Alternatives to the current UNFCCC process

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supervised by
Dr. Fabian Wagner

Kristian Jachnowitsch

1127780

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Affidavit

I, **KRISTIAN JACHNOWITSCH**, hereby declare

1. that I am the sole author of the present Master's Thesis, "ALTERNATIVES TO THE CURRENT UNFCCC PROCESS", 68 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
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Abstract

The present paper investigates the alternatives for the political setting chosen for the climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC). In doing so, it first defines criteria for the categorization and evaluation of a climate regime design. As a second step, these criteria are applied to nine different groups of alternative approaches. The result of this analysis is presented in form of a categorization table where the groups of approaches are evaluated on a scale from 1 to 5 with respect to particular evaluative criteria. Finally, possible directions for combinations of approaches are outlined based on the preceding analysis.

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List of Abbreviations/Acronyms

AOSIS	Alliance of Small Island States
BAU	Business as usual
CDM	Clean Development Mechanism
CFCs	Chlorofluorocarbons
CO_2	Carbon dioxide
EU27	27 member states of the European Union before 1st July 2013
GDP	Gross domestic product
GHG	Greenhouse Gases
G77	Group of 77
IMF	International Monetary Fund
OPEC	Organization of the Petroleum Exporting Countries
PAMs	Policies and measures
R&D	Research and Development
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America
WTO	World Trade Organization

1. Introduction

1.1. Problem and Relevance

The United Nations Framework Convention on Climate Change (UNFCCC) entered into force on 21st March 1994 with the main function to provide a forum where all countries come together to design a global climate policy. The first step in regulating emissions was the adoption of the Kyoto Protocol which entered into force in 2005. The Kyoto Protocol imposed emission limitation targets for developed countries while the developing countries were exempted from obligations. The first commitment period of the Kyoto Protocol ended at the end of 2012 and – as a consequence of failed negotiations on a second commitment period at the Copenhagen Conference in 2009 – the UNFCCC process was left without a succession regulation. The climate conferences of Cancun, Durban and Doha that followed Copenhagen were driven by the attempts to revive the process by defining a new schedule for the elaboration of a second commitment period. It was agreed to extend the Kyoto targets until 2020 and the goal was set to adopt a universal climate agreement by 2015, which will come into effect in 2020.

It is uncertain whether the new roadmap for the negotiations will succeed and whether countries can agree on a new universal treaty by 2015. Even in this case, the new treaty would become effective only in 2020, 26 years after the UNFCCC was founded. Until then – as a consequence of the failure to include important emitting countries such as the US, China, Russia, Brazil, India or Japan – the extended commitment period of the Kyoto protocol covers less than 15% of the global CO_2 emissions (Parnell, 2012).

The UNFCCC process was therefore neither effective in addressing mitigation nor efficient in negotiating concrete commitments. The starting position for the present paper is that this failure is rooted in the design of the chosen policy approach whose characteristics do not meet the specific requirements of the global warming problem. Consequently, if the envisioned revival of the climate process is to succeed, a change of the political approach for the design of a climate regime will be necessary. The present paper sets out to analyze in which directions this change can go. It therefore groups, categorizes and evaluates the alternatives to the current UNFCCC process which are listed in Daniel Bodansky's article "International climate efforts

beyond 2012: a survey of approaches" (Bodansky, 2004). Thereby this work aims at providing a general framework for the analysis of alternative climate policies. Using this framework it might be then possible to investigate particular policy options in more detail.

1.2. Methodology and Structure

This paper is based on the survey of over 40 alternative approaches assembled by Daniel Bodansky in 2004. The main idea is to abstract from the individual differences of the particular approaches listed in Bodankys article and to focus on their key defining characteristics. By dividing these approaches into nine different groups, this paper enables the discussion of general characteristics of possible directions a climate regime can pursue. It is an important aspect of the presented analysis that the subsequent categorization and evaluation is applied to the thereby abstracted groups and not to particular approaches. In this way, the chosen methodology allows the discussion of general mechanisms for the design of a climate regime and their relationship to each other, without having to focus on the particular details of each single approach.

The starting point of this work is the analysis of the status quo situation. *Chapter 2.1* investigates the international dimension of global warming. In doing so, it especially highlights the problems of negative externalities (chapter 2.1.1), time inconsistency (chapter 2.1.2) and free-riding (chapter 2.1.3). Having discussed the specific challenges of international climate policy, the second chapter proceeds with the description of the shortcomings of the UNFCCC process – namely its too inflexible instruments (chapter 2.2.1), its universal nature (chapter 2.2.2) and its lack of incentives for participation (chapter 2.2.3).

Chapter 3 addresses the alternative approaches to the UNFCCC. *Chapter 3.1* defines the descriptive and evaluative criteria which are needed for the categorization and eventual evaluation of different kinds of approaches. This analysis is implemented in *Chapter 3.2*. Here the nine different groups of approaches are described and evaluated by the respective criteria. The result of this evaluation is presented in form of a categorization table in *chapter 3.3*.

Finally, *chapter 4* discusses the possibilities for several combinations of the analyzed approaches. The demand for combining the different options is derived

through the interpretation of the categorization table in *chapter 4.1*. Subsequently, *chapter 4.2* analyzes which combinations are possible among the approaches and suggests two potential directions for combining the approaches. Finally, *chapter 4.3* provides an overview about further alternatives beyond the basic consensus of the nine discussed approaches.

2. Global Warming Gridlock

2.1. Global Warming as an international issue

Global warming is not merely an environmental issue but a complex international problem which is closely interconnected with economics and raises questions in the fields of international relations, welfare, development and distributive ethics in general (Victor, 2011: 31).

Burning fossil fuels and thereby setting free CO_2 is inherent to all economies worldwide. As it is shown by the 2012 BP Statistical Review of World Energy, approximately 88% of the world's energy is generated by burning oil, coal and gas (BP, 2012: 42).

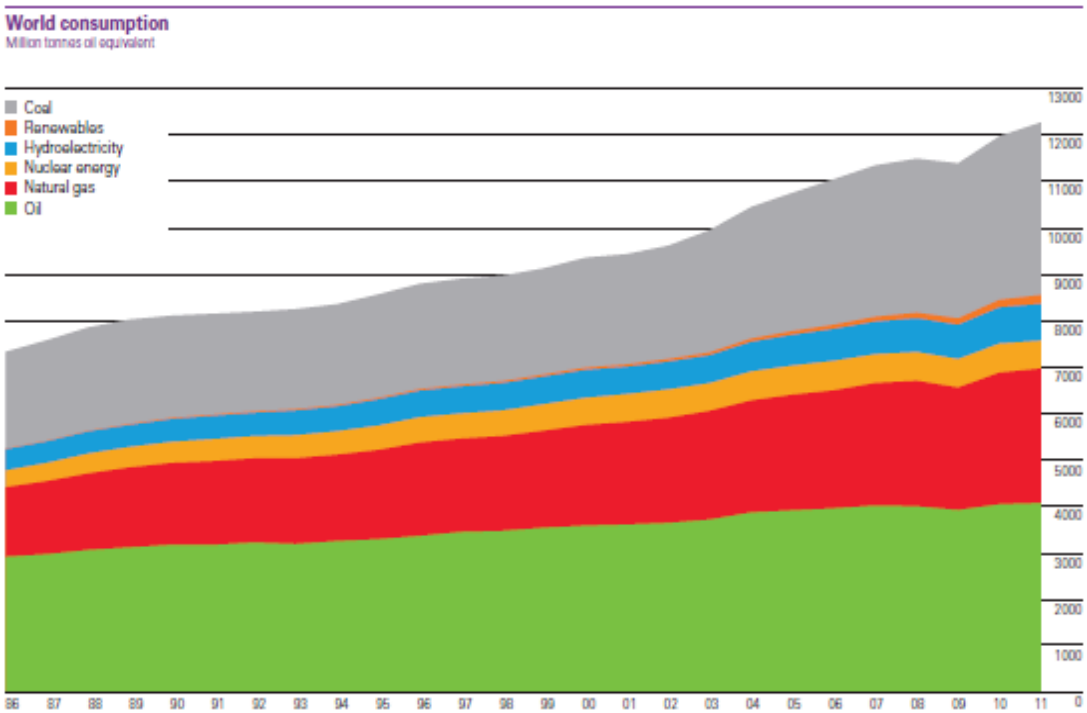

Figure 1 World Energy consumption (BP, 2012)

This high dependency of the world's economies on fossil fuels is depicted in Figure 1. It becomes clear that – despite their growth in importance during the recent years – technologies for renewable energy are far from being able to replace the traditional energy sources. It is also not foreseeable when they will be able to do so. Having said that – and given the fact that the worldwide energy demand is expected to grow further rapidly (Exxon Mobil, 2013) – it becomes clear that a significant change of the CO_2 emission pattern would require nothing less than a transformation of the very foundations of the worldwide energy infrastructure.

It is the long atmospheric lifetime of CO_2, ranging between 100-200 years (Archer et al., 2008) (Victor, 2011: 39), which makes the emission of CO_2 a global problem. In a hypothetic scenario, a short lifetime of CO_2 would limit the effects of the emitted gas to the country and region of origin and guarantee the adherence of the *polluter pays principle*, i.e. that the emitting countries only would have to face the consequences of their own emissions. In contrast, with the real atmospheric lifetime of CO_2, it does not matter where the gas is emitted; it spreads around the world in the atmosphere and affects the climate globally.

This constellation can be described by the three characteristics of *negative externalities*, the *time inconsistency problem* and the *free-riding problem*, which will be discussed in more detail in the following.

Negative Externalities emerge when the activity level of actor A affects the well-being of actor B without a compensation being paid (OECD, 2003). Negative externalities are therefore an institutional problem – the institutional setting of a society or market allows that the social costs of an activity are not included in the production function of actor A, resulting in a higher activity level than it would be desirable.

The situation of negative externalities in the case of global warming is demonstrated in table 1 which displays the current CO_2 emission levels of the countries (EDGAR, 2013a) (EDGAR, 2013b).

Country	Emission total in ktons CO2	Emission per capita	% of world emissions
China	9700000.00	7.2	29 %
US	5420000.00	17.3	16 %
EU27	379 0000.00	8.57	11 %
India	197 0000.00	1.6	5.9 %
Russia	183 0000.00	12.8	5.4 %
Japan	124 0000.00	9.8	3.7 %
South Korea	61 0000.00	12.6	1.8 %
Canada	56 0000.00	16.2	1.6 %
Indonesia	49 0000.00	2.0	1.4 %
Saudi-Arabia	46 0000.00	16.5	1.3 %
Brazil	45 0000.00	2.6	1.3 %
Haiti	2601.3	0.26	
Mauritius	2950.56	2.26	
Nauru	1.10	0.12[1]	
Samoa	178.16	0.97	

Table 1 CO_2 Emission Profiles of selected countries

Even under the assumption of an equal allocation of the negative consequences associated with climate change among all countries, there is a clear mismatch in the relationship of *responsibility vs. consequences* of climate change. The fact that – despite their much higher per capita emissions – the inhabitants of industrial countries would face the same climate change consequences as the inhabitants of Haiti, Mauritius, Nauru or Samoa, constitutes a clear breach of the polluter pays principle, as all countries would have to pay the same price irrespective of their actual responsibility. However, even this view can be considered an extenuation because the consequences of climate change are by no means equal for all countries. On the contrary, their industrial and technological advantage allows

[1]Own calculation.

industrial countries to better adapt to climate change while the countries of the *Alliance of Small Island States* (AOSIS) which have the least responsibility for the climate problem are endangered by it in their very existence. Consequently – and this view is further underlined by a look at the cumulative historical emissions (Vaughan, 2009) – the industrial countries and China have benefited economically from the use of cheap fossil fuels whose price did not reflect the negative externality of climate change.

Furthermore, the emission profiles partly determine and explain the different interest groups present at the negotiations. Having the largest per capita emissions of the industrial countries, the **US** are very skeptical of legally binding emission reduction targets as these could impose very high costs on its economy and provide competing countries with an economic advantage (Vevatne et al., 2005). The **European Union**, on the other hand, has claimed strong leadership ambitions in the climate change negotiations and has favored legally binding emission targets from the very beginning of the process (Vevatne et al., 2005: 5). A reason for that can be found in the high environmental awareness of the European population and the technological leadership of the Europeans in the area of emission reduction technologies. The economic growth of the large developing countries such as **China, India and Brazil** during the past decade has significantly raised their CO_2 emission levels in absolute terms, while the per capita emission levels still remain below the levels of industrial countries.[2] Therefore, these countries have highlighted their role as developing countries and refused to take on binding emission reduction commitments (Vevatne et al., 2005: 11). A similar position is represented by the **G77 states** which include the developing countries present at the negotiations. The countries most vulnerable to climate change are organized in the Alliance of Small Island States **AOSIS** and have been stressing the issues of mitigation, adaptation, technology development and transfer and financial support during the negotiations (Betzold et al., 2011). Finally, as a special group, the **Oil Exporting Countries** are concerned about the decline of their exports as a consequence of the reduced oil consumption worldwide following an agreement in the climate negotiations (Mouawad and Revkin, 2003).

