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The Clean Development Mechanism – Experiences and Lessons for Ecologic Integrity and Sustainable Development

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List of Abbreviations

AAU	Assigned Amount Unit
AWG-KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
BAU	Business As Usual
CDM	Clean Development Mechanism
CDM EB	Clean Development Mechanism Executive Board
CER	Certified Emission Reduction
CH_4	Methane
COP	Conference of the Parties
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
DNA	Designated National Authority
DOE	Designated Operational Entity
EUA	European Union Allowance
EC	European Commission
EI	Ecologic Integrity
EIT	Economies in Transition
ERU	Emission Reduction Unit
ETS	Emission Trading Scheme
EU	European Union
FDI	Foreign Direct Investment
GS	Gold Standard
GWP	Global Warming Potential
HFC-23	Fluoroform
IRR	Internal Rate of Return
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
KP	Kyoto Protocol to the United Nations Framework Convention on Climate Change
LDC	Least Developed Countries
MAC	Marginal Abatement Costs
NH_4	Ammonium

N_2O	Nitrous Oxide
PDD	Project Development Document
QELRO	Quantified Emission Limitation and Reduction Obligation
POA	Programme Of Activities
SD	Sustainable Development
SIDS	Small Island Development States
SSA	Sub-Saharan Africa
UBA	Umweltbundesamt (German Environmental Agency)
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNWCED	United Nations World Commission on Environment and Development
US	United States of America
VER	Voluntary Emission Reduction
WWF	Worldwide Fund for Nature

1 Introduction

Experiences from the first years of the Kyoto Protocol have revealed flaws in design. Moving towards the end of the first commitment period, there is particular dissension regarding the success of the Clean Development Mechanism (CDM) as an integral part of the KP. Many experts see the CDM as a tremendous success in mobilizing capital to support emission reduction in developing countries. According to estimations of the World Energy Outlook, the need for capital flows from industrialized to developing countries to take them to a low-carbon development path has raised to the amount of $ 1 trillion until 2030; having so far generated more then € 9 billion of investments in more then 3000 projects, supporters see the CDM as the central building block for generating the huge financial needs (Butzengeiger-Geyer et al., 2010).

As this paper shows, just looking at these indeed impressive numbers obscures severe shortcomings. Consequently, an in-depth assessment of the CDM analyzes its effectiveness and efficiency in achieving its individual targets; in addition to the superior ecologic target of emission reduction, the CDM is supposed to generate Sustainable Development (SD) impacts in developing countries. After a brief overview of international climate policy in chapter 2, chapter 3 describes the CDM’s framework as well as involved stakeholders and its interplay with carbon markets. Laying the theoretical groundwork for this paper, section 4 illustrates that in theory the CDM is capable to achieve a given ecologic target efficiently in a static model. From a dynamic perspective however, the CDM does not show a convincing efficiency. Furthermore, section 4 defines the preconditions for Environmental Effectiveness (EE) in regard to the CDM.

Section 5 subsequently addresses the CDM’s practical implementation by evaluating its development and the experiences of involved actors. The central finding drawn from the assessment is that the CDM has not been up to reach its different objectives simultaneously. Especially SD impacts seem to have been disregarded in the vast majority of CDM projects; both the geographical distribution and distribution of project types reveal a disadvantageous balance for regions and projects particularly desirable from the SD perspective. Moreover, the effectiveness in actually reducing global Greenhouse Gas (GHG) emissions seems to be doubtful for a substantial number of projects. The source of these fundamental shortcomings of the CDM can be mainly found in its underlying arrangements and procedures. Although the CDM has a multidimensional target system, it does not create appropriate incentives for participants to pursue these targets in a balanced way; while there is a value for emission reductions from the generation of emission certificates, no monetary value is given to additional SD criteria. Since there is a series of trade-offs between effectiveness and efficiency, this incentive scheme results in private actors seeking nothing but the generation and purchase of emission certificates at lowest costs. Hence, efficiency considerations are in general given preference over effectiveness. The fundamental objective of climate protection combined with further desirable impacts for developing countries has often fallen by the wayside. But failure has also occurred at public level. As the analysis in section 5.5 of the EU Emission Trading Scheme (EU ETS) reveals, EU governments have failed in promoting stable signals and incentives to the CDM through a massive over-allocation of emission allowances to polluters.

But what are the consequences from these findings for the future climate protection process? As former head of the United Framework Convention on Climate Change (UNFCCC) Yvo de Boer recently declared in a newspaper interview, "[…] we have to admit the Kyoto Protocol is dead." (TAZ, 2011). After the definite denials of several global emitters to participate in a second commitment period, he does not see any sense in a continuation with the remaining countries, accounting for not even 20 percent of global emissions. And also Christiana Figueres, current head of the UNFCCC in view of the next international climate conference in Durban believes that "[…] this planet is not going to be saved by any big bang agreement." (ThinkProgress, 2010). Still, despite of all its weaknesses it is of all things the CDM that has already been decided to be continued in the post-Kyoto era, even in the more and more likely absence of a successor protocol (GIZ, 2011a). Most notably, the European Union (EU) has arrived at a unilateral agreement to further reduce their emission levels up to 2050 providing for a certain degree of future use of the CDM (Cames et al., 2011).

Consequently, a growing number of voices was raised requesting a reformation of the CDM to overcome the described shortcomings. As a result, various reform proposals have been elaborated and promoted by countries and international experts. Section 6 evaluates some of the most prominent and promising approaches. As it turns out, there are in fact possibilities to enhance the overall integrity and effectiveness of the mechanism. Key to foster a balanced pursuit of objectives accordingly lies in creating an adequate incentive scheme or obligations for participants as well as in establishing straightforward and standardized procedures restricting the scope for undesirable behaviour. The proposals in chapter 6 do not necessarily have to be established within the UNFCCC; as long as there will be demand for emission certificates from industrialized countries, these approaches can also be applied at different levels, no matter if at national, regional or sectoral level. A growing number of experts sees the future of climate protection in such a decentralized building block approach. As Robert Falkner, researcher at the London School of Economics sums up: "That is, I would argue, the future for climate negotiations. It is a second-best future but one we must accept as a fact." (AlertNet, 2011).

2 International Climate Policy – The UNFCCC and the Kyoto Protocol

The UNFCCC was adopted at the so called "Earth Summit" in Rio de Janeiro in 1992 with the objective of a "[…] stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."(UN, 1992). Entering into force in March 1994, the UNFCCC forms a binding agreement under international law that constitutes basic principles, institutions and procedures of international climate protection policy (Haensgen, p.16). To date, it has been ratified by 194 countries. These countries are separated in three different groups according to their varying roles and responsibilities (UNFCCC, 2011e).[1] In Art. 4.2b of the UNFCCC, Annex I Parties commit to an individual or joint reduction of GHG emissions to the levels of 1990. Emission reduction targets were further specified with the ratification of the Kyoto Protocol in 1997.

With the Kyoto Protocol (KP), a supplementary protocol to the UNFCCC was adopted in 1997 (UN, 1998). The objective in Art. 2 UNFCCC also applies for the KP, which beyond that defines the way in which this objective can be achieved. Ratifying the KP, Annex I Parties accepted binding emission reduction obligations for the first time. To date, 193 countries have ratified the KP, accounting for 63,7 percent of total GHG emissions of all Annex I countries in 1990 (UNFCCC, 2011e).[2] Art. 3.1 KP stipulates an aggregated reduction of six different GHG in Annex I countries in the first commitment period 2008-2012 of a minimal amount of 5 percent under the 1990 emission level.[3] To allow for the comparability of these GHG relating to their Global Warming Potentials, they are converted into CO_2-equivalents (CO_2e) that can be understood as the single currency of international climate protection (Endres, 2007, p.262). Emission reduction targets differ from one country to another. Annex B of the KP defines these so called Quantified Emission Limitation and

[1] Annex I Parties include mainly industrialized countries and Economies in Transition. Non-Annex I Parties are mostly developing countries. For a detailed listing of the composition of each group, see Annex II and III.
[2] The only signatory that has not ratified the KP is the United States.
[3] For a list of all 6 GHG, see Annex I.

Reduction Commitments (QELRO).[4] The individual QELRO add up to an overall reduction target of 5,2 percent under the base year level until end-2012 (UNFCCC, 2011c).[5]

One special feature of the KP is the establishment of several market-based instruments. In addition to domestic measures for the compliance with their QELRO, Annex I Parties have the possibility to make use of the flexible mechanisms constituted in Art. 6, 12 and 17 of the KP. These comprise the market-based mechanisms Joint Implementation and Clean Development Mechanism as well as the Emissions Trading. Due to the global impact of GHG, the place where GHG abatement measures are conducted is of no relevance to the atmosphere. Consequently, the flexible mechanisms concede Annex I Parties the flexibility to credit foreign emission reduction units against their domestic reduction targets (Haensgen, S.19f). The acquired emission reduction units are added to the buyer party's assigned amount (KP, Art 3.10-12).[6] The Emission Trading directed in Art.17 KP enables Annex I Parties that have emission reduction units exceeding their QELRO at their disposals, to sell these units to other Annex I Parties. This mechanism comprises both emission certificates distributed to each Annex I Parties and reduction units generated in the project based mechanisms (UNFCCC, 2011d).

Art. 6 KP specifies the flexible mechanism Joint Implementation (JI). JI allows Annex I Parties to acquire emission reduction units generated from emission reduction projects in different Annex I countries. These units are called Emission Reduction Units (ERU) and correspond to the reduction of one ton of CO_2.

