, the input side of the fossil industry should be maintained. Actors like *Greenpeace* approved market-oriented mitigation strategies such as emissions trading but they were never in favor of maintaining the fossil fuel industry. Other actors in turn only agreed to market-oriented mitigation strategies because they saw it as an opportunity to maintain the fossil fuel industry. In other words, they opted for the lesser evil in order to avoid direct regulations involving fossil fuel extraction (Krüger, 2015, p. 78ff). In disputes on the rating of CCS, these latent conflicts erupt. After all, mitigating climate change with CCS takes the neglect of the input side and the solely focus on the output side to extremes. That is why CCS-conflicts have an

explosive force that could lead to massive cracks within the eco-modern discourse coalition and thus could politicize international climate policy. A politicized situation is characterized by decisions that are not made for alleged reasons of constraints but are considered as contested choices between alternatives.

Decisions in favor of – or in compliance with – the continued use of fossil fuels are built on expectations of future innovations that would be needed to facilitate the safe and economically feasible widespread deployment of CCS or other techno-fixes (e.g. solar radiation management). However, avoiding structural transformations and prioritizing technological innovations imply lock-in effects: Continuity in energy infrastructure as well as in production and consumption patterns deteriorate the baseline conditions for future transformational processes. Pinning hopes on techno-fixes like CCS comes with a very low fault tolerance. A possible outage of mitigation technologies – e.g. in terms of falling short of expectations or producing harmful side-effects – is not taken into account. Climate governance that depends on techno-fixes is quite vulnerable. Any kind of failure would have severe ecological and social effects.

Decisions against the continued use of fossil fuels could be legitimized by a strict orientation towards the precautionary principle: avoidance of risk due to incomplete knowledge. Such an approach breaks with the prevailing notion of progress that focuses on technological innovation and (material) prosperity. Instead, a different ideal of progress – increasing one's options – is set in place. Progress would then mean a reduction in dependencies and constraints. In other words: Progress in this spirit begins when the compulsion to progress ends (Adorno, 2003, pp. 625, 638). And what else does CCS mean – what does “the challenge of continual striving and vigilance” (Spreng et al., 2007, p. 854) mean – but a compulsion to progress?

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## **References**

- Adorno, T.W., 2003. Fortschritt. In: Tiedemann, R., Adorno, G., Buck-Morss, S., Schultz, K. (Eds.), Theodor W. Adorno. Gesammelte Schriften. Suhrkamp, Frankfurt am Main, pp. 617–638.
- Andresen, S., Butenschøn, S.H., 2001. Norwegian Climate Policy: From Pusher to Laggard? *Int. Environ. Agreem. Polit. Law Econ.* 1, 337–356.
- Bäckstrand, K., Meadowcroft, J., Oppenheimer, M., 2011. The politics and policy of carbon capture and storage: Framing an emergent technology. *Glob. Environ. Change* 21, 275–281.
- Brand, U., 2010. Sustainable development and ecological modernization: The limits to a hegemonic policy knowledge. *Innov. Eur. J. Soc. Sci. Res.* 23, 135–152.
- Brunnengräber, A., Dietz, K., Hirschl, B., Walk, H., Weber, M., 2008. Das Klima neu denken: eine sozial-ökologische Perspektive auf die lokale, nationale und internationale Klimapolitik. Westfälisches Dampfboot, Münster.
- de Coninck, H., 2008. Trojan horse or horn of plenty? Reflections on allowing CCS in the CDM. *Energy Policy* 36, 929–936.
- de Coninck, H., Bäckstrand, K., 2011. An International Relations perspective on the global politics of carbon dioxide capture and storage. *Glob. Environ. Change* 21, 275–281.
- Evar, B., Armeni, C., Scott, V., 2012. An introduction to key developments and concepts in CCS: history, technology, economics and law. In: Markusson, N., Shackley, S., Evar, B. (Eds.), *The Social Dynamics of Carbon Capture and Storage. Understanding CCS Representations, Governance and Innovation*. Earthscan, London/ New York, pp. 18–30.
- Global CCS Institute, 2014. *The Global Status of CCS: 2014*. Global Carbon Capture and Storage Institute, Melbourne.
- Görg, C., 2003. Regulation der Naturverhältnisse. Zu einer kritischen Theorie der ökologischen Krise. Westfälisches Dampfboot, Münster.
- Hajer, M.A., 1995. *The Politics of Environmental Discourse. Ecological Modernization and the Policy Process*. Clarendon Press/ Oxford University Press, New York.
- Hajer, M.A., 1997. Ökologische Modernisierung als Sprachspiel. Eine institutionell-konstruktivistische Perspektive zum Umweltdiskurs und zum institutionellen Wandel. *Soz. Welt* 48, 107–132.
- Hansson, A., 2008. Kolets återkomst: Koldioxidavskiljning och lagring i vetenskap och politik. The return of Coal: Carbon dioxide capture and storage in science and politics. Linköping University Electronic Press, Linköping.
- Hansson, A., 2012. Colonizing the future: The case of CCS. In: Markusson, N., Shackley, S., Evar, B. (Eds.), *The Social Dynamics of Carbon Capture and Storage. Understanding CCS Representations, Governance and Innovation*. Earthscan, London/ New York, pp. 74–90.