[2] This was true for China until approximately 2005. Since then the per capita emission levels rose from 4.5 t CO_2 to 7.2 (EDGAR, 2013b) which is already close the per capita emission level of the EU27 states.

The second problem of the current situation is the one of *time inconsistency*. Time inconsistency results from the fact that combatting global warming is a long-term project which requires governments to take expensive and unpopular measures at present in order to receive the vague benefit in the form of a prevented or – worse – only slowed down global warming in a distant future.

The vagueness of future benefits from mitigation efforts in the present is further enhanced due to the fact that it is very difficult to quantify the costs of a future global warming for a particular country. Hence the danger to be avoided remains abstract while the costs of mitigation efforts are very concrete and obvious: For developing countries, a limitation of CO_2 emissions allowances could result in a slowed down economic growth, therefore making it harder to catch up with the industrial countries and to improve the living conditions of their populations. For industrial countries, global efforts in the fight against climate change would most likely result in emission caps for their industries and in financial commitments to support mitigation and adaptation in developing countries – both being very expensive projects, especially in the current time of financial crises and tight public budgets. Furthermore, it has to be considered that economic prosperity of a country affects its geopolitical position in international relations. Therefore, the environmental issue of the fight against global warming is directly linked to geopolitical considerations.

The short-term orientation of policy in most countries due to important elections every 2-4 years creates strong incentives for governments to pursue politics delivering immediate benefits and pushing the costs to the future (Victor, 2011: 40). Thus, it becomes evident that one of the greatest challenges for a future global climate regime lies in finding ways to overcome the problem of time inconsistency.

Finally, the quest for combatting global warming can be interpreted as a quest to overcome the problem of free-riding. In a mutual effort to reduce CO_2 emissions, each country can either choose the strategy of cooperation by participating in the global mitigation efforts, or the strategy of free-riding. As the output of a slowed-down or prevented global warming can be considered a non-exclusive public good in the sense that it is not possible to differentiate between participating and non-participating countries in its provision (Nordhaus, 1999), free-riding is likely to become the dominant strategy. It would therefore be rational for a country to leave the mitigation work to other countries and avoid costly measures to contain the own emissions while still profiting from efforts of other countries. However, if every

country followed this logic, this would lead to a *pareto-inferior* situation as there would not be any mitigation effort at all and, as a consequence, all countries would lose.

The logic of the free-riding problem is very relevant in the context of climate change. It reflects both, the common attitude that one country's mitigation efforts alone do not make any difference as well as the competitive character of the global warming debate which is not entirely an environmental one, but plays a significant role in economic and geopolitical considerations of countries. It is therefore important for a climate regime to provide incentives for participation in order to overcome the free riding problem.

These three problems define the area of tension within which global climate policy has to operate. In part, these problems also provide an explanation why it has been so difficult for the UNFCCC process to find an agreement on a global climate regime. The following chapter analyses the approach which was taken during the UNFCCC process and describes its shortcomings.

2.2. Problems of the UNFCCC Process

Although the basic principle of outgoing infrared radiation being trapped by greenhouse gases was known since the nineteenth century (Victor, 2011: 32), global warming did not become an international political issue before the late 1980´s.

What was missing was the idea that humans are able to significantly affect the environment. The change of mindset occurred in the 1970s. Technological advancement brought issues such as Dichlordiphenyltrichlorethan (DDT), supersonic aircrafts or increased nuclear weapons testing into public debate and made western societies seriously consider the anthropogenic footprint on the atmosphere (Victor, 2011: 30). At the same time, with the 1972 Stockholm Conference, International Environmental Law slowly emerged on the international stage.

The discovery that chlorofluorocarbons (CFCs) were depleting the ozone layer and have contributed to the emergence of the ozone hole posed the first serious challenge for global atmospheric policy (Environmental Protection Agency , 2007). This challenge was successfully addressed by the 1987 Montreal Protocol. As David G. Victor points out, the approach taken in the Montreal Protocol when dealing with

the ozone layer problem figured as a role model on which the later efforts to fight global warming within the UNFCCC process were oriented (Victor, 2011: 219-240). The Montreal protocol approach can be characterized by the following three steps:

1. **Emergence of a scientific consensus** about the threat for the environment and humanity and agreement on the need for coordinated global action.
2. **Negotiation of a framework convention** under the umbrella of the United Nations which generally addresses the environmental problem without defining binding commitments for the parties.
3. **Negotiation of a protocol to the convention** stating concrete, legally-binding commitments of the parties in the form of 'targets and timetables'.

However, the results of both processes could not be more different. While the ozone problem is largely solved, there was almost no progress during the UNFCCC process. This suggests that despite having been effective in the ozone case, the Montreal Protocol approach was not the right method to address the problem of global warming. Indeed, as it will be shown in the following, the UNFCCC process suffered under the three problems of a *broad table*, *inflexibility of the methods* and a *lack of incentives.*

2.2.1. Broad Table

The placement of the negotiations under the framework of the United Nations following the Second World Climate Conference in 1990 (Bodansky, 2001) created the requirement to involve all countries into the climate negotiations – a constellation which David G. Victor calls a *broad table* (Victor, 2011: 210). A broad table reflects the self-understanding of the UN as an inclusive and universal forum which provides all countries with the possibility for a peaceful dialogue. Therefore, almost all UN institutions are open for every country. In the case of global warming, which is a global issue concerning the interests of all countries, a broad table is believed to guarantee fairness, transparency and legitimacy of the climate talks. Any other approach to this problem is likely to be confronted with the accusation of being elitist, as in that case a small group of countries would decide about global developments affecting the whole world.

However, the great flaw of the broad table approach is that – with national sovereignty requiring unanimity as the decision-making principle in global negotiations – it leaves very little room for the finding of an agreement. As the

negotiations require the consent of all countries, it is likely that countries would agree on the lowest common denominator, a phenomenon which is described in Arild Underdals law of the least ambitious program (Underdal, 1980). Evidently, the common denominator decreases with more countries participating in the negotiations.

According to David G. Victor, this constellation shaped the result of the United Nations Framework Convention on Climate Change, which entered into force on 21st March 1994, inasmuch as countries agreed on "no more than what was agreeable to every nation on the planet" (Victor, 2011: 206) – namely largely on very general procedural issues, thereby postponing all the controversial issues to the future (Bodansky, 2004). This approach showed the self-understanding of the convention which was rather considered a further landmark for the future process to follow than a final solution to the problem of climate change.

Concrete commitments followed in 1997 with the agreement on the Kyoto Protocol which entered into force in 2005. These commitments imposed emission limitation targets for developed countries while the developing countries were exempted from any mitigation obligation. However, despite having reached concrete commitments for emission reductions, the Kyoto Protocol cannot be called a success as it did not define a mechanism for the inclusion of large developing countries into the regime and postponed this issue again for future negotiations. Consequently the issue of the inclusion of developing countries into the regime has been credited with leading to the collapse of the negotiations at the 2009 Copenhagen Conference, which was trying to elaborate a post-Kyoto agreement for the period after 2012 (UNFCCC, 2013a). The fundamentally different positions between the developing countries arguing for a document on Kyoto basis with commitments for industrial countries only, and industrial countries, attempting to include developing countries into the regime, became too apparent and could not be ignored anymore. As a result, Copenhagen became the symbol for the failure of the international climate diplomacy.

Furthermore not all countries which are present at the negotiations are equally interested in an agreement. There are as well reluctant countries participating in the negotiations that might consider a failure in reaching an agreement a success as well (Victor, 2011: 210). An example to be mentioned are the OPEC Oil exporting countries, for whose economies a strong decline in the worldwide demand for fossil

fuels as a result of eventual negotiation agreement would pose a serious threat. The rule of unanimous consent puts these countries into a powerful position, allowing them either to blackmail the other participants in order to get the perfect outcome for themselves or to block the negotiations as a whole. This offers the context to understand the claims for financial compensation by the OPEC countries during the negotiations (Barnett, 2008).

Despite the high symbolic meaning of universal climate negotiations, the arguments presented above seem to speak in favor of reducing the size of the table in order to include only countries whose emissions matter the most for climate change. This would most likely simplify the negotiations and the decision-making process. As shown in table 1, negotiations consisting of the six emitters China, US, EU27, India, Russia and Japan, would already cover more than 70% of the total annual emissions. This idea is taken up by the Club Approach which will be discussed in more detail in chapter 3.2.4.

2.2.2. Too Rigid Instruments

The debate of the climate negotiations first and foremost focused on the discussion of targets and timetables as instruments for mitigation and not on concrete political measures to achieve the envisioned reductions. If adhered to, targets and timetables promise the greatest control over the global emissions and thereby the greatest environmental effectiveness. On the other hand, targets and timetables are the least flexible approach and therefore make it difficult for countries to assess the economic costs of compliance.

The targets and timetables approach made sense in the case of CFC regulation. It was relatively cheap and easy for countries to adopt legislation banning CFCs from industrial use and hence there was not much need for flexibility. Due to its great effectiveness in the Ozone case, there was little doubt about the application of the 'targets and timetables' approach for addressing the issue of climate change. The 1988 Toronto Conference on the changing atmosphere ended with a non-binding call for governments to cut emissions 20% below the 1988 levels by 2005 and to develop a comprehensive convention on climate change (Victor, 2011: 204). This way, although not being legally binding, the Toronto Conference concretized the call for political action against global warming – which was supposed to be based on targets and timetables as the main instrument.

However, targets and timetables did not work under the UNFCCC process. As David G. Victor points out, governments have little control over future events that might have an influence on the GHG emission profile of their countries (Victor, 2011: 215-216). Victor demonstrates that the events which affected the CO_2 balance of countries the most, such as the German reunification, the British discovery of gas fields next to its coast, or the Chinese rapid economic growth were unpredictable, unplanned, and beyond governmental control. It is therefore very risky for a government to commit itself to a legally-binding emission reduction target, as it cannot plan the events in the future.

Consequently, unless they are given some degree of flexibility, governments are reluctant to commit themselves to absolute emission limitations. The focus on targets and timetables is therefore likely to make the negotiations more complicated. It reduces the range of possible solutions and adopts a black and white perception, implying that either the governments agree on a target or they do nothing to mitigate their emissions. This view does not allow interim stages in the form of commitments to concrete policy measures, international cooperation, or technology transfer. It is therefore likely to have blocked the progress in the climate negotiations of the UNFCCC process.

2.2.3. Lack of Incentives

Given the large and unforeseeable costs of GHG mitigation and the problems of time inconsistency and free-riding which were mentioned in chapter 2.1, there are usually few incentives for governments to agree on strict commitments. This holds for industrial countries which are facing financial crises and budget cuts as well as for developing countries whose priorities are placed on economic development and the fight against poverty among their population.

It has to be acknowledged that the vague long-term prospect of having contributed to mitigating climate change does not provide a sufficiently strong incentive for high emitter countries to accept serious commitments in order to reduce their GHG emissions. Moreover, as it has been mentioned previously, the technological advantage of industrialized countries reduces their incentives for taking action even further. On the other hand, developing countries and AOSIS states which are interested the most in reaching an agreement have the least influence on the negotiations.

Consequently, there is a need for a framework for an international agreement that harnesses the self-interest of the participating countries to ensure its creation and maintenance. Such an agreement could include co-benefits for other areas like economy, technology transfer, financial support, or increased trade. Speaking in terms of time inconsistency, this would mean bringing the outputs of cooperation for the countries from the future to the present which would provide countries with strong incentives to comply with the reached agreement. The question about the incentives for cooperation, therefore, forms an important criterion for the analysis of alternative approaches to the UNFCCC in the following chapter.

3. Analysis

Having discussed the shortcomings of the UNFCCC process in chapter 2 this work proceeds with the conceptualization of political alternatives to the current approach. For this purpose, this chapter groups over 40 approaches to design a climate regime listed in Daniel Bodansky`s article “International climate efforts beyond 2012: a survey of approaches” (Bodansky, 2004) according to their main rationale. Therefore nine groups of approaches are defined: ‘Stronger country differentiation’, ‘Agreement on a general principle’, ‘Long term allowances’, ‘Club Approach’, ‘Sectorial approach’, ‘Carbon trading’, ‘Taxation’, ‘PAM focused Approach’, and ‘Technology approach’. As mentioned earlier, these groups abstract from the individual differences of the particular approaches and focus on the analysis of their main characteristics which they have in common. Prior to this analysis, chapter 3.1 elaborates adequate criteria which are required for this purpose. In doing so, it is suggested to differentiate between *descriptive criteria*, characterizing the mechanisms which are used by the approaches, and *evaluative criteria* which make it possible to compare and evaluate the approaches. Chapter 3.3 summarizes the results of this analysis in form of a categorization table which displays the assessment of the groups of approaches with regard to the evaluative criteria.

3.1. Criteria

3.1.1. Descriptive Criteria

The most important criterion to describe an approach is the *method* which is applied in order to reach the goal of reduced GHG emissions. The UNFCCC process, for example, relies on the method of defining legally-binding emission targets and timetables to which countries have to comply. Targets and timetables promise the strictest form of controlling emissions but are often considered to be too rigid for countries to be effectively adopted. As it will be shown in chapter 3.2, this method is not the only one possible. Instead of defining binding targets, alternative approaches can for example focus on market-based instruments, agreements on technological exchange or on the negotiation of concrete policy packages.