The Clean Development Mechanism (CDM) as defined in Art. 12 KP in contrary enables Annex I Parties to acquire emission reduction units generated from emission reduction projects in Non-Annex I Countries. These units, like the ERU, represent the reduction of a ton of CO_2 and are called Certified Emission Reductions (CER).

Both market-based mechanisms belong to the concept of offsetting mechanisms (Rentz 1995, p.90). They differ in the arrangement of certain design elements but have correspondent economic functionality (Scharte, 2001, p.87). This paper focuses on the CDM being the central offsetting mechanism of international climate policy. According to current estimates, the CDM will have generated an amount of 2728 Million CER by the end of the first

[4] For a detailed overview of each Annex-I Party's reduction target, see Annex II.

[5] For member countries of the EU, a combined reduction target of 8% is defined in Annex B of the KP. To reach this target jointly, QELRO have been divided differently among the member states. The spectrum reaches from QELRO in Germany and Denmark of 21% to an allowance of additional emissions beyond the base year level of 27% in Portugal (UNFCCC, 2011c).

[6] Each Annex-I Party's assigned amount is calculated with its emission level and their individual QELRO as contracted in the KP.

commitment period (UNEP, 2011). Hence, it is of essentially higher relevance than the JI, which is expected to generate about 637 Million ERU until the end of 2012.Consequently, Wara and Victor (2008, p.9) unmistakably state: „If one wants to study offsets in the real world, one studies CDM".

3 Flexible Mechanisms - The Clean Development Mechanism

3.1 Target System

As described in the previous section, UNFCCC and KP have an explicit ecologic objective. Being an integral part of the KP, the CDM primarily has to measure up to this superior target (UN, 1998). In addition, Art 12.2 KP defines the particular purpose of the CDM. Accordingly the CDM is supposed to assist Annex I Parties in achieving compliance with their QELRO as well as serving Non-Annex I Parties in achieving SD. The first part of this objective is meant to provide support to the achievement of the superior ecologic target; giving Non-Annex I Parties the opportunity to achieve parts of their reduction obligations using a market mechanism is supposed to allow for enhanced efficiency (Endres, 2000). Section 4.2 gives an in-depth theoretical analysis of how the CDM is capable to increase efficiency of the global emission reduction process.

The second part of Art 12.2 KP on the contrary defines an additional target to the primary ecologic one; the CDM is meant to simultaneously make a contribution to SD in host countries. On the contrary to the emission reduction target, this second target is not further specified. Hence, to be able to make any statement about the effectiveness of the CDM in this regard, it is necessary to take a closer look at the concrete denotation of this concept. There has been a longstanding debate about the concept of SD in past decades. The so called Brundtland Report, published by the United Nations World Commission on Environment and Development (UNWCED) in 1987 defines SD as " […] a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs." (UNWCED, 1987, Art.30). At the World Summit on Sustainable Development in 2002, the significance of SD for the CDM was addressed and recorded in the Johannesburg Plan of Implementation. Accordingly, main indicators important for the CDM's success in promoting SD are, inter alia, the development of advanced, cleaner, more efficient and cost-effective energy technologies, an increase of the share of renewable energy supply and by doing so to achieve poverty eradication as well as an improved standard of living (UN, 2002, p.16). As can be seen, the concept of SD comprises benefits on different levels. Burian (2006) classifies possible SD impacts in three categories, namely ecological, social and economic aspects. Accordingly, a positive SD impact of an emission abatement measure can be defined as an improvement of at least one of these three categories without negative impact on any of the others. Following this definition, the condition for a positive SD impact evaluation of a CDM project is a Pareto Improvement (Burian, 2006). Table 1 gives an overview of SD indicators on each individual level.

Table 1: SUSTAINABLE DEVELOPMENT INDICATORS

SUSTAINABLE DEVELOPMENT		
Ecologic Development	**Social Development**	**Economic and Technological Development**
→ Air Quality → Water Quality and Quantity → Soil Condition → Other Pollutants → Biodiversity	→ Quality of Employment → Livelihood of the Poor → Access to Affordable and Clean Energy Service → Human and Institutional Capacity	→ Quantity of Employment and Income Generation → Balance of Payments and Investments → Technology Transfer and Technological Self-Reliance

Source: Own illustration based on Sutter (2003)

Obviously, the SD concept also contains ecologic indicators. Hence, there is a certain degree of overlapping between the SD objective and the goal of emission reduction. However, while the contribution of emission reduction projects to ecologic SD indicators like Air Quality is obvious, there is no implicit link to other SD indicators; whether a project has a contribution to e.g. the standard of living or the employment rate has to be assessed individually for each project. Still, the CDM procedures do not require any detailed assessment of a project's SD impact (Sterk et al., 2009). As illustrated in the project cycle below, the responsibility of assessing a project's SD contribution is solely borne by the host country; if it does not have objections, projects can be approved and carried out that do not feature any SD contribution or even produce harmful impacts (Butzengeiger-Geyer, 2010). Consequently, it is hard to make quantitative statements about the effectiveness of the CDM in achieving its SD target. Section 5 however shows that there is a series of trade-offs between the CDM's effectiveness regarding its SD target and efficiency. Section 6.5 illustrates a voluntary approach to closely assess the SD impacts of CDM projects, the so called Gold Standard (GS).

3.2 Governance and Project Cycle

The supreme body of the CDM at international level is the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol (COP). It decides on rules and modifications to the CDM and decides on the recommendations made by the CDM Executive Board (EB) (UNFCCC, 2011f). The EB has supervising function for operations and activities of CDM participants. It is furthermore responsible for the accreditation of independent third-party inspection authorities, so called Designated Operational Entities (DOE). Being either a domestic legal entity or an international organization, these are mainly responsible for validating potential CDM projects as well as verifying the actual emission reductions from a project and requesting the according issuance of CER from the EB (UBA, 2007, p.19). At national level, each country participating in the CDM is required to establish a Designated National Authority (DNA). Their main task is to approve projects by controlling the fulfilment of the required project criteria (UBA, 2007, p.14ff). To actually generate CER, each project has to pass through a standardized process. Table 2 illustrates the different steps of the CDM`s project cycle as well as the involved actors at each level.

Table 2: CDM PROJECT CYCLE

Project Phase	Involved Actors
Project Design	Project Participant
National Approval	DNA
Validation	DOE
Registration	EB
Monitoring	Project Participant
Verification	DOE
CER issuance	EB

Source: UNFCCC (2011f)

The first step of the Project Cycle consists in developing a standardized Project Design Document (PDD), containing detailed information about the project as well as the ecologic impacts and the methodology chosen for implementation. Together with a Letter of Approval containing information on the project’s contribution to SD, this document is submitted to a DOE for validation. Based on these documents, the DOE evaluates whether the project meets all requirements of the CDM as set out in the modalities and procedures and either rejects or validates the project. If deemed valid, registration of the project is requested from the EB. In case there are no objections from the EB, the project is registered as an official CDM project against a registration fee. Once registered, the project implementation can be initiated. Throughout the duration of the project, project participants are responsible for collecting data necessary to quantify the achieved emission reductions. A monitoring report containing this data has to be prepared and submitted to an arbitrary DOE which verifies whether the reductions claimed in the report have been actually achieved. The DOE subsequently writes a certification report indicating the certified amount of emission reduction achieved with the project, which is submitted to the EB. In a last step, if there are no objections against the certification report, the EB issues the requested amount of CER, charging another fee to cover administrative costs (UBA, 2007; UNFCCC 2011f).

Looking at the various steps of the project cycle, the number of actors involved and the necessary bureaucracy throughout the whole process, one can already assume associated time lags and high transaction costs. The resulting consequences for the CDM's performance are addressed in section 5.4.

3.3 Linkage between CDM and Emission Trading

To assess the CDM's effectiveness and efficiency, it is also necessary to take a look at the broader carbon market. Lecoq and Ambrosi (2007, p.134) define the carbon market as "[…] the sum of all transactions in which one or several parties pay another party or set of parties in exchange for a given quantity of 'GHG emission credits'".

Art. 12.9 KP identifies both public and private entities as permitted participants in the CDM, i.e. governments, private enterprises and civil society. While the KP only defines emission caps for Annex I Parties at national level, several signatories have implemented national and regional Emission Trading Schemes (ETS) applying emission limits to private installations and entities. In this way, governments are able to transfer the incentive for reducing emissions from public to private level (UBA, 2007, p.11). Since ETS are the main source of CER demand, they have vital impacts on prices and consequently the incentives for CDM projects. Having accounted for 70 percent of the overall demand for CER so far, the EU ETS is exemplified for the analysis of emission trading schemes in this thesis (World Bank, 2010, p.55). Not only has it been the largest ETS worldwide; with a further reduction commitment of 20 percent below 1990 levels until 2020 it is the only scheme having already fixed a notable reduction target for the post-2012 era and hence currently the only certain future source for CER demand (Cames et al., 2011). The EU ETS covers more than 10,000 private installations in the European energy and industrial sectors, responsible for about 40 percent of overall GHG emissions (Hausotter et al., 2011, p.27). An emission cap is imposed on each individual entity and an according amount of certificates in the form of European Union Allowances (EUA) is distributed. Installations are obligated to closely monitor and report their emissions. Each ton of GHG emission has to be covered by a certificate. Thus, in order to meet their emission caps, installations emitting more GHG than their assigned certificates can choose between reducing their own emissions (internal reduction) and buying EUA from installations having excessive certificates (external reduction) (Cames et al., 2011). Connecting the EU ETS to the KP flexible mechanisms, the EU Linking Directive additionally enables entities to buy and charge offsetting certificates from the CDM (UBA, 2007).[7] The operation of the EU ETS is divided in three different phases in order to be able to continuously revise and improve it.[8] EUA are distributed anew in every phase in correspondence with emission forecasts for each individual installation. Currently, the EU ETS is operating in its second trading period, lasting until the end of 2012. Excessive emission certificates that are not used in one phase can be banked, i.e. transferred in the subsequent phase and used for compliance (Cames et al., 2011).