- Hansson, A., Bryngelsson, M., 2009. Expert opinions on carbon dioxide capture and storage – A framing of uncertainties and possibilities. *Energy Policy* 37, 2273–2282.
- Huber, J., 1993. Ökologische Modernisierung: Zwischen bürokratischem und zivilgesellschaftlichem Handeln. In: Prittwitz, V. von (Ed.), *Umweltpolitik als Modernisierungsprozeß. Politikwissenschaftliche Umweltforschung und -lehre in der Bundesrepublik*. Leske + Budrich, Opladen, pp. 51-69.
- Huber, J., 2011. Ökologische Modernisierung und Umweltinnovation. In: Groß, M. (Ed.): *Handbuch Umweltsoziologie*. VS Verlag für Sozialwissenschaften, Wiesbaden, pp. 279-302.
- IPCC, 2005. *Special Report on Carbon Dioxide Capture and Storage*. Cambridge University Press, Cambridge/ New York.
- IPCC, 2014. Summary for Policymakers. In: *Climate Change 2014. Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge/ New York, pp. 1-30.
- Klein, N., 2014. *This changes everything. Capitalism vs. the climate*. Simon & Schuster, New York.
- Krüger, T., 2015. *Das Hegemonieprojekt der ökologischen Modernisierung. Die Konflikte um Carbon Capture and Storage (CCS) in der internationalen Klimapolitik*. transcript, Bielefeld.
- Markusson, N., Ishii, A., Stephens, J.C., 2012. Learning in CCS demonstration projects: social and political dimensions. In: Markusson, N., Shackley, S., Evar, B. (Eds.), *The Social Dynamics of Carbon Capture and Storage. Understanding CCS Representations, Governance and Innovation*. Earthscan, London/ New York, pp. 222–244.
- Markusson, N., Shackley, S., 2012. Introduction to Part I: Perceptions and representations. In: Markusson, N., Shackley, S., Evar, B. (Eds.), *The Social Dynamics of Carbon Capture and Storage. Understanding CCS Representations, Governance and Innovation*. Earthscan, London/ New York, pp. 33–44.
- Meadowcroft, J., Langhelle, O., 2009a. The politics and policy of CCS: the uncertain road ahead. In: Meadowcroft, J., Langhelle, O. (Eds.), *Caching the Carbon. The Politics and Policy of Carbon Capture and Storage*. Edward Elgar, Cheltenham/ Northampton, pp. 267–296.
- Meadowcroft, J., Langhelle, O., 2009b. The politics and policy of carbon capture and storage. In: Meadowcroft, J., Langhelle, O. (Eds.), *Caching the Carbon. The Politics and Policy of Carbon Capture and Storage*. Edward Elgar, Cheltenham/ Northampton, pp. 1–21.
- Methmann, C., Rothe, D., Stephan, B. (Eds.), 2013. *Interpretive approaches to global climate governance. (De)constructing the greenhouse*. Routledge, New York.
- Mol, A., Sonnenfeld, D., Spaargaren, G. (Eds.), 2009. *The Ecological Modernisation Reader. Environmental Reform in Theory and Practice*. Routledge, New York.
- Petersen, A., 2014. *The Emergence of the Geoengineering Debate Within the IPCC (Case Study). Geoengineering Our Climate? A Working Paper Series on the Ethics, Politics and Governance of Climate Engineering*.
- Román, M., 2011. Carbon capture and storage in developing countries: A comparison of Brazil, South Africa and India. *Glob. Environ. Change* 21, 391–401.
- Scrase, I., Watson, J., 2009. CCS in the UK: squaring coal use with climate change? In: Meadowcroft, J., Langhelle, O. (Eds.), *Caching the Carbon. The Politics and Policy of Carbon Capture and Storage*. Edward Elgar, Cheltenham/ Northampton, pp. 158–210.