If binding targets are chosen, the criterion of *emission trading* analyses whether the approach envisions the establishment of such a mechanism which aims at allowing a more flexible realization of the targets and providing financial incentives for the compliance of countries.

Related to the question of the method is the criterion of the *direction* of the approach. An approach can have a top-down direction, when multilateral negotiations define commitments for countries to which national policies would have to adjust. This was the case under the UNFCCC process. On the other hand, a bottom-up approach starts with looking at concrete policy measures of what countries are able to implement, given their national circumstances (Bodansky, 2004).

Furthermore, approaches can be differentiated depending on whether or not they include mechanisms for *technology transfer* and *financial assistance* for developing countries. An agreement on technology transfer could be a way to reduce the emissions in developing countries as it would replace ‘dirty’ technologies with modern and efficient ones. A mechanism for setting up a system of financial assistance could support important reforms in developing countries and thereby simplify their inclusion into a global climate regime.

Participation is another important criterion which addresses the question whether the approach follows the example of the UNFCCC by providing a *broad table* or whether it works with a ‘club’ structure, addressing several selected countries only. However, even though an approach can be universal, the commitments of a thusly

established regime can be distributed in different manners. The criterion of *differentiation* describes the principles which are being applied to determine the burden sharing between countries within an approach.

Finally the criterion of *compatibility with the UNFCCC* discusses whether the approach can be implemented within the framework which was established by the UNFCCC process or whether the establishment of a new institutional structure would be necessary.

3.1.2. Evaluative Criteria

Unlike the descriptive criteria discussed above, the evaluative criteria are not value-free but it holds that an approach is better the more it fulfills a certain evaluative criterion. In the following, seven criteria addressing environmental, political and economic considerations will be presented.[3] They will function as a benchmark in chapter 3.2 when it comes to evaluating the approaches. For every criterion, the approaches will be given a score in the range from 1 to 5, depending on the degree of fulfillment of the criterion by the approach. In a hypothetical ideal scenario, all criteria would be fulfilled with a 5. However, as it will be shown below, this is not possible as there is partly a tradeoff between the criteria, implying that an improvement in one criterion would come at the expense of another. Therefore, it is expected that there will be clusters formed with different approaches performing well in different criteria. This will provide indications for possible combinations of the approaches which will be discussed in chapter 4.2.

The most important evaluative criterion is the *environmental effectiveness* of an approach. Environmental effectiveness is to be defined as the extent to which an approach is able to reach the goal of a stabilization of GHG concentrations in the atmosphere to a safe level (Gainza-Carmenates et al., 2010). Therefore, approaches promising a stronger reduction in GHG emissions score higher than less strict approaches. However, it has to be considered that it is usually not possible to evaluate the environmental effectiveness of an approach without taking into account related criteria such as the questions of political and economic feasibility, incentives for participation or the ease of implementation which depend

[3] In choosing the evaluative criteria, this paper was guided by the criteria applied by Michel den Elzen and Marcel Berk in their discussion of bottom-up approaches for defining future climate mitigation commitments (den Elzen and Berk, 2004: 42).

on the approach chosen and at the same time have a significant influence on its real environmental effectiveness. Nevertheless, as all the criteria shall be evaluated separately, for the purpose of this work it is suggested to assume an *all things being equal* context and to evaluate the environmental effectiveness isolated and unweighted from interfering criteria. This is to say that it is only focused on the question to which degree the methods of the approach promise a GHG emission reduction in an optimal situation.

A second important criterion describes the *incentives for cooperation*. As it has been shown in chapter 2, the problem of time inconsistency makes cooperation in a climate change regime very costly and difficult for countries. Consequently it was one of the reasons for the failure of the UNFCCC process that it did not provide enough incentives for countries to participate. For the purpose of this paper, incentives will be understood in two ways. The highest rating for incentives will be given to approaches which would benefit countries in case of their cooperation, but also approaches promising a high degree of flexibility for countries to meet their commitments will be considered as providing incentives for cooperation.

Clarity of equity principles is another important criterion which is essential for the public acceptance of a climate change regime. Commonly, equity is associated with notions of fairness and justness (Swedish Environmental Protection Agency, 2002) and the Intergovernmental Panel on Climate Change (IPCC) addresses the issue as a "challenge […] to ensure that neither the impact of climate change nor that of the mitigation policies exacerbates existing inequities both within and across nations" (IPCC, 2001). However, as it will be shown in the application of this criterion, there are many competing notions of what equity actually means in a climate regime. For example, a climate regime based on the *ability to pay* principle would lead to a different result than a climate regime based on the *principle of historical responsibility,* which would again be different from a climate regime with *equal per capita allocation* as its basic principle. A detailed discussion and comparison of the various equity principles belongs to the sphere of philosophy and cannot be addressed here. The criterion *clarity of equity principles* therefore rather assesses to what extent the eventual allocation of mitigation commitments can be considered a result of a clear vision of one meaning of equity in a climate regime.

The criterion *simplicity of the negotiation process* evaluates the approach based on the likelihood to achieve an agreement in international negotiations. The UNFCCC

example shows that approaches which envision strict commitments with little flexibility and possibility to assess the costs of compliance lead to a difficult negotiation process with little chance of reaching an agreement. Consequently, the criterion is better fulfilled the more flexible an approach is and the greater the incentives for participation are. On the other hand, the simplicity of a negotiation process can be in a reverse relationship to the criterion *ease of implementation* which will be discussed below. This is the case when important details needed for the implementation are left out or papered down during a negotiation for the sake of its simplification.

Flexibility has already been mentioned when discussing the previous criteria. An approach is more flexible the more it allows taking into account the specific political and economic circumstances of a country in the setting of commitments. Therefore top-down approaches with legally binding targets and timetables offer the least flexibility, whereas a bottom-up, sector-based analysis of a country's mitigation possibilities would be rated the best in this criterion. It is possible in some situations that a high extent of flexibility contradicts the environmental effectiveness; on the other hand, flexibility is positively linked to the criteria of *incentives for cooperation*, *simplicity of negotiation process*, and *certainty about costs*.

Certainty about costs is a criterion which describes the extent to which an approach allows countries to control, calculate and foresee the economic costs which are associated with their compliance. The least certainty about costs is provided by top-down approaches where targets are set independently from the specific circumstances of the country. Yet, this criterion is positively correlated to the degree of flexibility of an approach and the criterion of the *simplicity of the negotiation process*, as countries are more likely to agree to commitments when they are able to foresee the costs which these commitments will impose on their economies.

Finally, *ease of implementation* assesses the efforts needed to implement an approach according to its objective. Thus, approaches which require high transaction costs for monitoring and enforcement of compliance would have a poor performance according to the criterion whereas easily implementable approaches receive a good score for this criterion.

Table 2 presents an overview over the discussed evaluative criteria and their interrelations to each other.

Criterion	Positively correlated	Negatively correlated
Environmental Effectiveness	-	Flexibility
Incentives for Cooperation	Flexibility Simplicity of the negotiation process certainty about costs	-
Clarity of equity principles	-	-
Simplicity of the negotiation process	Incentives for participation Flexibility Certainty about costs	Ease of implementation
Flexibility	Incentives for participation Simplicity of the negotiation process Certainty about costs	Environmental effectiveness
Certainty about costs	Flexibility Simplicity of the negotiation process	-
Ease of implementation	-	Simplicity of negotiation process

Table 2 Interrelations of the evaluative criteria

3.2. Alternatives

3.2.1. Stronger Country Differentiation

This group of approaches focusing on a stronger country differentiation leaves the UNFCCC process largely unchanged and is therefore compatible with the UNFCCC framework. The direction of the approaches remains a top-down target setting. What is new is that the approaches in this group aim at a much stronger differentiation between the countries in the climate regime. Thus, by defining more groups with specific commitments, the approaches allow a stronger consideration of the specific situation of the countries, thereby making the target setting more effective as countries would receive targets according to what their economic situation allows

them to contribute. At the same time, established graduation rules based on economic indicators such as per capita income, determine when countries automatically graduate into a higher group with stricter commitments in the case of economic growth or descend in the case of economic decline.

In this manner, the approaches aim at solving the greatest problem of the UNFCCC process, namely the inclusion of developing countries into a climate regime. Assuming long term economic growth of developing countries, the criteria for automatic graduation of countries from one group with less strict commitments to a higher group with stricter commitments form an elegant solution to guarantee that in the medium term the commitments of the countries grow together with their economic development.

The differentiation and target setting are done in a different way by the approaches. Usually, the group of countries with the highest income remains with legally-binding emission reduction targets whereas lower income groups face other types of targets. While there is no intended mechanism for technological transfer, most approaches aim at establishing a mechanism for financial assistance in order to support developing countries in lower groups in reaching their targets.

Those targets can either include other forms of commitments such as in the 'Keep in Simple, Stupid' approach which defines 12 groups of countries and assigns different packages of commitments to each (Bodansky, 2004: 43), or define less stringent and partly conditional targets for newly industrialized countries or recently industrialized countries (Ott et al., 2004). Commonly, while developed countries are given absolute emission targets, developing countries in lower groups have to comply with *carbon intensity targets*, defining the allowed quantity of emissions per unit of output which is supposed to improve along with economic growth of a country (Kim and Baumert, 2002). This is the case in the approaches 'Further Differentiation' (Swedish Environmental Protection Agency, 2002), 'Global Framework: Kyoto, Decarbonization and Adaptation' (CAN, 2003), and 'Multistage/New Multistage' (Höhne et al., 2003).

Evaluation

The group of approaches does not assign legally binding emission targets to all countries – which would be the reference for the highest grade for this criterion. Especially the fact that large developed countries such as Brazil, India and China

are likely to get weaker targets lowers the grade. However, the approaches meet the requirements of the criterion as they usually assign the most stringent commitments to developed Annex I countries which are responsible for the majority of the emissions. Furthermore, even though developing countries in lower groups do not have the most stringent commitments, they are nevertheless included into the regime with the perspective of graduating into higher commitment groups in the future. Overall, the *environmental effectiveness* of the approaches is graded a 4.

There are no clear *incentives for participation* provided, in the course of which a country would get a direct benefit from its participation in the regime. Indirect benefits of participation could result from the high flexibility and differentiation of the regime, which make it possible to address the circumstances of countries more specifically. In this sense, an incentive for the participation in the regime could be the fact that by doing so, countries would avoid a more inflexible regime. Therefore, the incentives for participation provided by this group of approaches are graded a 2.

The approaches score the highest in terms of *clarity of equity principles*. They clearly define the ability to pay principle, as the most central principle for burden sharing among countries. Therefore the strong differentiation tries to guarantee that countries only get the kind of commitments, with which they are able to comply. Additionally rules for automatic graduation ensure that countries assume stronger commitments once they become able to do so. Assuming that economically strong countries have emitted the most GHG gases in the past, the group of approaches covers the principle of historical responsibility as well. All together, the equity principles are communicated in a very clear way and can be considered fair. The clarity of equity principles is therefore graded a 5.

Generally, stronger differentiation between countries can be a means to simplify the negotiation process. For example, the interim stage of carbon intensity targets offers a way to find a compromise in the debate whether or not developing countries should have commitments in dealing with an environmental problem largely caused by industrial countries. Therefore, it can be said that the amount of possible compromises increases the more an approach allows differentiating between countries. However, the approaches still contain disputatious issues – such as the question which criteria should be used to allocate countries to different groups, the definition of targets for each group, and the agreement on rules for automatic graduation – which can become a subject to complicated negotiations. Hence the

simplicity of the negotiation process is not guaranteed by the approaches and is therefore graded a 3.

The criterion of *flexibility* describes a strong aspect of the approaches. With flexibility being defined as the space an approach offers to take into consideration the specific situation and needs of a country, it can be assumed that an approach is the more flexible, the more it allows to differentiate between countries and commitments. Therefore those approaches that have a stronger differentiation among countries as their basic principle naturally should get a high grade in the criterion of flexibility. The grade is lowered due to fact that there is usually little flexibility in the compliance with a target. Therefore, the approach does not lead to greater flexibility for developed countries in the first group with most stringent targets who would have to face legally binding emission reduction targets anyway. As a consequence, the flexibility of the approaches aiming at a stronger country differentiation is graded a 3.

The criterion *certainty about costs* is graded a 3. For industrial countries in the first group that are subject to legally binding emission reduction targets and timetables, the costs of compliance are difficult to assess, as the targets are set top-down without concrete policy measures being considered. Furthermore, as it is unknown which challenges the countries will encounter in the future, a commitment to an absolute number of emission reductions could become a very costly project. On the other hand, the certainty about costs increases for developing countries in the lower groups which are often assigned with indexed targets, allowing them to combine economic growth with CO_2 mitigation. Furthermore, the defined graduation criteria allow an automatic adjustment of the commitments to the changed economic or political context of the countries.