As will be seen in section 5.5, many critical voices have raised concerning the recent and future arrangements under the EU ETS. Especially the free and disproportionate distribution of EUA has prevented the establishment of clear price signals for CER and accordingly robust incentives to the CDM.

4 Theoretical Assessment of the CDM

4.1 The CDM in the Spectrum of Environmental Policy Instruments

Giving Annex I polluters the opportunity to relocate parts of their emission reduction obligations, the CDM ranks among the concept of offsetting mechanisms. There have been various definitions and differentiations of the term offsetting in literature. According to Rentz (1995, p.90), individual emitters are allowed to deduct CO_2 reductions that have been achieved in their own or foreign operations either in their home country or foreign countries, from their own CO_2 reduction obligations. According to this definition, offsetting mechanisms and consequently the CDM rank among the concept of certificates as one of the types

[7] Every Annex I Party can individually decide on the extent to which CER and ERU are chargeable for compliance. In Germany for example, installations may charge offsetting credits to a maximum amount of 22% of their allocated EUA (UBA, 2007, p.11).
[8] Phase I (2005-2007), Phase II (2008-2012), Phase III (2013-2020).

of standard economic policy instruments. The basic idea of this instrument is to define an emission cap for certain pollutants in a specified area. Accordingly, the CDM belongs to the quantity instruments for emission reductions; the quantity of emissions is fixed, whereas the price is variable (Bartmann, 1996, p.149f). The permitted total amount of emissions is divided into subsets by a public authority. Any polluter is only authorized to emit the amount of pollutants that is covered by a correspondent possession of certificates. The specific characteristic of the certificate solution is that the allocation of the emission cap is carried out by market mechanisms, aiming at enhanced efficiency. Referring to the international climate protection process under the UNFCCC, governments of Annex I parties distribute emission certificates adding up to their overall national caps as defined in Annex B of the KP, creating a gap between the allowed amount of emissions and the initial emission levels.[9] The gap can either be closed through domestic abatement measures or the purchase of additional certificates (Endres, 2000, p.110ff).

The subsequent sections evaluate the CDM against different criteria. The efficiency assessment illustrates the functionality of the CDM in regard to its objective of supporting Annex I Parties to comply with their reduction obligations. At first, efficiency will be assessed from a static view, assuming a constant technological level. This assumption is dropped in the subsequent section, assessing the CDM's efficiency from a dynamic perspective including technological progress. The assessment of the CDM's effectiveness on the contrary addresses its contribution to the ecologic goal of emission reduction. Since the CDM itself is not designed to effect net global emission reductions, conditions for the mechanism are defined necessary to safeguard the Ecologic Effectiveness of the Kyoto Protocol.

4.2 Efficiency Assessment

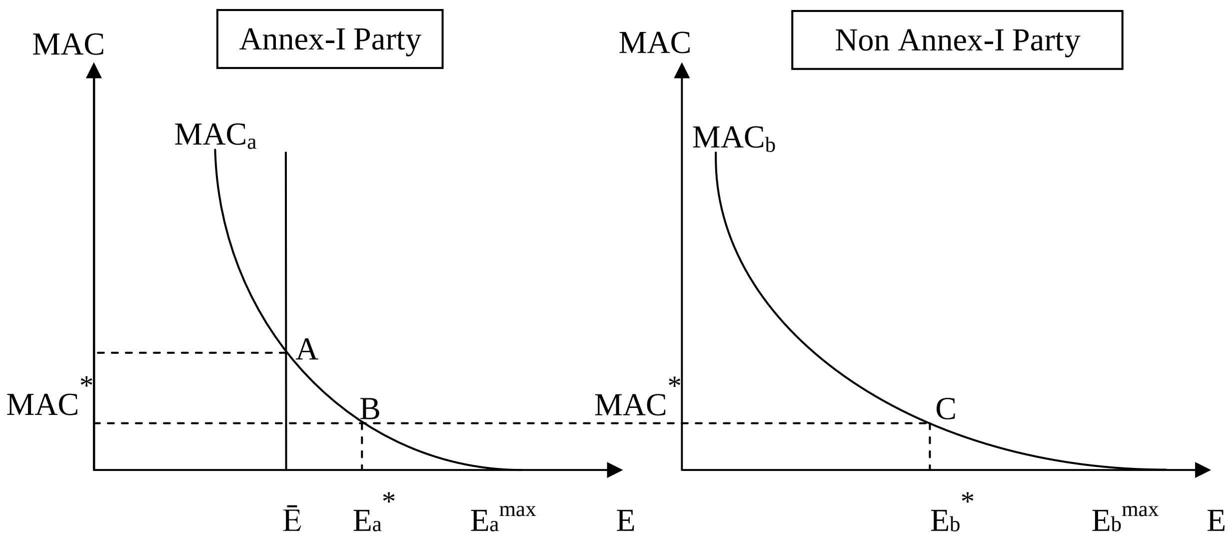
4.2.1 Static Efficiency

Static efficiency of an environmental policy instrument is achieved, if any given ecologic target is reached cost-efficiently (Endres, 2000, p.122). In the special case of the CDM, static efficiency accordingly means that emission reduction measures are conducted at the place where costs for emission reduction measures are lowest. An individual cost minimizing emitter seeks to take those measures for emission reduction that help him comply with his

[9] There are different ways of distribution for the endowment of certificates that bear individual problems. These will not be further addressed in this thesis.

individual obligation at the lowest costs (Gerhard, 2000, p.32f). Hence, the CDM basically aims at arbitrage of differing emission reduction costs deriving from large differences in technological standards between Annex I and Non-Annex I Parties (Scharte, 2001, p.97). The illustrated model in this section mainly bases on the elaborations of Rentz (1995) and Endres (2000). Figure 1 illustrates how the CDM can lead to static efficiency: This Figure is drawn under the assumption of only two emitters, one Annex I Party and one Non-Annex I Party. MAC_i represent the marginal abatement cost curves of both Parties. Starting at E_i^{max}, their increasing run is based on the assumption that the higher the level of achieved emission reductions, the more expensive it gets to conduct additional emission reduction measures (Endres, 2000, p.127). Moreover, the Non-Annex I Party in this model is able to reduce emissions at lower costs than the Annex-I Party. Consequently, MAC_b has a lower slope than MAC_a.[10]

Figure 1: STATIC EFFICIENCY



Source: Own illustration based on Rentz (1995) and Endres (2000)

At the initial situation, there are no emission restrictions and both Parties emit the maximal amount of pollutants E_a^{max} and E_b^{max}. The Annex I Party is now confronted with an exogenous emission cap of $\bar{E}$ and thus has to reduce emissions by an amount of $\overline{E_a^{max}\bar{E}}$, involving costs of the area under MAC_a of $[E_a^{max}\bar{E}A]$ (Rentz, 1995).

[10] In this model the Marginal Abatement Cost functions are continuously differentiable. In reality, this assumption is not rational since single abatement measures often involve large investments. Accordingly, abatement cost curves are more likely to have discrete cost speed-ups (Rentz, 1995, p.143).

Introducing the ability to make use of the CDM creates incentives to trade for both parties, if their marginal abatement costs differ: as long as $MAC_a > MAC_b$, welfare can be increased if reduction measures are conducted by the Non-Annex I Party who gets compensated by the Annex I Party. The Optimum is reached when $MAC_a = MAC_b$ (Gerhard, 2000, p.33). This condition is assumed to be achieved at MAC*. At this point, neither party has any further incentive to trade. The certificate market has come to an equilibrium involving a cost-effective allocation of emission reduction (Tietenberg, 1985, p.21). The required emission reduction is achieved jointly in both parties, depending on the exact position and slope of both MAC_a and MAC_b. In Figure 1 the overall costs of reduction correspond to the areas [B E_a* E_a^{max}] + [C E_b* E_b^{max}]. The overall benefit created through the CDM corresponds to [A B E_a* $\overline{E}$] – [C E_b* E_b^{max}].