- Shackley, S., Evar, B., 2012. Up and down with CCS: the issue-attention cycle and the political dynamics of decarbonisation. In: Markusson, N., Shackley, S., Evar, B. (Eds.), *The Social Dynamics of Carbon Capture and Storage. Understanding CCS Representations, Governance and Innovation*. Earthscan, London/ New York, pp. 149–171.
- Shackley, S., Waterman, H., Godfroij, P., Reiner, D., Anderson, J., Draxlbauer, K., Flach, T., 2007. Stakeholder perceptions of CO<sub>2</sub> capture and storage in Europe: Results from a survey. *Energy Policy* 35, 5091–5108.
- Spreng, D., Marland, G., Weinberg, A.M., 2007. CO<sub>2</sub> capture and storage: Another Faustian Bargain? *Energy Policy* 35, 850–854.
- Stephens, J.C., Hansson, A., Liu, Y., de Coninck, H., Vajjhala, S., 2011. Characterizing the international carbon capture and storage community. *Glob. Environ. Change* 21, 379–390.
- Stephens, J.C., Liu, Y., 2012. The evolving international CCS community. In: Markusson, N., Shackley, S., Evar, B. (Eds.), *The Social Dynamics of Carbon Capture and Storage. Understanding CCS Representations, Governance and Innovation*. Earthscan, London/ New York, pp. 127–148.
- UNFCCC, 1992. United Nations Framework Convention on Climate Change. Online: [unfccc.int/files/essential\\_background/background\\_publications\\_htmlpdf/application/pdf/conveng.pdf](http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf) (last accessed 22.07.2016).
- UNFCCC, 2015. Adoption of the Paris Agreement. Online: [www.unfccc.int/files/meetings/paris\\_nov\\_2015/application/pdf/cop\\_aup\\_template\\_4b\\_new\\_\\_1.pdf](http://www.unfccc.int/files/meetings/paris_nov_2015/application/pdf/cop_aup_template_4b_new__1.pdf) (last accessed 22.07.2016).
- Unruh, G.C., 2002. Escaping carbon lock-in. *Energy Policy* 30, 317–325.
- Viebahn, P., Nitsch, J., Fishedick, M., Esken, A., Schüwer, D., Supersberger, N., Zuberbühler, U., Edenhofer, O. 2007. Comparison of carbon capture and storage with renewable energy technologies regarding structural, economic, and ecological aspects in Germany. *Int. J. of Greenh. Gas Control* 1, 121–133.
- White, J.A., Chiaramonte, L., Ezzedine, S., Foxall, W., Hao, Y., Ramirez, A., McNab, W., 2014. Geomechanical behavior of the reservoir and caprock system at the In Salah CO<sub>2</sub> storage project. Online: [www.pnas.org/content/111/24/8747.full.pdf](http://www.pnas.org/content/111/24/8747.full.pdf) (last accessed 22.07.2016).
- Wuppertal Institute for Climate, Environment and Energy, 2015. The Paris Agreement: Kick-Off for True Global Climate Cooperation. Online: [www.wupperinst.org/uploads/tx\\_wupperinst/Paris\\_short\\_assessment.pdf](http://www.wupperinst.org/uploads/tx_wupperinst/Paris_short_assessment.pdf) (last accessed 22.07.2016).