The *ease of implementation* of approaches focusing on a stronger country differentiation is reduced due to their top-down direction. The fact that concrete policy measures in every country are not considered when determining the targets might lead to difficulties in the realization of the targets by the countries. Therefore, most approaches address the need for the establishment of a financial mechanism supporting developing countries in the fulfillment of their commitments. Another issue of great relevance with regards to the implementation of the approaches is the need for the establishment of a sophisticated mechanism for data collection and monitoring, in order to assess the compliance of the countries and to control the

graduation of countries into the next group. These aspects complicate the implementation of the approaches and therefore this criterion is graded a 3.

3.2.2. Agreement on a general principle

Just like the group of approaches discussed in the previous chapter, the approaches focusing on the definition of a general principle for burden-sharing inside the regime do not modify the UNFCCC process much. Consequently, the method of the approaches remains the definition of legally binding emission reduction targets which are set in a top-down direction. The novelty is that instead of negotiating the numbers for emission reductions, as it was the case during the UNFCCC process, the approaches shift the focus of the negotiations to a procedural level. This is achieved by agreeing on a general principle which is then used to determine the reduction targets for all countries.

This group of approaches aims at universal participation of all countries and is as such compatible with the UNFCCC process. In their majority the approaches do not address the issues of emission trading, technology transfer or financial assistance, although generally it would be possible to add these mechanisms to the regime.

As mentioned above, the focus of the discussed approaches lies in the definition of a clear rule to determine legally binding emission targets for the countries. In an ideal case, an agreement on such a principle would provide a high degree of transparency to the negotiations, significantly simplify the negotiation process, and eventually lead to a ‘fair’ negotiation outcome. However, it has to be considered that there is not just one ‘fair’ outcome but rather that the eventual allocation of mitigation burden depends on the equity principle chosen by the approaches. These equity principles can be broadly classified into the four groups ‘per capita weighting’, ‘historical responsibility’, ‘equal costs’ and ’ability to pay’.

Equity principles focusing on ‘per capita weighting’ allocate the emission allowances on a per capita basis. This is the case with the approaches ‘Expanded Common but Differentiated’ (Gupta and Bhandari, 1999) and ‘Per Capita Allocation’ (Agarwal, 2000) which aim at distributing absolute emission targets between countries in a way that as a result – after a transition period – all people irrespective of their country would have an equal number of GHG emission allowances. A special case in the per capita weighting group is the ‘Global Preference Score’ approach (Müller, 2001). This approach allows countries to vote on competing proposals about the

allocation of the emission targets. The votes are weighted according to the population of the countries in order to establish an aggregated formula for the determination of the emission allowances.

Another way to define an equity principle is the allocation of emission reduction burden according to the historical responsibility of countries for climate change, which is derived from the countries' GHG emissions in the past. This approach is commonly referred to as the 'Brazilian Proposal' (Rosa et al., 2004). By using rolling baselines when calculating the targets for each commitment period, the Brazilian Proposal ensures that countries which reduce their emissions in the short term would be rewarded with less stringent targets for future commitment periods and vice versa. Thus the approach creates an elegant way to gradually include fast growing developing countries into the regime as their historical responsibility would grow with every commitment period.

The 'Equal Mitigation Costs' approach focusses on 'equality' as an equity principle (Babiker and Eckaus, 2000). In this approach, countries first determine the necessary amount of emission reductions to reach a desired atmospheric concentration level in the future and then agree on an economic model to calculate the mitigation costs. The amount of necessary reductions will then be allocated between countries in a way that the mitigation results in an equal GDP percentage reduction for all countries.

Finally, the 'Ability to Pay' approach (Jacoby and Schmalensee, 1999) defines the 'ability to pay' as the central equity principle for the allocation of the mitigation burden among countries. Similarly to the approaches focusing on the stronger differentiation between countries, this approach differentiates between developing countries and industrial countries and uses GPD per capita in order to allocate absolute reduction targets among industrial countries.

Evaluation

The approaches in this group aim at defining legally binding absolute emissions targets for all countries. As this can be considered the strictest method to address mitigation, the criterion of *environmental effectiveness* is graded a 5.

Keeping the structure of the UNFCCC process, the approaches inherit the latters' shortcoming of not providing enough *incentives for participation* of countries in the regime. Therefore, there are no direct benefits for participating countries and –

unlike in the case of the approaches focusing on stronger differentiation between countries – a participation in the regime cannot prevent a worse outcome from the perspective of the countries, as the targets envisioned by the approaches already form the most stringent type of commitments. Hence, apart from idealism, there are very little incentives for countries to participate in a thusly established regime. The incentives for participation are therefore graded with the lowest grade: 1.

The basic idea of the approaches in this group is to define a general principle for a fair and transparent definition of targets for countries. Therefore the criterion *clarity of equity principles* is by definition addressed and fulfilled by the approaches, no matter if the equity principle of the approach is oriented on ability to pay, per capita weighting, equality or historical responsibility. Consequently, this criterion is graded a 5.

The stricter the method of an approach, the more difficult is the negotiation about the allocation of the targets. As these approaches envision the most stringent und inflexible form of commitments, the negotiations would be expected to be very difficult. The fact that the approaches try to shift the focus of negotiations from the discussion of numbers to the discussion of general principles does not lead to a significant simplification. The negotiators would be likely to 'translate' from the principles discussed to the corresponding emission targets and would therefore claim for the equity principles promising the best outcome for their country. However, the shifting of focus in the negotiations towards a general principle could increase the transparency of the negotiations and thereby allow a stronger public pressure and involvement during the negotiations. Altogether, the criterion of *simplicity of the negotiation process* is graded a 2.

With the focus being put on top-down legally binding emission reduction targets for all countries, the approaches do not allow a high degree of *flexibility*. The grade is slightly increased to 2 as the equity principle chosen might to a certain degree lead to some consideration of the specific economic situation of the countries.

The criterion *certainty about costs* is graded with the grade 1, as absolute binding reduction targets in combination with little flexibility offer the worst condition for countries to assess their costs of compliance.[4]

Finally, the *ease of the implementation* of the approaches does not differ from approaches focusing on stronger country differentiation and is therefore graded a 3, as well.

3.2.3. Long Term Allowances

The idea behind approaches focusing on the allocation of long term emission allowances is that due to the long atmospheric lifetime of CO_2 it does not make a big difference when the gases are emitted into the atmosphere, as long as safe long term GHG concentration levels are not exceeded until a specified date. Therefore the approaches aim at determining the amount of maximum permissible emissions until the specified date and to allocate the entitlements for the emissions to countries in a top-down direction according to specified equity principles. Such equity principles would be for example the 'principle of historical responsibility' or the assumption of a 'long-term convergence rate of emissions' (Bodansky, 2004). Thereby countries would be free to decide when to reduce their emissions, as long as they do not exceed the total amount of their long term emission allowances.

The approaches can be realized both with universal participation under the framework of the UNFCCC or, as suggested by the 'Long Term Permit Program' approach, under a club structure addressing only the most important polluters, such as the US, EU27, Russian Federation, China, Japan, India and Brazil (Bodansky, 2004: 44). There are no special mechanisms envisioned to promote technology transfer or to install a system of financial assistance for developing countries. The definition of top-down, long-term targets allows installing national and international systems of tradable emission trading systems in order to allocate the emission reductions in the most efficient way.

[4] An exception is the 'Equal Mitigation Costs approach' which is based on the equal allocation of the mitigation costs among countries.

Evaluation

In theory, the definition of a 'safe' GHG concentration level alongside with top-down emission reduction targets promises a good *environmental effectiveness*. However, the extreme long-term orientation of the approaches leads to the problem of time inconsistency and therefore renders the approaches environmentally ineffective. The allocation of long-term emission allowances would allow countries to emit a lot of GHG gases in the short term and shift the mitigation costs to future governments. As it is impossible to predict what happens in the future, it seems to be a too high risk for the environment to accept high short term emissions, relying only on a promise of a later mitigation. Therefore the environmental effectiveness of the approach is graded a 1.

Although there are no direct benefits resulting from the participation, the criterion of *incentives for participation* is graded a 3 due to the high flexibility which is offered by the long-term orientation of the approaches. Especially developing countries are enabled to pursue a policy of economic growth in the short term prior to addressing the issue of mitigation.

The *clarity of equity principles* cannot be evaluated in general terms as this criterion depends on the equity principles chosen by each approach for the allocation of long term emission allowances. As mentioned before, there is a variety of possible allocation principles such as historical responsibility, equal mitigation costs or equal per capita emissions which can be applied for the allocation.

Although being dependent on the eventual equity principles chosen, it is expected that the very high flexibility of the approaches increases the *simplicity of the negotiation process* as it allows countries to maintain their goals and to avoid high costs in the short term. Therefore, the criterion of the simplicity of the negotiation process is graded a 4.

The mentioned very high degree of *flexibility* can be considered the greatest strength of this group of approaches. The long-term allocation of emission permits makes it possible for countries to choose their own mitigation policies and therefore enables maximal consideration of a country's specific economic and political situation. The flexibility criterion should therefore be graded with a 5.

The same high grade is given to the *certainty about costs*. As countries are free to decide how much efforts they invest at a certain point in time for mitigating their emissions, they have – at least in the short term – full control over the costs.

The problem of time inconsistency poses the greatest challenge for the implementation of the approaches, as it is very difficult to assess whether or not countries would keep their promise to mitigate in the future. Due to this difficulty, the ease of implementation criterion is graded a 1. In order to reduce the degree of uncertainty, it might be a solution to define shorter commitment periods which would then go at the expense of the flexibility.

3.2.4. Club Approach

The Club approaches aim for a bottom up process of the establishment of an international climate regime. The basic idea of the approaches is that instead of trying to find a 'big solution' in universal multilateral negotiations, a small group of countries which matter most with regard to GHG emissions takes the lead and agrees on measures and burden-sharing for the mitigation of their emissions. The measures agreed on can be either the definition of targets and timetables for each country such as envisioned in the approaches 'Converging Markets' (Tangen and Hasselknippe, 2005) and 'Parallel Climate Policy' (Steward and Wiener, 2003), or packages of policies and measures offered by each club member in a bidding process, as suggested in the 'Carbon Club Approach' by David G. Victor (Victor, 2011).

The advantage of a club approach is that by reducing the amount of participants it becomes easier to find a compromise between negotiating parties and to design agreements addressing the specific circumstances of the participants. The premise for a club's working is that it has to offer clear benefits such as preferential access to clean market technology, funding, carbon markets and political prestige (Victor, 2011: 264), for the participants – thereby rewarding their voluntary participation and creating incentives for other countries to join the club. Therefore, agreements on financial assistance, technology transfer and international carbon markets form the very core of a club approach.

Starting with a small number of countries, exclusiveness and non-universality become the major principles of club-approaches, rendering them incompatible with the UNFCCC framework. However, it is possible to imagine that the benefits offered

by the club would provide incentives for other countries to seek candidate status and to negotiate conditions for their membership. Thereby a club which has started with several countries only, could evolve into a global climate agreement.

Evaluation

The *environmental effectiveness* of a club approach depends on the countries included and the mitigation measures promoted. Given the small number of countries participating in the negotiations, it would be easier to agree on more ambitious goals, either in form of targets and timetables or in form of concrete policies and measures (PAMs). The fact that a Club approach necessarily excludes the majority of countries from the climate regime reduces the environmental effectiveness of the approach. However, given that already the six greatest GHG emitting countries cover more than 70% of the emissions, the effectiveness of the club approaches is likely to remain high, if the most important emitting countries are included. The criterion is therefore graded a 4.

The *incentives for participation* play a great role for every climate regime. In the case of the club approaches, their relevance is even higher as they have to provide reasons for countries to voluntarily accept mitigation commitments while the majority of other countries are left outside the climate regime. Therefore, a club has to offer advantages to its members in order to compensate them for both, the costs for mitigation efforts and the competitive disadvantage relative to non-participating countries. Mechanisms aiming at technology transfer, carbon trading, projects in the framework of a *Clean Development Mechanism* (CDM), and financial assistance are therefore essential to the functioning of a club. In the end, the relation between advantages offered by a club and the costs arising through the mitigation obligations determines whether or not it is rational for a country to join the club. The criterion is therefore graded neutrally with a 3.

There is no clear equity principle which determines the logic of the club approaches. As the basic paradigm is to simplify the negotiations by reducing the amount of participants, a possible principle could be labeled realism or pragmatism. As the club would include the most polluting countries which at the same time are likely to be the richest countries and the ones with the highest accumulated emissions, the approach can further address the equity principles of ‘ability to pay’ or ‘historical responsibility’. However, as the club approaches have to leave the framework of the

UNFCCC, they can be considered non-transparent, elitist and undemocratic. Therefore, the criterion of *clarity of equity principles* is graded a 2.

As already mentioned, it is the main goal of club approaches to increase the *simplicity of the negotiation process* by reducing the number of participants in the negotiations. However, this is not necessarily the case. In order to be environmentally effective, it is necessary for a club to include major developing and developed countries. Therefore, the main conflicting issue, namely the question of burden sharing between industrial countries and large developing countries would not vanish with the reduction of the participants. Furthermore, the need to include a sophisticated system of incentives into the regime would add more topics to the negotiations, thereby making them more complex. All in all, the simplicity of negotiation process is graded with a 3.