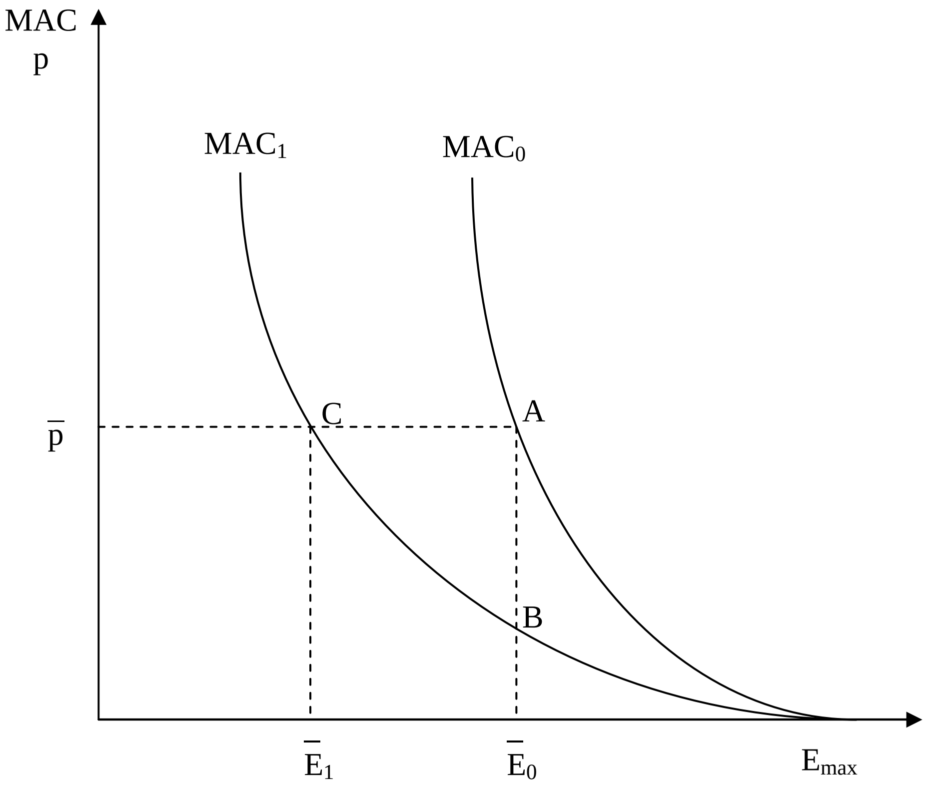
Under the assumptions made, the CDM is static efficient in theory. However there is a series of barriers to static efficiency in reality. These obstacles will be envisaged among the evaluation of the CDM's practical application in chapter 5.

4.2.2 Dynamic Efficiency

The application of the CDM leads to efficiency from a static economic perspective. Efficiency of environmental policy instruments has to be reviewed as well from a dynamic perspective though. The question to be asked in the context of dynamic efficiency refers to the CDM's ability to foster the introduction and development of innovative environmental technology, increasing the ecologic productivity by leading to better usage of the input factors for emission reduction (Michaelowa, 1997).[11] Accordingly, enhancing ecologic productivity means that a certain amount of emission reduction can be achieved at decreasing costs respectively emission reduction can be increased at constant costs (Endres, 2000, p.133). Consequently, technological progress is one opportunity for emitters to simultaneously realize economic growth while keeping emissions constant or even reduce them (Michaelowa, 1997). Figure 2 demonstrates the way how technological progress can increase welfare. The explanation of Figure 2 is consistent with Figure 1. Point A represents the starting point. $\overline{p}$ is the world market price of CER and assumed to be constant. At the initial technology, described by MAC_0 and a sufficient emission cap, an Annex I Party reduces its emissions by $\overline{E_{max}\overline{E_0}}$.

[11] Several authors, e.g. Michaelowa (1997) or Gerhard (2000) equivalently use the term "innovative efficiency".

Figure 2: DYNAMIC EFFICIENCY



Source: Own illustration based on Endres (2000)

Any further reduction obligation is covered by the purchase of CER, because the costs of further domestic reduction are higher then the certificate price $\bar{p}$ (Endres, 2000, p.138ff).
The introduction of a new technology now leads to a rotation of the marginal abatement cost curve from MAC_0 to MAC_1. In the new situation in Point B, the market price of certificates is higher then the cost of additional domestic abatement, leading to a substitution of CER for further domestic emission reduction of $\overline{\bar{E}_0 \bar{E}_1}$ and a new equilibrium in Point C, where again the price of CER is equal to domestic marginal abatement costs. Initially, the new technology leads to a cost reduction of [E_{max} A B]. By the consequent substitution of CER for domestic measures, the Annex I Party is able to realize another cost reduction of [A B C]. Hence, the overall savings of the technological progress are [E_{max} A C] less costs of the new technology (Endres, 2000, p.139). Figure 2 can also be applied for any Non-Annex I Party. Accordingly, the CDM leads to an emission reduction of $\overline{\bar{E}_{max} \bar{E}_0}$ and disposal of the generated CER at the certificate market. By introducing a new technology, the Non-Annex I Party will further reduce its emissions to $\bar{E}_1$ and sell the additional CER at a price of $\bar{p}$. Dropping the unrealistic assumption of a constant world market price however weakens the dynamic incentives in this model. As described in section 5.5, CER prices are dependent on various factors and have

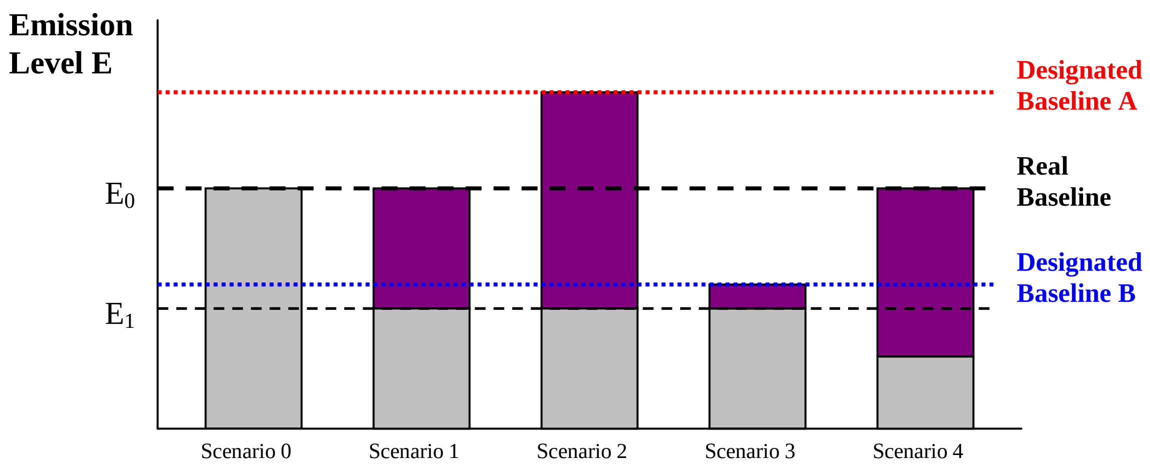
shown high volatility in recent years. Assuming dynamic prices, technological progress leads to both a decline of demand for CER from Annex I Parties and an increased supply from Non-Annex I Parties. Accordingly, technological progress implies a price drop which in turn reduces dynamic efficiency (Gerhard, 2000, p.92f). Incentives for technological progress in Annex I Parties are further narrowed by the finding that it generally involves high costs that in turn reduce the overall benefit of the innovation. More precisely, a new technology is only introduced as long as its costs are below the savings achieved (Gerhard, 2000, p.92). This is why critics, like Michaelowa (1997), associate offsetting mechanisms with a low degree of dynamic efficiency due to the ability and the cost advantage of conducting external rather than internal abatement measures. Looking at the previous analysis reveals a trade-off between the CDM's static and dynamic efficiency. By providing emission allowances for Annex I Parties at low costs, the CDM's static efficiency reduces the pressure to innovation and hence constrains structural change. Whenever threats to the static efficiency due to increasing costs and market prices are revealed in the further analysis of the CDM's practical implementation, dynamic efficiency is in turn increased. In reality, any measure changing the framework of the CDM has direct effects on its static and dynamic efficiency. Several changes, whether already implemented or yet discussed and their impacts are discussed in chapters 5 and 6.

4.3 Ecologic Effectiveness

According to Gerhard (2000, p.29), Ecologic Effectiveness (EE) of an environmental policy instrument indicates its ability to realize an environmental quality standard set at political level in a given period of time. Certificates in general are of a high EE; the amount of certificates distributed defines the emission cap that cannot be exceeded, at least by legal means, while the allocation of the certificates is achieved efficiently on free markets (Endres, 2000). But what exactly does EE mean in the sense of the CDM? In its current arrangements, the CDM is a pure offsetting mechanism, meaning that any emission reduction achieved within CDM projects allows for the emission of the equivalent amount of GHG in Annex I countries (Tietenberg, 1985). Hence, the CDM itself does not result in any net reduction of global GHG emissions. Consequently, the criterion for the assessment of the CDM's EE used in research and practice is its Ecologic Integrity (EI), see among others Endres (2000) and Haensgen (2002). To understand the fundamental meaning of EI in regard to the CDM, the term additionality is key (Schneider, 2007, p.7). Art. 12.5 KP requests emission reductions to be additional. The condition for additionality defined by the UNFCCC (2006a, p.16) is fulfilled, "[…] if anthropogenic GHG emissions are reduced below those that would have occurred in the absence of the registered CDM project activity." To understand the importance of this condition, the term additionality will be further segmented in different sub-categories according to Scharte (2001, p.92ff). First, the investment related additionality requires an accredited CDM project not to be profitable by itself, involving earnings that are not sufficient to cover its costs without the CDM. Only realizing the project as a CDM project changes this cost-benefit ratio by additionally generating revenues from CER. If the generated CER yield overall earnings above the costs involved, there is an incentive for investors to carry out the project. Hence, one crucial factor for the investment decision is the cost of emission reductions associated with a project. These so called specific abatement costs are described by the ratio of the investment costs and the generated reduction units. The investment is profitable, if the specific abatement costs are lower than the marginal abatement cost for the same amount of emission reduction (Haensgen, 2003, p.79f).