Table 1 Positions on eco-modern assumptions<sup>1</sup>

Eco-modern assumptions	Agreement	Restriction	Skepticism
The objective of climate policy is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.	Australia Brazil Canada EU Indonesia Japan New Zealand Norway <i>Bellona</i> <i>CCSA</i> <i>EURELECTRIC</i> <i>Greenpeace</i> <i>ICC</i> <i>IEEP</i> <i>IETA</i> <i>SustainUS</i> <i>WCI</i> IPCC		
The objective of climate policy will be achieved by a portfolio of technological options.	Australia Brazil Canada EU Indonesia Japan New Zealand Norway <i>Bellona</i> <i>CCSA</i> <i>EURELECTRIC</i> <i>ICC</i> <i>IEEP</i> <i>IETA</i> <i>WCI</i> IPCC	<i>SustainUS</i>	
The main criterion for the assessment of technologies is their potential to reduce mitigation costs.	Australia Canada EU <i>Eskom</i> <i>EURELECTRIC</i> <i>Greenpeace</i> <i>ICC</i> <i>IETA</i> <i>WCI</i> IPCC		<i>SustainUS</i>

<sup>1</sup> The following applies to all tables: Countries and the IPCC are in upright letters, the observer organizations in *italics*. Submissions that don't take a stand on the respective issue are not listed. Every actor is only listed once – even if it puts forward an argument several times (in different submissions).

Table 2 Positions on CCS

Positions on CCS	Agreement	Restriction	Skepticism
CCS is important as the global supply of primary energy will continue to be dominated by fossil fuels.	Australia Canada EU New Zealand Norway <i>Bellona</i> <i>CCSA</i> <i>CSLF</i> <i>EURELECTRIC</i> <i>ICC</i> <i>IEEP</i> <i>IETA</i> <i>Indian Institute</i> <i>IRGC</i> <i>WCI</i> IPCC		<i>SustainUS</i>
CCS has the potential to reduce mitigation costs.	Australia Canada EU <i>Eskom</i> <i>EURELECTRIC</i> <i>ICC</i> <i>IETA</i> <i>WCI</i> IPCC		<i>Greenpeace</i>
The geological storage of CO <sub>2</sub> is secure.	Australia Canada EU Norway Qatar <i>Bellona</i> <i>CSLF</i> <i>EURELECTRIC</i> <i>IETA</i> <i>WCI</i> IPCC	Brazil	Venezuela <i>Greenpeace</i> <i>SustainUS</i>
CCS contributes to sustainable growth.	Australia Canada Norway <i>Bellona</i> <i>ICC</i> <i>IETA</i> <i>Indian Institute</i> <i>WCI</i>	Brazil	Venezuela <i>Greenpeace</i> <i>SustainUS</i>

Table 3 Positions on ecological modernization

Position on ecological modernization	Agreement	Restriction	Skepticism
Ecological modernization is the adequate reaction to the ecological crisis.	Australia Brazil Canada EU Indonesia Japan New Zealand Norway <i>Bellona</i> <i>CCSA</i> <i>EURELECTRIC</i> <i>Greenpeace</i> <i>ICC</i> <i>IEEP</i> <i>IETA</i> <i>WCI</i> <i>(WWF)</i> IPCC		<i>SustainUS</i>

Table 4 Positions on the relevance of CCS within the eco-modern portfolio of options

Relevance of CCS within the eco-modern portfolio of options	Agreement	Restriction	Skepticism
CCS is a relevant option within the eco-modern portfolio.	Australia Canada EU Indonesia Japan New Zealand Norway <i>Bellona</i> <i>CCSA</i> <i>EURELECTRIC</i> <i>ICC</i> <i>IEEP</i> <i>IETA</i> <i>WCI</i> IPCC	<i>Brazil</i>	<i>Greenpeace</i>