The *flexibility* of the club approaches depends on the measures adopted by the club to regulate mitigation. The flexibility is lower if the club adopts legally binding emission reduction targets for all countries (1), than if countries negotiate about PAMs in a bidding process, as suggested by David G. Victor (3). The same applies for the criterion *certainty about costs* which is graded a 1 in case of targets and timetables and a 3, if the mechanism focuses on PAMs.

It speaks in favor of the criterion *ease of implementation* that the club approach has a voluntary nature – the participating countries should therefore be interested in the existence of the club and would be likely to comply with the rules. In addition, the smaller group of countries would allow for a more detailed discussion of commitments which would eventually simplify their implementation. However, on the other hand, club approaches face the challenge of establishing a system of clear benefits for the participating countries which is not easy to be implemented. Especially the idea of providing club members with preferential access to markets for new technologies is difficult to realize as it is likely to interfere with the most-favored-nation principle of the WTO (WTO, 2013). Thus, the ease of implementation is graded a 3.

3.2.5. Sectorial Approach

The first step in a sectorial approach is a comprehensive bottom-up analysis of a country`s or region’s economic sectors. Based on this analysis, it is possible to identify the potential for emission savings in each sector and consequently to

elaborate binding national sectorial targets. Thus a sector-based approach allows taking into consideration the different national circumstances with regards to standard of living, fuel mix for electricity generation, economic structure or the competitiveness of internationally-oriented industries sector (den Elzen and Berk, 2004). Furthermore, the sectorial analysis could help revealing concrete needs for technological and financial support. Examples for sectorial based approaches are the 'Triptych approach' (den Elzen, 2002: 17-28) and the 'Multi-Sector Convergence approach' (Jansen et al., 2001).

These two approaches differ in the sectors they consider. The 'Triptych approach' differentiates between three sectors: the power sector, the sector of energy intensive industries and the domestic sector. For all three sectors, targets are determined for 13 world regions. The sectorial targets are added up to form absolute national emission targets. The 'Multi Sector Convergence' approach differentiates between the sectors of industry, power, household, transportation, service, agriculture and waste and follows the same pattern of adding up sectorial targets. It has to be considered that the criteria used to define the sectorial targets vary with the respective sectors. For example, the definition of targets for the industry sector is affected by both, the expectations about the future economic growth and the identified potential for energy efficiency improvement. On the other hand, targets for the domestic sector follow the future population growth rates and the expectations regarding the convergence on per capita domestic emission levels, while the power-production sector targets reflect the expectations of a future growth rate in electricity production adjusted by the improvement rate in emissions intensity (Bodansky, 2004: 35). Thus, every sector is likely to be assigned with realistic targets which can be achieved by the respective countries.

Both approaches do not aim at establishing mechanisms for emission trading, technology transfer and financial assistance. However, as sectorial analysis forms the core of these approaches, the analysis might reveal needs for modernization and investments in specific sectors of a country. Consequently, agreements on technology transfer and financial assistance can be considered a good supplement to these approaches. Since the approaches aim at universal participation, they can be implemented within the UNFCCC framework.

Evaluation

The *environmental effectiveness* of the sectorial approaches is graded a 2. It is not guaranteed that the optimal GHG concentrations will be reached through the bottom-up procedure. Rather, the sectorial analysis seems to aim at a compromise between GHG mitigation and considerations regarding the economic growth within the sectors and attempts to distribute the mitigation costs between the sectors in the most cost efficient way.

By analyzing each sector, the sectorial approach addresses the concern that imposed top-down targets for countries can become too expensive because specific national circumstances were not taken into consideration. Also, this approach aims at a compromise between environmental protection and economic growth, which is the main concern of large developing countries. Therefore, although there are no direct *incentives for participation*, the participation in regimes established by sectorial approaches has the benefit that countries could avoid a more inflexible and expensive arrangement. Consequently, the approaches score a 3 with regard to their incentives for participation.

The most obvious equity principle of the sectorial approaches is the ability to pay principle. It is one of the advantages of a target allocation based on sectorial analysis that it would lead to targets which are feasible for all countries. Furthermore, the approaches can be characterized as pragmatic and realistic because they put a focus on defining targets which would be accepted and realized by countries rather than imposing top-down targets. However, the fact that there is not one single criterion for the determination of the targets, but that each sector has its own criterion according to which targets are defined, might lead to lack of transparency in the process. All in all, the *clarity of equity principles* is graded a 3.

The sectorial analysis provides a large data set which can be used as an orientation during the negotiations. This would enable the negotiators to focus more on concrete measures and avoid the discussion of symbolic numbers for emission reduction targets, as it seems to have been the case during the UNFCCC process. This way, the shift of the focus to concrete policies due to the sectorial analysis would enlarge the room for compromise finding and therefore increase the *simplicity of the negotiation process*. However countries would still need to agree on a model for the interpretation of economic data acquired from the sectorial analysis and on

the criteria to be used for the definition of the targets. The criterion is therefore graded a 3.

With regards to target setting, bottom-up approaches generally offer a higher possibility to address the specific economic circumstances of a country then it is possible with top-down approaches. This is the case with the sectorial approaches whose core idea it is to define targets reflecting what countries are able to deliver. As *flexibility* has been defined earlier as the extent to which a regime can take into consideration the specific situation of countries. the sectorial approach can be considered a flexible approach. With regard to compliance within the given target, the approaches lose flexibility as they aim for absolute target levels. However, it is possible to add `allowance factors´ to the defined national emission targets in order to increase flexibility at this point (Jansen et al., 2001: 16-18). The flexibility criterion shall therefore be graded a 4.

The *certainty about costs* of the approaches is graded a 4, as well. The more sectors are addressed specifically by a regime, the more the resulting target is backed by ideas of concrete policy measures required for the compliance of the countries. Knowing about these measures, it is eventually possible for a government to assess the costs for its participation under the regime. Furthermore, by including projections regarding the expected sectorial growth rates into the target definition formula, the sectorial approaches attempt to make the costs more calculable. Consequently, provided that the growth projections are correct, the compliance costs would be unlikely to become an unexpected problem for countries in the sectorial approach.

The greatest problem for the criterion *ease of implementation* is the need for a sophisticated data collection in order to perform the sectorial analysis. Therefore, it is necessary to implement a system of data collection, reporting and monitoring. Thus, the ease of implementation criterion is graded a 3.

3.2.6. Carbon Trading

Carbon trading approaches aim at achieving a high efficiency and flexibility in a global climate regime. The premises for carbon trading systems are top-down defined emission limits for each country. The country then allocates the received emission allowances to companies within its major industries. The companies in turn can – depending on their actual emissions – either sell unused allowances or buy

additional allowances on the carbon market (Milunovich et al., 2007). This way, the amount of GHG emission reductions needed to reach the determined emission cap can be achieved most efficiently. Companies with a lot of unused potential to reduce their GHG emissions are likely to have lower marginal costs for the optimization of their production process than for buying additional allowances. Vice versa, companies for which the marginal costs of further emission reduction would be too high, could benefit from the opportunity to compensate their emissions by buying additional allowances. The advantage of carbon trading models is therefore that – in theory – they automatically allocate emission reductions to the economic agents which can reach them at the lowest costs.

A subsystem of carbon trading is the CDM. It is defined in Article 12 of the Kyoto Protocol and allows industrial countries to implement emission reduction projects in developing countries and earn certified emission reduction credits in return (UNFCCC, 2013b). Thereby the mechanism allows industrial countries to 'outsource' their mitigation in situations where further reduction of the own emissions would be too expensive. It becomes clear that the CDM follows the same logic as carbon trading mechanisms in attempting to provide the most flexible and cost-efficient way of allocating emission reduction efforts between countries.

However, while undoubtedly bearing a high potential for enhancing the efficiency of a climate regime, the CDM bears risks as well. These risks arise through the need to define thresholds for a business as usual (BAU) scenario of the emissions of developing countries without the CDM projects. This is necessary to then calculate the reductions achieved by the projects and to derive the emission reduction credits. As higher emission baselines promise more project investments, the CDM mechanism is likely to create `perverse incentives´ for governments and companies in the hosting developing countries to inflate their predicted BAU emissions in order to attract the CDM investments (Victor, 2011: 93-99). It is therefore not easy to differentiate between hot air and real emission reductions within the CDM mechanism. Without providing calculations, David G. Victor assumes that the share of hot air lies between one-third and two-thirds of all CDM credits (Victor, 2011: 96).

The carbon trading approaches can be divided into the three groups *carbon trading between* countries, *carbon trading between a country and an institution* and *national carbon trading*. The scheme of carbon trading between countries can be further differentiated based on the allocation of the emission allowances. The approaches

‘Hybrid International Emissions Trading’, ‘Soft Landing in Emissions growth’, and ‘Three part policy architecture’, are oriented on a cap and trade system with the allocation of internationally tradable emission permits based on prior defined emission targets for every country (Aldy et al., 2001) (Blanchard et al., 2001) (Stavins, 2004). In order to increase the flexibility for participating countries and to protect them against a too high emission permit price on the market, the ‘Hybrid International Emissions Trading’ approach introduces the *Safety Valve mechanism*. This mechanism allows countries to buy additional allowances from an international institution at a predetermined price (Aldy et al., 2001). Another way to distribute the emission permits is proposed in the ‘Insurance for Adaptation funded by Emissions Trading’ approach which suggests the allocation of emission permits to the vulnerable countries most endangered by global warming. These countries would then be able to sell the permits to the industrial countries and thereby generate revenues in order to finance their adaptation to climate change (Jaeger, 2003).

Carbon trading can also occur between a country and an institution. The ‘Dual Intensity Target’ approach differentiates between a relatively weak compliance target, which is legally binding, and a non-legally binding but more ambitious selling target. If a country emits less than stated by the latter, it can generate revenues by selling the surplus to an international institution (Kim and Baumert, 2002). The ‘Purchase of a Global Public Good’ approach takes a similar direction by allocating allowances to countries based on a BAU scenario and creating the possibility to sell unused allowances to an international bank, thereby providing incentives for countries and companies to reduce their emissions (Bradford, 2004).

Finally, emission trading can also occur only on a national level as it is suggested by the ‘Domestic Hybrid Trading’ approach which distributes emission permits for countries every year. These emission permits are converted in nationally tradable emission endowments which are distributed among the country`s major industrial sectors (McKibbin and Wilcoxen, 2002).

In theory, carbon trading is an inclusive concept and would therefore be compatible with the UNFCCC framework. In fact, after the agreement on the Kyoto protocol, many analysts expected that over time, national and regional emission trading schemes would converge and develop into a single market with a single price for an emission credit (Victor, 2011: 77). However, rather than a conversion of the markets, a tendency of fragmentation of national and regional carbon markets can be

observed. Each of these markets defines a different price for carbon credits, depending on the stringency of national mitigation policies. It becomes clear that the convergence of markets is only possible between countries which have a similar level of ambition. Therefore, an international carbon trading system can be as well a good option for a club approach of like-minded countries.

Technology transfer does not play a major role in most carbon trading approaches. An exception is the 'Safety Valve with Buyer's Liability' approach which envisions the definition and implementation of a technology strategy alongside with national emission trading schemes (Victor, 2003). Many carbon trading approaches provide a financial transfer mechanism from industrial countries to developing countries for the purpose of adaptation (Jaeger, 2003). This is reached by either installing a safety valve mechanism, making the purchase of allowances from an international institution a requirement of the regime, or the allocation of emission permits to the most vulnerable countries.

Evaluation

The cap and trade mechanism of the carbon trading approaches relies on the definition of binding emission reduction targets. Therefore, under the assumption of the compliance of all parties, the carbon trading approaches promise the greatest control of the GHG concentration levels in the atmosphere. Hence, in the absence of the safety valve mechanism, the *environmental effectiveness* of carbon trading approaches is graded a 5. The grade is reduced for approaches allowing countries to buy additional allowances in order to go beyond their emission caps. This can be the case for safety valve approaches or with emission trading between countries and international institutions. In both cases the control of the climate regime over the GHG emissions is weakened. This leads to a downgrading of the environmental effectiveness to a 3.

The *incentives for participation* are reduced by the fact that countries are usually reluctant to agree on binding emission reduction targets which form the basis of the emission trading approaches. Without flexibility mechanisms such as the safety valve, the majority of the countries would have only few incentives to participate in the carbon trading regime. The exemption would be countries with a highly developed renewable energy sector. These countries could benefit from selling their allowances and from exporting their technologies. The incentives for participation are therefore graded a 2. The grade for the criterion is increased to a 3 through the

addition of a safety valve mechanism which allows countries to better control their compliance costs.

Approaches focusing on carbon trading emphasize the principles of flexibility and efficiency and the allocating function of the market[5]. The *clarity of equity principles* cannot be generally assessed as it depends on the eventual distribution of emission allowances among countries.

The focus on binding emission targets would make the negotiation process difficult as countries are usually reluctant to agree on binding targets and timetables. It is therefore likely that the negotiations on the eventual allocation of emission allowances would be of similar difficulty as the negotiations on the UNFCCC process. The criterion *simplicity of the negotiation process* is therefore graded a 2.

Market-based approaches such as carbon trading aim at maximizing the *flexibility* of the global mitigation efforts. Carbon trading approaches allow countries to decide themselves whether they stick to the emission target determined by the issued emission allowances or buy additional allowances on the carbon market. This allows a high consideration of the specific economic situation of each country, especially of the marginal costs for mitigation. The flexibility criterion is therefore graded a 4.