Secondly, the ecologic additionality requires each CDM project to generate real emission reductions. Real in this context means that a proper monitoring methodology has proven that emission reductions have actually occurred (Wara, 2007, p.14). To be able to warrant this condition, the GHG emitted after the investment are compared to those that would have been produced in the absence of the project. Only emissions below this business-as-usual (BAU) scenario baseline can get certified as CER (Scharte, 2001). Figure 3 shows the importance of precise and honest monitoring and baseline setting for the CDM's EI with the help of different scenarios, based on the analysis from Butzengeiger-Geyer et. al (2010).

Figure 3: ECOLOGIC ADDITIONALITY OF THE CDM



Source: Own illustration based on Butzengeiger-Geyer (2010)

E_0 is the initial emission level. The grey area in the initial Scenario 0 accordingly represents the amount of GHG emitted in the absence of the CDM. Conducting an emission reducing CDM project results in the new emission level E_1. For the imaginable resulting scenarios, the grey areas represent the monitored and declared emission level resulting from the project, while the purple areas represent the amount of issued CER. Scenario 1 illustrates the ideal situation as originally intended with the CDM. The baseline is set correctly at the actual initial emission level E_0. Also, the emission level resulting from the project is monitored correctly. Consequently, the amount of issued certificates corresponds exactly to the emission reductions achieved, safeguarding the ecologic additionality of the project. The following scenarios illustrate different possible errors that can occur throughout the project. Scenarios 2 and 3 demonstrate the impacts of flawed baseline setting. In Scenario 2, the resulting emission level is monitored correctly, while Designated Baseline A is set at an exaggerated emission level. As a consequence, the amount of issued CER exceeds the actually achieved emission reductions, resulting in a net increase of global emissions and hence inhibiting ecologic additionality. On the contrary, in Scenario 3 Designated Baseline B is declared as the reference scenario falling below the actual initial emission level. In this scenario, the amount of achieved emission reductions exceeds the number of issued certificates. Accordingly, this scenario results in a net global emission reduction. Scenario 4 demonstrates the problem of faulty monitoring. While the baseline is set correctly in this scenario, the monitored emission level resulting from the project is too low. As in Scenario 2, this excessive declaration of achieved emission reductions results in a net increase of global emissions.

Consequently, EI of a CDM project can only be fulfilled through a proper assessment of whether the project would also be implemented without the CDM incentive as well as through a realistic determination of the baseline scenario and a sound monitoring methodology (Schneider, 2007). The issuance of CER from non-additional projects may even lead to an increase of global emissions; authorizing an Annex I Party to increase their total emissions while the corresponding reductions generated in the project would have occurred anyhow would inflate the overall emission cap of the KP and thus bust its EE (Schneider, 2007; UBA, 2001). The same applies for CER that have not actually occurred due to a false determination of the reference scenario or an excessive amount of monitored emission reductions. But even if additional, EI of CDM projects can still be undermined by the problem of leakage. Scharte (2001, p.95) defines leakage as those indirect and negative side-effects that a CDM project has on GHG emissions outside the project. As a typical example for leakage, he illustrates the substitution effect of forest protection projects;

conserving forest areas in a certain region often leads to an increased usage of different forests not covered by the project. Although it is difficult to consider the leakage induced by a project in the calculation of its emission reductions, it is important to maintain a project's EI. Accordingly the CDM EB provides methodologies and standards for the assessment of leakage.

Summing up, the CDM's EI is a necessary condition for the effectiveness of the Kyoto Protocol. In fact the identification of a project's EI has proved to be one of the CDM's major challenges, see among others Schneider (2007) and Wara (2007). Lex De Jonge, Chair of the CDM EB, although considering the CDM as a successful instrument, emphasizes the indispensability of additionality recognizing "[…] that the CDM, at its best, is a zero sum game […]" (IISD, 2009). Consequently, different proposals have been made aiming at strengthening the CDM's EI. Moreover, concepts have been elaborated moving the CDM from pure offsetting towards a mechanism capable to create net emission reductions. Section 5.4 analyzes the problems occurring at the demonstration of additionality in practice. It is shown across section 5 that in practice trade-offs occur between the CDM's EI and its efficiency. Section 6 demonstrates possibilities for how to deal with the problems of proving additionality and presents approaches to transform the CDM into a mechanism going beyond pure offsetting and thus contributing to global mitigation efforts.

5 Weaknesses in Practical Implementation

5.1 Geographical Distribution of CDM Projects

The quantitative geographical distribution of CDM projects is remarkably unequal, whether in the distribution between or within different regions, see among other Arens et al (2007) and Lütken (2011). Figure 4 gives a crude numeric comparison of countries' score on CDM registration, while Figure 5 illustrates the distribution within regions using Africa as example. The picture is the same when looking at the volume of expected CER generated in each region. During the early days of the CDM, the distribution was still more unbalanced with a few well developed countries representing the bulk of CDM project development. At the end of 2006, after the CDM's remarkable take-off there was the meagre amount of just one project registered in Sub-Saharan Africa (Lütken, 2011, p.4). While for the EI of the CDM the location where projects are conducted plays no immediate role, underrepresented countries are obviously hardly able to benefit from possible SD impacts.

Figure 4: GEOGRAFICAL DISTRIBUTION OF REGISTERED CDM PROJECTS

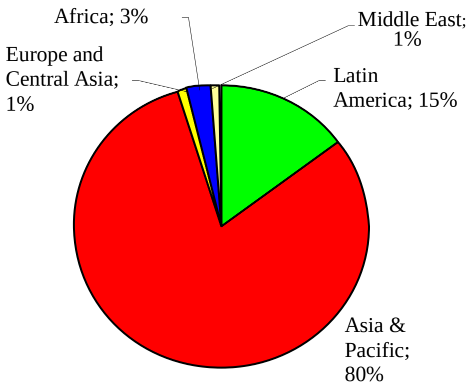
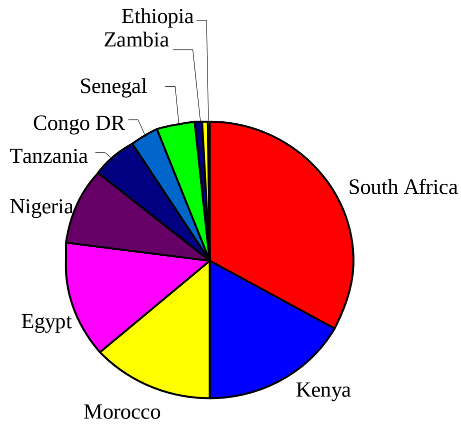


Figure 5: CDM PROJECTS IN AFRICA



Source: Own illustrations based UNEP, 2011-06-17

Examining the reasons for this low application of the CDM, Arens et al. (2007) look at the specific circumstances Africa offers to potential project developers: In the year 2000, Africa accounted for not more than 3.57 percent of worldwide GHG emissions with the lowest levels of per capita emissions worldwide. With 40 percent South Africa is the main emitter. Together with Kenya, Morocco, Egypt and Nigeria it accounts for the major part of emissions in Africa (Arens et al., 2007, p.7). As can be seen in Figure 5, this sample of main African emitters corresponds exactly to those countries hosting the lion's share of CDM projects. As Arens et al. (2007) explain there are several obstacles to the implementation of CDM projects in the remaining countries. First of all and most obvious, an overall low level of GHG emissions results in low emission reduction potentials. Also, the majority of investors seeks for projects that generate certain and not to small amounts of CER, since small-scale projects offering few emission reductions are rarely rentable considering the involved transaction costs; as Wara (2007) shows, in 2006 the largest 5 percent of projects accounted for more than 70 percent of CER supply. Arens et al. (2007) see another reason for the preference of investing in projects in certain countries in a favourable general investment climate prevailing in these countries. Since the CDM is a voluntary and market-based mechanism, it can be expected that investments flow predominately to countries and projects with low investment risk. A comparison of the Worldwide Governance Index provided by the World Bank does indeed show an above-average ranking in one or several indicators for those countries hosting a high number of CDM projects (World Bank, 2011a).[12] However, Niederberger and Saner

[12] The WGI can be taken as an approximation for a countries investment climate. For detailed information on the Indicator, its methodology and for the Indicators for distinct countries, see Worldbank (2011a).

(2005) state that a country's investment climate fails in comprehensively explaining its CDM attractiveness. For example, India and several Latin American countries despite of a relatively poor rating in investment climate belong to the host countries with highest CDM participation.

Facing the low participation in the CDM of many Non-Annex I Parties, several concerns were raised stating that the design of the CDM would not be able to foster balanced financial flows to Non-Annex I Parties and that additional measures were necessary to achieve an equal distribution across the world. Especially Sub-Saharan Africa, Small Island Development States (SIDS) as well as Least Developed Countries (LDC) were entitled the "lost world" in CDM (Lütken, 2011, p.1).[13] These countries though are particularly desirable to participate in the CDM from a SD view, as there is much need for social and economic aspects of SD as poverty eradication and improved standards of living (Burian 2006). Moreover, different research has revealed that particularly small-scale projects are better integrated in the economy and thus have stronger SD impacts than large-scale projects (Butzengeiger-Geyer et al., 2010, p.39). Consequently the CDM EB, acknowledging the existence of barriers to the participation of these particular groups of countries called for proposals to tackle these obstacles (UNFCCC, 2006b). The response was the adoption of the Nairobi Framework in 2006 aiming "[…] to help developing countries, especially those in Sub-Saharan Africa, to improve their level of participation in the Clean Development Mechanism (CDM) and enhance the CDM's geographical scope" (UNFCCC, 2006c). Central Features of the Nairobi Framework comprise capacity building for the development of CDM projects as well as enhancing capacity of DNA and the promotion of investment opportunities for projects. Another initiative was the introduction of Programmes of Activities (POA) aiming particularly at an improved CDM participation of LDC; as the opportunities for medium- or even large-scale projects in LDC are quite limited due to the small size of the economy and low GHG emission levels, POA enable the realisation of micro scale activities by summarizing measures at household level to programmes (Lütken, 2011, p.5).

Since the introduction of the Nairobi Framework and POA, the situation has changed. Up to 2011, 23 LDC have been participating in the CDM, mostly in Sub-Saharan Africa, compared to three in 2007. There are currently 206 POA in the CDM pipeline, either registered or at validation, of which 37 are hosted in LDC (UNEP, 2011). Still, Figures 4 and 5 based on topical data gives a highly unbalanced impression of the geographical distribution. However,

[13] Annex III indicates the Non-Annex I countries classified as LDC by the UN.

it can be doubted if the sheer quantity of projects is a very meaningful measure to draw conclusions about the actual distribution. To give more qualified information, Lütken (2007) odds out countries that are just not rationally to be considered as potential CDM participants whether because of ongoing armed conflicts or the tiny size of population and emission levels.[14] This method results in participation rates of 68 percent among LDC compared to 62 percent in better developed countries. Still, as Lütken (2007) points out, these relations do not yet say anything about the degree to which these countries are participating. He therefore develops indicators that are supposed to allow for a decent comparative performance evaluation. His results seem surprising: Comparing the different country groups' project generation ability, i.e. the number of projects divided by national emissions, LDC together with China rank on the second place behind Latin America. Taking a country's percentage of emissions covered by CER as indicator giving evidence to the extent the CDM is supporting emission reduction efforts, LDC even rank on the first place. To what extent this surprisingly good score of LDC can be traced back to the introduction of the Nairobi Framework and the POA has yet to be assessed.

The inequality in the geographical distribution of CDM projects is probably not as striking as it might look when catching a first glimpse at Figures 4 and 5. Still, it is doubtful if the CDM design is even capable to result in a more or less balanced geographical distribution. The discussion about the distribution reveals a trade-off in the design of the CDM objectives: Emitters try to comply with their QELRO in a cost-efficient way. Recalling the static analysis in chapter 4.2.1, they look for those emission reductions involving the lowest costs. Shown above, this is typically the case in large-scale projects with high amounts of reduction potential that are typically findable in countries with high overall levels of GHG emissions. These in turn do not comprise Sub-Saharan countries or LDC, which are particularly desirable for SD impacts like poverty eradication and an improved standard of living.

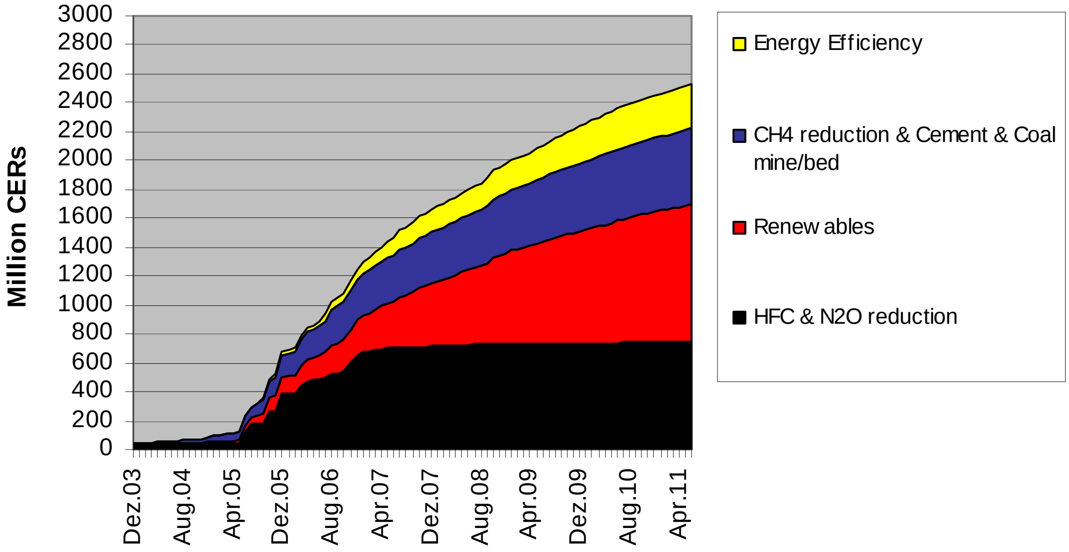
The measures taken so far have been one first step towards an increased emphasis on SD. Other possible measures in the international discussion about how to give more weight to the SD objective by fostering projects in LDC are addressed in chapter 6.

[14] These countries are Afghanistan, Somalia, Chad, Mauritania, Sudan, Haiti and East Timor due to armed conflicts in the recent past as well as Comoros, Solomon Islands, Samoa, Vanuatu, Sao Tomé and Principe, Kiribati and Tuvalu due to their very small population and emission levels.

5.2 Distribution of Project Types

Looking at the quantitative distribution of different project types within the CDM results in a similar unbalanced picture as the geographical distribution seen in the previous section. For the further analysis, different project types are classified into the four quantitatively most important groups. In particular, these project types having so far largely dominated the CDM pipeline are HFC and N_2O reduction, renewables, NH_4 reduction, Cement and Coal Mines, as well as energy efficiency (UNEP, 2011). Figure 6 illustrates the CER delivered from each project type as a function of time since the launch of the CDM until May 2011.

Figure 6: ACCUMULATED CER GROWTH



Source: Own illustration based on UNEP, 2011-08-26

After the launch of the CDM in 2003, especially HFC-23 and N_2O reduction projects have seen rapid growth in number and CER issued. From 2005-2007, they accounted for the lion's share of CER, remaining at a constantly high level over time and still being the second largest CER generating projects in 2011. Since 2006, different project types too experienced an accelerated growth. Especially renewable energy projects have grown above average, representing the largest share of CER issuance in 2011. Still, since the existence of the CDM, HFC-23 and N_2O reduction projects have generated 71 percent of all issued CER (UNEP, 2011).

But why have these industrial gas capture projects been so obviously favoured by project developers? As Wara (2007) explains, HFC-23 and N_2O as well as CH_4 are basically by-products of certain industrial processes. Projects capturing and destroying these GHG are typically characterized by low abatement costs as they do not request large investments for technological transformation. Besides, the payback period from investment to CER issuance is short compared to other project types (Burian, 2006, p.62). In turn, these projects generate high volumes of CER since the Global Warming Potential of these industrial gases is immense. HFC-23 for example has a Global Warming Potential of 11.700 times as much as CO_2 (Lecocq and Ambrosi, 2007). This means in turn that the abatement of one ton of HFC-23 within a CDM project allows for the emission of 11.700 tons of CO_2 in Annex I countries. As Wara and Victor (2008) explain, these relations result in perverse economic incentives for project developers, since the price of reducing one unit of HFC-23 are outweighed by the earnings from selling the generated CER by far, no matter if market prices of CER are high or low. The profit from participation in the CDM is accordingly much higher than the earnings from the primary production. These net benefits create moral hazard by creating the incentive for producers to inflate their GHG emission to the maximum extent possible – and reduce them again. This relationship creates an obvious trade-off between efficiency and EI; regarding the economic behaviour of profit-maximizing producers, it is rational to extend and reduce their industrial gas emission as much as possible to absorb the rent provided by the CDM (Wara, 2007). At the same time, by increasing and again reducing GHG emissions they create huge amounts of additional CER for Annex I Parties that are by no means additional and consequently bust the EI of the whole mechanism. To avoid or at least to reduce this abuse of the mechanism, the CDM EB decided to only approve projects in industrial plants already existing before the start of the CDM. However, Wara (2007) observes an increase in production of relevant industrial plants in Non-Annex I Parties during the baseline period (2000-2004) exceeding the expected growth rate for the according industries by far. Although it cannot be assessed with absolute certainty whether this increased production was only an appropriate answer to increased demand, it is tempting to assume that significant parts of the expansion only occurred in order to take advantage of the CDM profits.

Renewable energy projects on the contrary have a series of disadvantages compared to gas capture projects from an efficiency perspective. As Burian (2006) describes, these projects require above-average capital intensity, meaning high investments, but in turn provide only few CER, resulting in relatively high specific abatement costs. Thus, a renewables project’s Internal Rate of Return (IRR) is not significantly increased by the revenues of CER sale. These characteristics from renewables projects furthermore result in an extraordinarily high share of transaction cost per CER. Evaluating the average CER issuance from renewable and non-renewable project types and setting them into relation with minimal fixed transaction costs of € 150,000 per project, Burian (2006) calculates transaction costs of € 0,34/CER for renewables projects, compared to € 0,04/CER for non-renewables projects.