One of the basic aims of carbon trading approaches is to provide *certainty about costs* by defining a clear price for the emission of one unit of GHG gases into the atmosphere. Without a safety valve the emission costs would fluctuate with the market price for carbon credits and the criterion would be graded a 4. The introduction of a safety valve mechanism would furthermore maximize the certainty about costs as there would be one fixed price for additional allowances. In this case, the criterion would be graded with a 5.

The *ease of implementation* of carbon trading approaches is graded a 3. While the CDM mechanism is facing the aforementioned problem of perverse incentives, the international implementation of the 'cap and trade' system would require new international institutions which would be in charge of organizing the carbon trading and the monitoring of the actual GHG emissions of the countries.

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[5] The allocating function of the market is defined as the tendency of an allocation of production factors towards their most efficient use, in a situation of a free market and without the consideration of transportation costs (Woeckener, 2006: 227-239).

3.2.7. Taxation

Carbon taxes are a top-down approach aiming to increase the price of fossil fuel consumption. Accordingly, consumers of fossil fuels would have to pay per CO_2 emission unit of their consumption. Thereby, the carbon taxation applies the pigouvian idea of the inclusion of negative external costs into the calculations of the parties responsible for the externalities (Nye, 2008). In the long term, carbon taxes have the goal to contribute to the change of energy infrastructure and to promote renewable energies. This might be possible as carbon taxes decrease the opportunity costs of renewable energies.

The advantage of a carbon tax lays in the fact that it promises a GHG emission reduction without imposing binding emission targets on countries. Therefore, the approaches aim at providing the countries with a high degree of flexibility so that economic growth would not be contrary to the compliance of a country in the regime. Furthermore, in the case of an equal taxation in all countries, the carbon taxation approaches would distribute the costs between the countries relative to their actual emissions. Such a distribution would be in accordance with the polluter pays principle.

Carbon taxation automatically raises the question of the utilization of taxation revenues. Therefore, mechanisms have to be defined by the regime, specifying the financial assistance and monetary flows to finance adaptation policies in the most vulnerable countries (Vielle et al., 2008). The issue of technology transfer is not specifically addressed by the approaches although it could be financed through the tax revenues as well. Also, a carbon trading mechanism is missing due to the absence of binding targets and timetables. Being a universal approach, carbon taxation should be addressed within the UNFCCC framework.

The environmental effectiveness of carbon taxes is debated in the economic literature. Wissema and Delink show in their analysis of the Irish energy sector that a tax of 10-15 euros per ton of CO_2 would have the potential to reduce the Irish energy related CO_2 emissions by 25% (Wissema and Delink, 2007). A similar positive assessment regarding the environmental effectiveness of carbon taxes is given by Lu et al., who analyzed the effects of carbon taxes on the Chinese economy. Lu et al. found that a carbon tax of 300 Yuan per ton of CO_2 could lead to a 17.45% emission reduction with a reduction of GDP of only 1.1% (Lu et al., 2010).

However, other research suggests a low mitigating effect of carbon taxes. In his analysis of the Swedish carbon taxes, Bohlin found that the impacts on emissions varied across sectors, with high impacts in the transportation sector and little impact in the industrial sector (Bohlin, 1998). In Norway, a decrease of the carbon intensity was observed by Bruvoll and Larsen in 2004. However, only 2% of this decrease was attributed to the implementation of carbon taxes (Bruvoll and Larsen, 2004). According to Gerlagh and Lise, carbon taxes have generally little impact on CO_2 emissions, unless they stimulate technological development (Gerlagh and Wietze, 2005).

Evaluation

As shown above, the *environmental effectiveness* of carbon taxation is currently debated in the scientific literature. Depending on the price elasticity of demand, it can lead to the reduction of emissions, but it is also possible that the taxation would be transferred to the consumers in the form of higher prices (Lin and Li, 2011). Furthermore, the price effect of carbon taxation can be contradicted by *fiscal cushioning*, i.e. when countries reduce other taxes in order to compensate for the carbon tax (Aldy et al., 2010). Another criticism of carbon taxation is that it only covers CO_2 emissions from fossil fuel burning. Therefore, carbon taxation does neither address other greenhouse gases nor the emissions from other sources, such as for example deforestation. As carbon taxation does not define absolute emission limits, it can be considered a weak mechanism to control emissions which aims at monetizing environmental pollution and thereby finding a compromise between economic growth and environmental protection. Consequently, carbon taxation by itself does not seem to be the mechanism which can solve the GHG emission problem and is therefore graded a 1.

The greatest *incentive for participation* of carbon taxation is the strong focus on flexibility. By agreeing on carbon taxes, countries would prevent inflexible and unfeasible arrangements which would be contrary to their economic development. Especially for large developing countries, such an agreement would make it possible to become part of the climate regime without having to sacrifice economic growth. Furthermore, carbon taxation would generate revenues which could be used for adaptation projects in developing countries. Thus, this approach provides high incentives for participation and consequently this criterion is graded a 4.

The main equity principle of carbon taxation is the polluter pays principle. Being the basic principle for international environmental law, the polluters pay principle has a high acceptance as it is considered fair that the GHG emitters should be held responsible for their environmental pollution. Another plus of this approach is its high transparency as it automatically reveals the compliance costs and is easy to be implemented. It can be considered unfair though that this historical responsibility is left out of consideration as all countries are held responsible in the same way. This problem can be solved by establishing a gradual inclusion of developing countries into the regime. In sum, the *clarity of equity principles* of the taxation approaches is graded a 5.

The negotiation process requires an agreement on the level of taxation. It might be difficult to reach such an agreement as, obviously, countries with high fossil fuels consumption would favor lower taxes and vice versa. Consequently, the process of the tax rate negotiations is expected to be complicated and to face the possibility of agreeing on the lowest common denominator. A way to address this problem is to establish a voting mechanism to determine the tax rates as it is suggested in the 'Harmonized Carbon Taxes Approach' (Nordhaus, 2001). Another problem might arise when developing countries claim a transition period for themselves in order to reflect the principle of historical responsibility. Some countries might also ask for sectorial exceptions from the taxation. All these issues have to be resolved during the negotiations which are not likely to be easy. Therefore the criterion *simplicity of the negotiation* process is graded a 3.

The taxation approaches have a clear focus on *flexibility*. They are therefore graded with a 5 as the highest mark with regards to this criterion. There are no targets and timetables and the economic actors inside the countries are free to decide how much CO_2 they are going to emit, while compensating the emissions with the payment of the tax. This allows a high consideration of the specific circumstances of a country. The same high grade is given to the criterion *certainty about costs*, as the taxation per unit of emissions allows the exact determination of compliance costs.

Carbon taxation is easily to be implemented by adapting national legislation. It is possible that an already existing international organization such as the IMF would implement the monitoring of the taxation (Bodansky, 2004). Furthermore, there is a need for a new institution to manage and allocate the tax revenues. The criterion *ease of implementation* is graded a 4.

3.2.8. PAM Focussed Approach

The PAM focused approaches put an emphasis on the input of countries consisting of concrete PAMs. They elaborate a list of concrete emission reduction measures and projects for every country individually. It is therefore a bottom-up approach which starts with what each government is able and willing to deliver rather than defining top-down goals (Victor 2011). Targets and timetables at maximum play a minor role in the PAM approaches. They can either not define any targets at all, as it is the case in the 'SD-PAM' approach (Winkler et al., 2002), the 'Climate Marshall Plan' (Schelling, 2002) and the 'Portfolio Approach' (Benedick, 2001), or formulate only voluntary and not burdensome targets such as in the 'Broad but shallow beginning' approach (Schmalensee, 1996).

It is possible to combine PAM approaches with agreements on technology transfer in order to facilitate the implementation of certain policies and projects for developing countries. David G Victor suggests a bidding procedure about mutual commitments where countries would negotiate policy packages consisting of concrete measures, financial contributions, technological exchange, and eventually emission caps (Victor, 2011: 243). The 'Climate Marshall Plan' approach envisions the establishment of an institution which would deal with technology exchange and would help finance energy-efficient and decarbonized technologies in the developing world (Schelling, 2002: 8). A similar direction is taken by the 'Portfolio approach' which aims at introducing a carbon tax in order to ensure sufficient and stable funding for a 'technological revolution´ (Benedick, 2001).

Financial commitments play a major role in almost all PAM approaches. The 'Human Development Goals' approach suggests a progressive taxation of *luxury emissions* in order to create a financial transfer flow from developed to developing countries. The 'Dual Track' approach aims at creating an Adaptation Fund and an Emission Mitigation Fund, both of which would be financed to the greatest part by developed countries (Kameyama, 2003).

Generally, the PAM approaches are universal and therefore compatible with the UNFCCC process, as every country is able to participate as long as it agrees to implement domestic PAMs. However, an agreement could as well be reached in negotiations with fewer participants as it is suggested by David G. Victor (Victor, 2011: 210-215).

Evaluation

With regards to the *environmental effectiveness* of the PAM approaches, there are positive and negative aspects to be mentioned. On the one hand, bottom-up approaches abandon binding targets and timetables and therefore do not guarantee that safe GHG levels in the atmosphere will be reached in the future. They rather allow countries to determine their appropriate mitigation path by themselves and therewith make room for tradeoff considerations between economic growth and GHG mitigation. On the other hand, the discussion about concrete policies and measures allows a more concrete debate about what can be done by each country in order to mitigate CO_2 emissions. This could be more environmentally effective than an agreement on symbolic targets and timetables. The environmental effectiveness is therefore graded a 3.

The incentives for participation are graded a 3 as well. By agreeing on concrete PAMs in international negotiations, countries become obliged to implement the respective policies, which reduces their degree of flexibility. On the other hand, the PAM approach would prevent rigid binding targets and make it more likely for countries to comply with the regime. Furthermore, the strong linkage of the approaches with potential mechanisms for technological exchange and financial support creates further incentives for participation.

The focus on PAMs for the participating countries tries to ensure that no country is assigned unfeasible targets. Therefore the ability to pay principle can be considered the main equity principle of PAM approaches. Ability to pay is an appropriate principle for climate negotiations as it makes the success of a climate regime more likely. However there might be different interpretations present in the negotiation process on what each country is able to deliver. Therefore – unlike for example in the case of the principle of historical responsibility – there is not one single burden allocation among countries which results from the application of the principle. Rather there are many possibilities to interpret the principle and to determine which countries have to implement which PAMs. Consequently, the eventual distribution of mitigation commitments would depend on the negotiation process. This variety of allocation possibilities goes at the expense of the transparency of the negotiation process and thus leads to a downgrading of the *clarity of equity principles* to a 3.

The focus on concrete policies and measures can make negotiations more complicated as – compared to the usual negotiations about targets and timetables –

it adds many additional issues and topics to the negotiations. Also, the assessment of the appropriateness of PAMs requires the collection, preparation and interpretation of a large amount of economic data which is a complicated and time-intensive process. On the other hand, the variety of new issues entering the negotiation process can also give room for compromise finding and might be an instrument to find a way out of the current negotiation gridlock. There are therefore both, aspects of the PAM approaches affecting the *simplicity of the negotiation process* in a positive way as well as aspects affecting it negatively, which leads to the grading of the criterion with a 3.

The negotiation about a wide range of PAMs provides countries with the opportunity to find a realistic commitment package which reflects what the country is able and willing to deliver according to its specific political and economic circumstances. Therefore, the approach offers a high *flexibility* in defining the commitments. Once the commitments are defined, however, the approaches do not offer any flexibility in the compliance and countries have to implement the commitments that are agreed upon. Due to the high flexibility in the definition of commitments, the criterion of flexibility is graded a 4.

The high flexibility in the definition of commitments leads to a high *certainty about costs* which is graded a 5. As countries get assigned with a list of policies and measures to be implemented, they would be able to exactly assess the costs of their compliance.

The basic idea of the PAM approaches is to provide realistic commitments which can be implemented by the countries. Therefore the criterion *ease of implementation* can be considered to be fulfilled with regard to the feasibility of the commitments. However the criterion is downgraded as the definition of targets requires the collection of much economic data to assess the feasibility of the policies and measures for the countries. Furthermore, a high degree of monitoring and reporting is necessary in order to control whether and to what extent the PAMs are implemented. Therefore the PAM approaches are graded with a 4 with regards to their *ease of implementation.*

3.2.9. Technology Approach

Technology approaches address the GHG emission problem by defining technological standards and attempting to replace older ‘dirty’ technologies by

modern, energy-efficient ones. The assumption of these approaches is that a certain innovation rate in technologies in the long term can lead to the disappearance of the problem of global warming or at least significantly slow it down. Therefore, the technology approaches do not define binding emission reduction targets but rather attempt to reach an agreement on energy-efficiency standards and technological exchange.

This can be reached in a top-down direction as in the case of the 'Technology Backstop Protocol Approach' (Bodansky, 2004: 56) and the 'Technology Centered Approach' (Barrett, 2003). The former aims at reaching an international agreement on specific technology-based targets such as for example the commitment of Annex I countries to introduce technologies for carbon capture and storage in all new fossil fuel plants. The latter consists of an orchestra of treaties addressing technology issues such as international R&D protocols for fostering a collaborative research on new technologies, agreements on technology standards and a multilateral fund to spread new technologies to developing countries.