Assessing both project types from a SD view draws quite another picture: A survey provided by UNEP (2009) attests renewables projects an overall strong SD impact; above all, they have a high job creation and securing potential. Having already created about 2,3 million jobs in recent years, the UNEP survey sees potential for further 20 million jobs in the renewable energy sector until 2030. Furthermore, replacing antiquated and highly polluting power production with clean and modern technologies, renewables projects create benefits for health and increased standards of living, especially for lowest-income rural population (UNEP, 2009). Apart from this, Wara (2007) points out that renewables projects are able to bring Non-Annex I Parties on a low-carbon development path, leading to an overall early retirement of high-carbon energy infrastructure. As Schneider (2007) states, the process of gas capturing in contrast is in general, if at all, not accompanied by notable SD impacts. These projects do neither generate significant additional long-term employment nor enhance the industry's competitiveness. As the technology for gas capturing is not innovative and available in most countries, these projects also cannot be assumed to generate a high level of technology transfer (Butzengeiger-Geyer et al., 2010, p.39).

Summing up, renewables projects have a highly positive SD impact, while supporting Annex I Parties in complying with their QELRO at increased efficiency. Gas capture projects are preferable from the compliance view but hardly have any SD effects and might have significantly dampened the CDM's EI. Drawing an unbiased pros and cons list, renewables projects seem to be the favourable choice. But since SD and EI do not have any direct financial value for project developers, preference has been given to gas capture projects throughout the first commitment period, which are more attractive from the sheer compliance view; seeking for efficiency in compliance, project developers neither pay attention to maintaining the mechanisms EI nor to achieving effectiveness of projects in fostering SD in host countries. The only authorities having an incentive to safeguard SD impacts of CDM projects are the DNA. Being the first entity to approve CDM projects in the project cycle, they have the possibility to reject projects not generating any SD benefits for their country. Still, Sterk et al. (2009) evaluating a series of CDM projects, find no evidence of DNA rejecting approval for projects lacking SD benefits. As a consequence from these findings, the EU has recently taken the choice from private actors by formally adopting the ban of credits from HFC-23 production and N_2O for the third phase of the EU ETS (GIZ, 2011a).

With CER Discounting and ambitious baseline setting, section 6.2 presents one possibility to create a more balanced incentive scheme between different project types.

5.3 Additionality

As pointed out in chapter 4.3, additionality of projects is the key prerequisite for maintaining the CDM's EI. The demonstration of a project's additionality constitutes one major step at the beginning of the project cycle and has to be portrayed exactly in the Project Design Document submitted to the DOE chosen by project developers.

The CDM EB has elaborated an "additionality tool" in order to facilitate the process of assessing a project's additionality (UBA, 2007). In a first step, alternative scenarios to a project have to be determined, which can serve as the baseline scenario. Under the current CDM regime, baselines have to be determined individually for each project based upon methodologies approved by the CDM EB (Sterk et al., 2009). The second step is an investment analysis, supposed to determine a project's economic attractiveness. Projects economically attractive without the CDM can still be additional, if barriers can be identified preventing the project from being carried out in the absence of the CDM. If a project is not economically attractive without the CDM, no barrier analysis is needed. In a final step, a common practice analysis has to show whether the project type has already established in the relevant sector or region (UBA, 2007, p.21f).

Schneider (2007) assesses the likelihood of investment related additionality for all 803 registered CDM projects and further 2,266 projects in the CDM pipeline in 2007. As a measure for the impact of CER on the economic attractiveness, he uses a project's change of its IRR if carried out as CDM project; the higher the role CER revenues play for a project the more likely it is additional.[15] Following this methodology, in total 40 percent of the registered projects seem not to be additional (Schneider, 2007, p.9).[16] Although the accuracy of Schneider's methodology in determining investment related additionality can be doubted, there is more evidence that a considerable share of CDM projects is not additional. Schneider's findings are, inter alia, underpinned by a Delphi Survey regarding the future perspectives of the project-based mechanisms conducted by Cames et al. (2007).[17] More then 800 worldwide experts with working experience in the KP flexible mechanisms were, among

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[15] There are other possible measures for the likelihood of investment related additionality used in literature, e.g. CER revenues per investment costs (Schneider, 2007, p.42).

[16] For a more detailed description of the methodology, see Schneider, (2007, p.42ff).

[17] Delphi surveys try to achieve a high level of anonymity and feedback. Basically, experts for the surveyed issue are asked to answer a series of questions. Afterwards, in a second round, they are confronted with the results and are asked to answer the same question again. For further information see Cames et al. (2007, p.72f)

others, asked questions about their appraisal of additionality in the CDM. Although 57 percent of respondents are of the opinion that CER revenues have a significant positive influence on projects' profitability, 86 percents believe that carbon revenues are in many cases only "[…] the icing of the cake, but are not decisive for the investment decision." (Cames et al., 2007, p.98). Another 71 percent believe that many projects would have also been carried out in the absence of the CDM.

Looking at the ecologic additionality does not draw a preferable picture. Although it is hardly possible to reproduce and understand the baseline scenario setting and the monitoring methodologies, Haensgen (2002) sees a probably high error rate. As she points out, both hosting party and investing party have an incentive to declare exaggeratedly high emissions in the baseline scenario and monitor exaggeratedly low resulting emission levels. In this way the host party can expect excessive financial transfers from the investor; the investor in turn receives an unjustifiable high amount of CER, he can either charge to his QELRO or sell on the carbon markets. The bottom line of this game is that a project eventually results in higher emissions than those that would have occurred in its absence, putting EI well out of reach.

Recalling the substantial importance of additionality for the CDM's EI, these findings draw an alarming picture. Knowing about this importance, one might wonder how such a weak performance could evolve. Looking at the process of proving additionality within the CDM reveals fundamental flaws in design; all four steps described above and necessary for the development of the PDD base on assumptions, estimations and hypotheses and are hence uncertain and subjective criteria. As Schneider (2007, p.7) points out, "the question as to whether a project would also be implemented without the CDM is hypothetical and counter-factual – it can never be proven with absolute certainty". Consequently, the process of proving additionality opens the floodgates to fraud; as Haensgen (2002) indicates, the hypothetical and project-specific character of the individual steps during the additionality assessment gives involved actors the opportunity to cheat. And even independent third-party DOE which play a decisive role in this process have an incentive to support this behaviour; as Schneider (2007) points out, project developers can assign any DOE of their choice, creating a competitive situation. Accordingly, prices for verification and validation have experienced a significant drop in recent years, leaving these entities only very limited time and capacity to spend on each job. Furthermore, DOE have an incentive not to gain a reputation of being above-average strict in the validation and verification process (Schneider, 2007, p.5ff). Furthermore, at a workshop of the CDM EB, an employee of the accredited DOE TÜV Süd complained that "[…] project developers whose project is not successfully validated and registered increasingly do not pay the agreed validation fee" and accordingly "[…] further increase the pressure on validators to validate all projects they are contracting." (GTZ, 2007, p.3).

The question of how the CDM's overall additionality can be increased, again shows the incompatibility of its target system. Starting at the described process and rules for proving additionality, any enhancing of the likelihood of additionality and thus improvement of EI is most likely connected with even more detailed and project specific criteria (Scharte, 2001, p.96). These in turn would further raise involved transaction costs and hence weaken the static efficiency. Furthermore, growing requirements would also come along with a growing number of lost opportunities, i.e. actually additional projects that do not meet the criteria (Schneider, 2007, p.28). Any measure to change the methodology of additionality assessment has therefore to choose which objective to give preference. One conclusion that can be drawn from the findings in this section is that enabling all involved private stakeholders to act unrestrictedly in order to maximize their own utility marginalizes the KP's primary and superior objective of EE. In other words, a stronger focus on EI is either connected with cutting the scope of action for all private participants or a change in the incentive scheme. Accordingly, various suggestions have been made and discussed in recent years, aiming at organizing the whole process of assessing additionality less project-specific and manipulable and thus enhancing the emphasis on EI. Some of these suggestions are presented in section 6.

5.4 Procedural Weaknesses

As described in chapter 3.2, the CDM's project cycle from project development until the actual issuance of CER involves a multiplicity of steps. However, short-time procedures for the whole process and hence for every single step are of great importance; Annex I investors are dependent on predictable and prompt delivery of CER, since they have to comply with their QELRO in given fractions of time (Wara and Victor, 2008). As shown in this section, the CDM has not been up to this requisite. Another issue causing problems in the project cycle are the involved transaction costs. These shortcomings pose major threats to the efficiency of the CDM.