It is also possible to install a climate regime based on technology standards from a bottom-up direction. The 'International Agreements on Energy Efficiency' approach starts with countries developing own energy efficiency standards for the main appliances in the residential and transportation sector. This is backed by an international agreement on efficiency level targets in the major emitting industries and the establishment of a global R&D fund (Ninomiya, 2003). The 'Portfolio Approach' focuses on the elaboration of national PAMs to promote technological development alongside to an international program for promoting technology transfer in developing countries (Benedick, 2001).

Having a universal nature, the technology approaches allow the inclusion of all countries and are therefore compatible with the UNFCCC framework. There is no emission trading mechanism foreseen as there are no binding emission reduction targets. While technology transfer forms the backbone of the approaches discussed in this chapter, most approaches envision the establishment of a financial mechanism to promote adaptation and to establish a global research and development fund. Different sets of criteria such as per capita income, historical responsibility, or the level of current emissions are used by different approaches to determine to what extent countries contribute to the fund.

Evaluation

With regard to the *environmental effectiveness* of technology approaches, it has to be stated that they are long-term oriented and have only very little mitigation effect in the short term. The fulfillment of this criterion is therefore graded a 1. Technological agreements are a good supplement to other approaches but it is not likely that they alone suffice to address the GHG emission problem.

The weak effectiveness of the approaches mainly results from the fact that the approaches in their general form do not define any binding targets, thereby maximizing the degree of flexibility of the participating countries. This high degree of flexibility leads to high *incentives of participation*. The incentives are furthermore increased as the approach promises technological modernization, innovation and economic growth for developing countries (Benedick, 2001), and the access to new markets for the developed countries. This criterion is therefore graded with a 5.

There does not seem to be a clear equity principle included in the technology approaches. At best, technological approaches can be subsumed under the principles of international cooperation and the faith in the market economy as they assume that once countries create favorable conditions for innovations and trade with energy-efficient technologies on an international level, the technological innovations would spread around the world, reducing the GHG emissions significantly. The eventual burden-sharing – with burden being defined as the technological or financial contribution of a country to the regime – depends on the allocation principle applied for this purpose. In a climate regime which is based on technology standards, ability to pay most likely would be the decisive principle. Altogether, the criterion *clarity of equity principles* is graded a 3.

The approaches move away from the ‘targets and timetables’ setting which formed the major obstacle of the UNFCCC process. This change of perspective increases the *simplicity of the negotiation process*. The high incentives for participation are another reason for the grading of the criterion with 5, the highest grade.

The abandonment of the targets and timetables conception makes the technology approaches very flexible. With regard to the grading of the *flexibility* criterion, one must differentiate between top-down and bottom-up approaches. The former reduce the degree of flexibility as they define efficiency targets in international negotiations without considering the particular situation of the countries and are therefore graded

with a 4. The latter allow for a bottom-up development of the technology standards regime based on what individual countries are willing to contribute. This enables the maximal consideration of the specific national circumstances and leads to the grading of the criterion with a 5.

It is only to a certain degree possible to assess the amount of governmental investment needed for the technological modernization of a country. As David G. Victor points out, the diffusion of technologies in the market cannot be directly controlled by the government and depends on various factors in the market economy (Victor, 2011: 52-57). There is thus no direct causality between a governmental policy and technological diffusion and the government can at the maximum create favorable conditions to indirectly support the diffusion. Nevertheless, the *certainty about costs* of the technology approaches can be considered to be higher than in the UNFCCC process, and the costs are likely to be lower. With regard to the evaluation of the criterion, a differentiation in top-down and bottom-up directions is necessary. Top-down targets allow a lower certainty about costs as they are not backed up by concrete governmental policies and should be graded a 3. Bottom-up targets, on the other hand, are based on governmental commitments for concrete policies and have therefore the same maximum certainty about costs as PAM approaches.

The *ease of implementation* of the technology approaches faces the mentioned problem of an only indirect causality between governmental action and technological diffusion. It is easy to adapt a respective law on technology standards but it remains uncertain whether or not the governmental policies would be sufficient to cause the diffusion of modern technologies needed for the compliance with the technological standards. As with the criteria before, it is suggested to differentiate between bottom-up and top-down directions – with top-down approaches being more difficult to implement (3) than bottom-up approaches (4).

3.3. Categorization Table

Approach	Environmental Effectiveness	Incentives for Participation	Clarity of Equity Principles	Simplicity of Negotiation Process	Flexibility	Certainty about Costs	Ease of Implemet ation
Stronger Country Differentiatio n	**4**	**2**	**5**	**3**	**3**	**3**	**3**
Agreement on a General Principle	**5**	**1**	**5**	**2**	**2**	**1**	**3**
Long Term Allowances	**1**	**3**	**N/A**	**4**	**5**	**5**	**1**
Club Approach	**4**	**3**	**2**	**3**	**1*** **3****	**1*** **3****	**3**
Sectorial Approach	**2**	**3**	**3**	**3**	**4**	**4**	**3**
Carbon Trading	5*** 3****	2*** 3****	N/A	2	4	4*** 5****	3
Taxation	**1**	**4**	**5**	**3**	**5**	**5**	**4**
PAM Focussed Approaches	**3**	**3**	**3**	**3**	**4**	**5**	**4**
Technology Approach	1	5	3	5	4***** 5******	3***** 5******	3***** 4******

Table 3 Categorization Table

(green=good performance, yellow=medium performance, red=weak performance; *= club approaches with legally binding targets and timetables, **= club approaches with PAMs, *= carbon trading approaches without a safety valve, ****= carbon trading approaches with a safety valve, *****=technology approaches with top-down target setting, ******=technology approaches with bottom-up target setting)**

4. Interpretation

4.1. Patterns

The analysis of the categorization table reveals one main evaluation pattern. As initially presumed, an inverse relationship between the criteria environmental effectiveness and incentives for participation can be observed. Approaches displaying a high environmental effectiveness tend to offer little incentives for participation. This is the case with the approach groups 'Stronger country differentiation', 'Agreement on a general principle' and 'Carbon Trading without a safety valve'. Conversely, approaches offering countries high incentives for participation such as 'Taxation', 'Long term allowances' and 'Technology Approach' usually come at the expense of the environmental effectiveness of the approach.

The reason for this reverse relationship is evident. Environmentally effective approaches require clear and binding commitments for concrete political actions of the respective countries. These commitments usually bear high compliance costs and their binding nature reduces the flexibility of the countries and hence their political and economic space to pursue goals in other policy fields. Consequently the approaches which are best graded in terms of their likely environmental effectiveness[6] stick to the structure of the UNFCCC process of defining legally binding emission targets and timetables. As the name suggests, this applies especially for the groups 'Stronger country differentiation' and 'Agreement on a general principle' which attempt to define a framework for the political realization of the UNFCCC structure. This can happen either by agreeing on a general burden-allocation principle or by implementing a greater differentiation among countries. The same applies to carbon trading models. While indeed increasing the degree of flexibility by providing countries with the opportunity to buy additional emission allowances, the structure of carbon trading models requires the definition of binding emission targets and timetables as their basic premise.

It is therefore not surprising that the approaches 'Taxation', 'Long term allowances' and 'Technology Approach', which go beyond the UNFCCC structure, offer high

[6] Note that – as discussed in the criteria chapter – environmental effectiveness describes the ambitiousness of the method chosen and abstracts from other factors which influence the eventual outcome of the approach.

incentives for participation. ‘Technology approach’ can be described as a soft policy measure[7], which focusses on providing a positive incentive for the cooperation of countries. Accordingly, in a climate regime focusing on technology transfer, most countries can only benefit from their engagement in the regime. The lack of coercive mechanisms and emission reduction targets minimizes the possibility that their cooperation may lead to a disadvantage for them. Although introducing a financial fee for GHG emissions, taxation approaches do not define an emission limit either, allowing countries to decide on their own how much GHG they are willing to reduce. The high flexibility which is offered thereby leads to a high grading of the *incentives for participation* criterion and qualifies taxation to be called a soft policy measure, as well. Finally – in spite of operating with emission targets – long term allowances raise the short term flexibility of countries by postponing the issue of target enforcement into a distant future. With regard to the short or medium term, it is therefore also possible to classify ‘Long term allowances’ as a soft policy measure. As described above, the three soft policy measures offer high incentives of participation. However, the high grading in this criterion comes at the expense of their environmental effectiveness which is graded with the lowest mark in all three cases. Hence, it can be stated that the less binding, enforceable, short-term oriented and concrete an emission reduction measure is, the smaller is the environmental effectiveness of the approach.

As flexibility is an important aspect in assessing the incentives for participation offered by an approach, the analysis above implies a similar inverse correlation between the criteria of *environmental effectiveness and flexibility*, as this is the case in the three previously discussed approach groups ‘Taxation’, ‘Long term allowances’ and ‘Technology Approach’. Also, the ‘Agreement on a general principle’ approach displays an inverse relationship between environmental effectiveness and flexibility. Here a high level of environmental effectiveness goes along with a low level of the approach`s flexibility. In the case of the sectorial approach, the inverse relationship between the two criteria is observable as well, yet slightly weaker, as the environmental effectiveness is graded a 2, while the *flexibility* criterion is evaluated with a 4.

[7] For the purpose of this work, *soft policy measure* is defined as a political mechanism which does not focus on legally binding targets and enforcement mechanisms.

There are however three groups of approaches for which this relationship is not applicable. Carbon trading models have an environmental effectiveness grade of 5 or 3 respectively, depending on whether or not a safety valve mechanism is provided. At the same time the possibility of buying additional allowances on the carbon market leads to a high flexibility of the regime as well, which — in mechanisms without the safety valve – however does not result in increased incentives for participation. The 'Stronger Country Differentiation' approach aims at keeping the high environmental effectiveness of the UNFCCC structure with its binding and short-term oriented nature and at the same time increasing the flexibility for participating countries by defining more groups with more differentiated packages of commitments. Therefore, 'Stronger Country Differentiation' approaches have a high environmental effectiveness grade of 4 and a medium flexibility grade of 3. Eventually, PAM approaches offer a medium environmental effectiveness of 3 which goes along with a higher flexibility due to the bottom-up definition of appropriate policies and measures.

As this paper defines flexibility as the degree to which the agreed emission reduction measures can address the specific economic circumstances of countries, a high flexibility allows a country to better assess its compliance costs and promises the definition of feasible commitments. Consequently, a strongly positive correlation between the criteria flexibility and certainty about costs is observable. With the exceptions of 'Agreement on a general principle' and 'Technology Approach', where the grades differ by 1, both criteria were evaluated equally for all approaches.

Finally, there exists a correlation between the criteria *incentives for participation* and *flexibility* /*certainty about costs*. The approaches 'Long Term allowances', 'Taxation', and 'Technology approaches with bottom-up targets' have high grades in both of these criteria, while the 'Agreement on a general principle' offers the lowest grades in the respective criteria.

4.2. Combinations

With the inverse relationship between the criteria *environmental effectiveness* and *incentives for participation*, the analysis in the previous chapter revealed the main problem which has to be solved by every climate regime. In order to effectively mitigate the anthropogenic GHG emissions into the atmosphere, any successful climate agreement has to have a high *environmental effectiveness* and at the same

time provide enough incentives for countries to participate in the regime. The previous analysis demonstrated that none of the discussed approaches by itself is able to resolve the contradiction between these criteria. Either, one criterion is ranked with a high grade while the other is ranked with a low grade[8], or both criteria have medium to low grades[9].

The failure of one approach alone to resolve the contradiction between the criteria environmental effectiveness and incentives for participation creates the need to consider possible combinations of elements of the previously discussed approaches. For this purpose, it is first required to determine which combinations between the approaches are generally possible. An overview about possible combinations is provided in table 4.

[8] Such as with the approaches „Stronger Country differentiation“, “Agreement on a general principle”, “Long Term Allowances”, “Carbon Trading without a safety valve”, “Taxation” and “Technology Approach”.
[9] As in the case of the approaches “Sectorial Approach”, “Carbon Trading with a safety valve” and “PAM focused approaches”.

Approach	Stronger Country Differentiation	Agreement on a general principle	Long Term Allowances	Sectorial Approach	Club Approach	Carbon Trading	Taxation	PAM focused approaches	Technology approach
Stronger Country Differentiation									
Agreement on a general principle									
Long Term Allowances									
Sectorial Approach									
Club Approach									
Carbon Trading									
Taxation									
PAM focused approache									
Technology approach									

Table 4 Combinations of the approaches

(green= easily combinable, yellow= conditionally combinable, red= not combinable)

The table makes it apparent that the approaches **Taxation** and **technology approach** can be considered *supplemental*, as they do not contradict any other approach groups. Hence elements of taxation and technology transfer can occur in every possible combination of approaches. It is also evident that almost all approaches can be either implemented in a universal setting or under a **club approach**. The club approach is only incompatible with the UNFCCC process approaches due to their universal nature. The **Stronger country differentiation approach** contradicts the `Agreement on a general principle' approach as the former explicitly allows the application of different principles for the burden sharing in different groups while the latter only allows the application of one general principle for all countries. As the UNFCCC process generally defines rather short term commitments, the combination with long term allowances would be only possible for country groups which do not have targets and timetables commitments. Same holds

for possible combinations of sectorial approaches and PAM focused approaches which can be applied as a target definition method for particular groups of countries. The **Agreement on a general principle** approach is mainly focused on the strict implementation of the UNFCCC structure and does not allow any deviations from a top-down setting of targets and timetables for all participating countries. This approach is therefore not compatible with any other approach with a different form of target setting and target definition. This limits its combination options to 'Carbon Trading', 'Taxation' and 'Technology approach'. Apart from the already mentioned combinations[10], the **Long Term Allowances Approach** can be applied as a long-term addition to short-term oriented PAM focused approaches. Furthermore, it is to a certain degree possible to combine this approach with the carbon trading- and sectorial approaches. However the combination with carbon trading might not work well in the short-term as the long-term allocation of emission entitlements would prevent any scarcity which is an important precondition for trading. In combinations with the latter, it is possible to define long-term emission allowances on a sectorial basis. As **Sectorial Approaches** define emission targets for a country`s sector and not for its whole economy, combinations with carbon trading approaches can only be implemented on a sectorial basis. The role of binding targets and timetables as a precondition for allocation of emission allowances makes the combination of **Carbon Trading** with PAM approaches – which do not define targets and timetables but rather focus on the input of concrete policies and measures for mitigation – difficult to imagine.

Table 4 defines the room for the combinations of the discussed approaches. Taking into consideration the high scores of the UNFCCC approaches [11] in the environmental effectiveness criterion, one possible combination would be to maintain the UNFCCC structure and to combine it with other approaches in order to increase the incentives for participation. This could be reached by introducing elements of the 'Technology Approach' to the UNFCCC regime, thereby promising developing countries a technological modernization of their industrial and energy sector in return for their participation in the climate regime. It is plausible that a well-designed system for technology exchange could indeed increase the incentives for participation in a UNFCCC structure. However, an important precondition for such

[10] The combinations which were already mentioned in the discussion of the combination prospects of previous approaches will not be mentioned twice.
[11] The Term 'UNFCCC approach' is an umbrella term for the two approaches `Agreement on a general Principle´ and 'Stronger Country differentiation'.

an increase in the incentives for participation is that the regime implements a stronger differentiation among countries and does not define targets and timetables for every participating country. Therefore, the approach 'Stronger country differentiation' should be preferred over 'Agreement on a general principle'. Additionally, a financial mechanism could be implemented in order to support developing countries in meeting their commitments under the regime and to finance their technological modernization. As a method for the organization of financial transfers from developed countries to developing countries, a carbon tax could be implemented as a further option for a combination. The collected funds would be managed by an international institution and could be for example used to finance technological patents for developing countries. Furthermore, a combination with carbon trading approaches could be applied in order to increase the flexibility for the countries assigned with targets and timetables.

A fundamentally different method to address the problem of lacking incentives for participation is to abandon the 'targets and timetables' structure of the UNFCCC process and to concentrate on approaches which offer a high degree of flexibility and high incentives for participation. This would be the case with the combination of the three approaches 'Taxation', 'Technology Approach' and 'Long Term Allowances'. 'Long Term Allowances' approaches have a long-term focus, 'Technology Approach' promises mitigation effects in the medium term and the implementation of a carbon tax leads to emission reductions in the short term. As mentioned above, each of the three approaches has to be placed opposite to the UNFCCC process in the *environmental effectiveness* vs. *incentives for participation/flexibility* dichotomy. The high performance in the latter criteria goes at the expense of the former. Therefore, contrary to the first combination approach described above, the incentives for participation are already given[12] and the role of the combinations is to increase the environmental effectiveness. While each of the three approaches alone cannot be considered to be environmentally sufficient, it could be assumed that the additive effect of the three approaches together would indeed increase the environmental effectiveness of a thusly established climate regime. In order to further increase the environmental effectiveness in the short term,

[12] This is true for 'Technology Approach' and 'Long term Allowances' and only partly true for 'Taxation'. The incentives for participation of the latter can be derived from higher flexibility and the chance to avoid more rigid commitments.

it is also possible to include the ‘PAM approach’ – another approach which takes the emphasis away from targets and timetables towards the increase of flexibility.

The question of political realization did not play a role yet in the above discussion of the two possible approach combinations. In fact, objections may be raised that while it is already difficult enough to agree on one approach, combinations of two and more approaches would significantly increase the complexity of negotiations and, with it, decrease the probability of reaching an agreement. Hence, even if – in the first example for combinations based on the UNFCCC structure – countries manage to agree on the rules for the differentiation of countries and the corresponding targets for every group, disagreement may emerge with regard to the concrete design of technology transfer mechanisms or the level of carbon taxation.

When analyzing the motivation behind the addition of the supplementary approaches to the first combination example based on the UNFCCC structure, it becomes apparent that adding mechanisms for technology exchange and financial transfers via carbon taxation primarily increases the incentives for participation for developing countries at the expense of the industrial countries. While the inclusion of large developing countries is an important premise for the success of the climate regime, it has to be acknowledged that the consent of industrial countries is at least of the same importance and its withdrawal would terminate every effort to build such a regime. Consequently, the question of how much industrial nations are willing to pay for the inclusion of the developing countries might become crucial for the success of the regime.

It is beyond the framework of the present paper to provide an assessment of the political feasibility of the discussed combinations. As described, combinations of approaches can complicate the negotiations. But on the other hand, as they also increase the number of possible compromises, they can contribute to the reaching of an agreement as well. It is up to a detailed analysis to determine which one is the dominating effect in which particular combination of approaches. The presented combinations are therefore not to be considered as policy advices but rather as an outline of how it might be possible to overcome the present negotiation gridlock by combining elements from different policy approaches.

4.3. Thinking outside the box

Despite all the differences which were discussed in this paper, all approaches reach a general consensus in two aspects. The first commonality is that all the approaches primarily focus on reducing GHG emissions into the atmosphere. The UNFCCC process defines the two degree goal as the benchmark for a safe warming (UNFCCC, 2009) which is associated with a GHG concentration of about 350 – 450 ppm (Victor, 2011: 47).

However, as the exact sensitivity of the climate to GHG is yet to be determined, it might be difficult to determine which GHG concentration is to be considered 'safe'. Furthermore, as David G. Victor points out, the 350-450 ppm goal seems to be rather symbolic, as already today's GHG concentrations are estimated to be at about 400 ppm (Victor, 2011: 47). In light of this scientific uncertainty and the obvious difficulties to reach an international agreement on GHG mitigation, an alternative for an international climate regime could be to shift the focus from *mitigating* to *managing* the anthropogenic GHG emissions. The latter requires the consideration of increased adaptation on the one hand and the implementation of geoengineering technologies on the other hand.

It speaks in favor of focusing on adaptation rather than on mitigation that – with regard to the high dependency of modern economies on fossil fuels – the realization of an international adaptation mechanism appears to be more likely than an international agreement on the GHG emission reduction. Investing political and financial efforts in adaptation might be considered more effective and goal-oriented than attempting to mitigate emissions in a competitive international atmosphere. Such a view accepts global warming to a certain degree and attempts to manage its consequences. An example for this approach is not to hamper the worldwide economic growth by emission targets but to oblige the major polluters to provide a certain percentage of their GDP for adaptation projects. It seems likely that in the tradeoff between controlling emissions and investing in adaptation (Victor, 2011: 48), adaptation will gain importance. On the other hand, critics of the adaptation approach claim that adaptation to an unhampered global warming would become much more expensive than what the mitigation of GHG emissions is assumed to cost (Romm, 2010).

Geoengineering is another way to manage the GHG concentration in the atmosphere. Being defined as "[…] interventions in the climate system by deliberately modifying the Earth's energy balance to reduce increases of temperature" (Royal Society , 2009), geoengineering technologies can be broadly classified into *Carbon dioxide removal techniques (CDR)* and *solar radiation management techniques (SRM)*. The former aims at removing CO_2 from the atmosphere by using various techniques such as ocean iron fertilization, atmospheric CO_2 scrubbers, in-situ carbonation of silicates or the chemical enhancement of alkalinity in oceans. The approach of the latter is to offset the greenhouse effect by reducing the energy absorption of the earth. This could be done by influencing the surface, desert or cloud albedo, spraying aerosols into the stratosphere in order to scatter more solar radiation back or even positioning sun shields in space for the reflection of solar radiation (Royal Society , 2009). It would go beyond the framework of this paper to discuss the political, judicial and ethical implications of geoengineering. However, as pointed out by Patrick Toussaint in his discourse on the international regulation of geoengineering, further research into the environmental impacts of such technologies may itself lead to significant environmental hazards (Toussaint, 2012). With regard to the global implications of even further research on geoengineering, there is little doubt on the need for a global regulatory framework in this field.

The second aspect shared by all approaches is that they address climate change as a separate issue rather than taking a more holistic position. Although – as one of the major future challenges for mankind – climate change seems to deserve a separate political framework, it can be argued that due to the high interrelation of climate change with the topics of global economy and development, a too narrow approach would lose potential for synergy effects. As an example for such possible synergy effects, *co-benefits* between the policies on air pollution and climate change should be mentioned (Wagner, 2012). These two fields are connected to each other, primarily by their sensitivity for the burning of fossil fuels. Therefore, climate policy can lead to a significant improvement of air quality and vice versa. It thus makes sense to consider co-benefits when designing a policy on global warming and to pursue an integrated approach which at the same time addresses climate change concerns as well as the local air pollution problem. The mentioned advantages seem to call for a holistic atmospheric policy approach rather than for fragmentation.

Similar co-benefits may arise when combining adaptation with development cooperation, and GHG mitigation with international trade and investment policies. Abandoning the separation of the global warming policy and putting it in the context of other global issues would mean giving up the idea that global warming is an environmental problem and regarding it as what it is: a multifaceted societal problem.

5. Conclusion

This paper analysed the political alternatives to the current UNFCCC process with the aim to provide a systematization and categorization of the proposed alternative approaches.

The first part of this paper provided a description of the status quo situation in climate diplomacy. Chapter 2.1 presented the global dimension of the climate change issue and highlighted the fact that this topic is not merely an environmental problem but is rather closely interconnected with the areas of economics, geopolitics and ethics. Furthermore, this chapter pointed to the problems of negative externalities, time inconsistency and free-riding that constitute the starting position of climate policy and significantly complicate the reaching of an agreement in the negotiations. Chapter 2.2 then analyzed with the UNFCCC process the approach which was taken by the international diplomacy so far to address the climate change issue. It has been demonstrated that in doing so, the UNFCCC process oriented itself on the role model of the 'Montreal Protocol Approach'. However, the latter's three steps structure did not prove to be the appropriate mechanism for the climate change problem. As a consequence, the effectiveness of the UNFCCC process was significantly hindered by the problems of a too broad table, the inflexibility of the methods and a lack of incentives which were analyzed in the respective chapters of this paper.

After having described the initial situation and the shortcomings of the UNFCCC process in chapter 2, this work proceeded with the analysis of the alternative approaches. Chapter 3.1 scrutinized the criteria required for such an analysis. In doing so, a differentiation has been made between descriptive criteria on the one hand and evaluative criteria on the other hand.

Both types of criteria have been applied in chapter 3.2 in order characterize and evaluate the nine groups of alternative approaches: 'Agreement on a general

principle', 'Stronger country differentiation', 'Long term allowances', 'Club approach', 'Sectorial approach', 'Carbon trading', 'Taxation', 'PAM focused approach', and 'Technology approach'. The result of this analysis was presented in chapter 3.3 in form of a categorization table which compares the approach groups according to their performance in the evaluative criteria.

Based on the preceding categorization and evaluation of the approaches, chapter 4 explored the possibilities for the combinations of the approaches. In order to derive the need for combinations, chapter 4.1 examined the patterns in the categorization table of chapter 3.3. The most obvious pattern identified is the inverse relationship between the criteria *environmental effectiveness* and *incentives for participation*. Approaches which perform well in the former criterion are graded with a low grade in the latter criterion, and vice versa. With this main pattern in mind, chapter 4.2 suggested two directions for combinations to resolve this contradiction – the first having the UNFCCC structure as its core and the second being based on the combination of three flexible approaches with high incentives for participation. Finally, chapter 4.3 shed light on further alternatives for dealing with climate change beyond the consensus of the analyzed approaches. In this context a shift of attention from mitigating to managing anthropogenic GHG emissions and the possibilities of adapting a more holistic approach by linking the climate change topic with other issues were discussed.

This paper provided a categorization of possibilities for designing a future climate regime after the UNFCCC process got stuck in a gridlock. It seems likely that in order to reactivate the climate negotiation process, basic features of the pursued approach need to be changed. The present work functions as an analytical overview by pointing out possibilities for the inclusion of alternative elements into the design of the climate regime, rather than implementing a detailed micro-level analysis. Every particular approach mentioned in this paper therefore deserves its own in-depth analysis about the perspectives, parameters and consequences of its application in a global climate regime.

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