Leguet and Elabed (2008) examine the individual steps throughout the project cycle and assess involved delays and bottlenecks. While they do not find any evidence of a PDD that has failed to gain national approval in the first step, time-lags have occurred between PDD submission and host country approval from one week up to 17 months. The next step, namely project validation by a DOE averages at a time span of eight months. Together with the subsequent registration through the CDM EB, the process of validating and registering CDM projects averages at a total duration of 572 days (World Bank, 2010, p.47). Furthermore, an increasing number of PDD has recently failed to get validated by the assigned DOE. Likewise, the CDM EB has rejected to register a growing number of projects already validated by DOE. Summing up to 1364 projects in July 2011, more than one third of all CDM projects in the pipeline have failed to gain validation (GIZ, 2011c). And even once a project has achieved registration by the CDM EB, delays in the process are overcome by no means; registered projects have to start operation, accordingly produce emission reductions that again have to be monitored and verified by a DOE, before CER are issued by the CDM EB. Experience has shown that on average another 607 days pass between a project's registration and the first issuance of CER (World Bank, 2010, p.47). Even once the verification process has been completed, severe time-lags occur until the actual issuance of CER. Wara and Victor (2008, p.16) assess the time the CDM EB needs to process the incoming issuance requests. They find out that assuming the registration of all projects in the CDM pipeline, the CDM EB's rate of processing issuance requests is at not more than one or two percent of the rate actually needed to issue all requested CER in a timely manner. Moreover, a large number of projects has failed to generate the amount of CER initially outlined in the PDD. On average registered projects yield 94 percent of the originally intended CER. Looking at different project types, Leguet and Elabed (2008, p.79) point out that these differ in success regarding CER issuance; while industrial gas capturing projects often over-perform compared to the intended reduction units, energy-related projects on an average only generate about 60 percent to 80 percent of outlined emission reductions. The large delays in the project cycle mainly seem to arise from lacks in capacity and staffing from involved actors. First of all, the elaboration of proper PDD including baseline determination and other relevant documents has proven to be a time-consuming process of high complexity and hence has been one of the main barriers to the implementation of CDM projects (Cames et al., 2007). Subsequently, as Wara and Victor (2008) point out, most DOE face substantial problems to assemble teams of sufficient size and capacity for conducting the necessary verification audits and certifications. However, as shown in section 5.3, the competitive situation among DOE has created pressure to carry out these steps in a low-cost and short-time manner.

Another severely criticized issue associated with the different steps in the project cycle is the high amount of transaction costs accumulating throughout the process. Ellis and Kamel (2007) draw a list of costs incurring at different levels of the project cycle. There are two different categories of costs involved in a CDM project. On the one hand, there are fixed costs resulting from the development of the necessary documents as well as the obligation to report and the certification process. On the other hand, there are variable costs in the form of fees like the UN Adaptation Fund Fee and the ongoing costs for monitoring and verification.[18] According to the Delphi Survey of Cames et al. (2007), the largest components of transaction costs are for PDD development including baseline determination, followed by costs for monitoring and verification.

The shortcomings throughout the project cycle have severe impacts on both the CDM's effectiveness and efficiency. In total, the whole project cycle from project approval until CER issuance lasts on average about three years and incurs a high amount of transaction costs. Furthermore, many projects have underperformed in reducing emissions or even failed in getting validated or registered and thus not generated the expected amount of CER. All these facts have negative implications for the CDM as a compliance mechanism; investors cannot fully rely on CDM projects to generate the CER they need to comply with their QELRO in a certain time or amount, leading to uncertainties that further increase transaction costs (World Bank 2010, p.47). The transaction costs associated with a project constitute one component of its marginal abatement costs. Recalling the static analysis in chapter 4.2.1, increasing marginal abatement costs lead to a lower amount of projects conducted, shifting a share of abatement efforts from external to internal reduction.[19] Accordingly, overall compliance costs rise, impairing the CDM's static efficiency. As Michaelowa et al. (2004) find out, the projects mainly crowded out by the involved transaction costs are small- and medium-scale projects, generating less than a total amount of 20,000 CER. This finding penalizes especially LDC, which as pointed out in section 5.1 typically do not meet the preconditions for large-scale projects. In turn, since it was shown that small-scale projects in LDC are particularly desirable from a SD perspective, the flaws in the project cycle also weaken the CDM's overall effectiveness regarding SD. This impact on SD performance is further supported by the finding that particularly energy-related projects have proved to underperform; the low average rate of CER issuance constrains the incentive for investors and project developers to carry out these projects (Leguet and Elabed, 2008).

[18] For a detailed list and estimations of transaction costs throughout the CDM project cycle, see Ellis and Kamel (2007, p.33).

[19] In accordance with figure 3, transaction costs lead to a rotation of MAC_b to the right (respectively up), while MAC^* is increasing. $\overline{E_a^{max} E_a^*}$ increases, while $\overline{E_b^{max} E_b^*}$ declines. As a result, the overall benefit from the CDM, [A B E_a^* $\overline{E}$] – [C E_b^* E_b^{max}], decreases.

The implications of the project cycle deficits reveal another trade-off between the CDM's EI and efficiency; the higher the qualitative requirements are for applied methodologies, and therefore the CDM's EI, the higher are as well the involved time-lags and transaction costs which in turn weaken the static efficiency. Mentioned before, since there is no direct value for a project's EI, both investors and project developers have a clear preference for efficiency and accordingly have been calling for simplified procedures and modalities for the CDM since its launch (Cames et al., 2007).

5.5 Development of the Carbon Market: The EU ETS

A further important aspect influencing effectiveness and efficiency of the CDM is the performance of domestic and international carbon markets. Demonstrated before, the incentive for project developers to participate in the CDM is mainly determined by the balance between involved costs and additional revenues. After the composition and effects of involved costs have been examined, this section focuses on the development of revenues. Revenues are mainly determined by the CER price which in turn is determined by supply and demand on the carbon markets (Sterk, 2008, p.1).

Taking a look at the development of the EU ETS since 2008 shows an immense negative trend both in market volume and prices for project-based emission reductions. As a survey from the World Bank (2011) shows, after an impressive expansion of the carbon markets between the launch of the KP in 2005 and its climax in 2007, carbon markets experienced double-digit declines in market volumes in all three subsequent years, followed by a substantial drop in prices. In 2011, the CER market hit rock bottom since its establishment in 2005 (World Bank, 2011b, p.49). Regarding the both fast and large expansion of the carbon markets, one might ask the legitimate question, why they transformed from bull to bear markets that suddenly. To answer this question it is helpful to take a close look at the recent and future development of demand and supply for offsetting credits.

As Sterk (2008, p.15) points out, the demand for CER is basically "[…] set politically by the stringency of the industrialised countries' emission targets and the extent to which they want to meet these targets through purchases instead of domestic action." As analysed in section 4.2.1, the motivation to purchase certificates instead of reducing domestic emissions basically depends on the differences in MAC between Annex I and Non-Annex I Parties. The incentive for both domestic abatement efforts and purchasing CER for compliance is however crucially dependent on the pressure deriving from emission caps and hence reduction obligations; a scarcity of certificates should encourage prices to rise, making it more expensive to pollute and so encouraging both internal and external emissions reductions. Pearson and Worthington (2009) as well as Reyes (2011) however heavily criticize an actual oversupply of emission allowances to European industrial sectors and the resulting lack in ambition. As they point out, emission projections were severely overestimated all across European countries in phase I. The resulting exaggerated and gratuitous issuance of EUA led to a weak demand and accordingly to a strong decline in all certificates prices. Consequently the issuance of certificates was tightened in phase II. Still, the signals set for the carbon markets were by far not ambitious enough, resulting in continuing low prices. The low demand was further weakened by the economic crisis starting in 2007. As a consequence of the global decline in production, global emission levels decreased. Accordingly, many emitters complied with their QELRO just by reacting to the economic downturn and temporarily reducing their production (World Bank, 2010). For phase III starting in 2013 the European Commission (EC) has adopted some measures in order to overcome their failure in setting proper incentives and signals for the carbon markets: The individual emission caps are replaced by an EU-wide cap aiming at an overall emission reduction until 2020 of 20 percent below 1990 levels and a 50 percent reduction until 2050 (Cames et al., 2011, p.10). Furthermore, certificates are no longer issued for free but increasingly get auctioned for most industrial sectors. For Pearson and Worthington (2009) however, these measures are nothing but a drop in the bucket. According to their calculations, they presume that until the end of phase II in 2012 an excessive 700 million certificates remain uncharged and thus can be used for compliance in phase III. Accounting for about 40 percent of the reduction target for phase III of the EU ETS, they assume that, despite the alleged improvements to the EU ETS, European companies do not have to make any domestic efforts to cut emissions until 2017. Reyes (2011) estimates the resulting windfall profits for certain European polluters, extraordinarily over-provided with EUA at € 20 billion in phase I and further € 71 billion in phase II. For phase III, he expects additional windfall profits of at least € 7 billion annually. Hence, he argues that the EU ETS is nothing but a subsidy scheme for certain polluters. On top of this damning indictment Pearson and Worthington (2009, p.4) point out that the ambitions of the EU ETS are by no means in line with requests from scientific institutions to fulfil the UNFCCC's environmental objective anyway; resulting in a total of 6 percent emission cut in the next 5 years, they fall a long way short of the proposal of the International Panel on Climate Change (IPCC) of an annual 3 percent reduction.

Coming back to global level, the consequences from these findings for global CER demand are even more striking bearing in mind that the EU ETS is at present almost the only potential absorber for CER supply from 2012 on; the negotiations about a second KP commitment period with new QELRO for Annex I Parties seem far from an international agreement. With the USA, Canada, Japan and Russia, 4 crucial Annex I Parties oppose a second commitment period (GIZ, 2011a). Moreover, national and local efforts to overcome this international regulatory gap by implementing national trading schemes like the EU ETS failed comprehensively; with the United States, Japan, South Korea and Australia, a substantial group of emitters was not capable of passing according legislations (World Bank, 2011b). An exception is California, which at federal state level introduced a cap-and-trade system, starting in 2012 (GIZ, 2011a).

Similar projections can be made for the post-2012 supply. The EC has announced and passed qualitative restrictions on the use of the CDM in order to safeguard its effectiveness regarding EI and SD; consequently, from phase III on, only CER generated in LDC will be chargeable for compliance (GTZ, 2010). Furthermore, CER from industrial gas capture projects are banned from the EU ETS from 2013 on (GIZ, 2011c). Accordingly, as can be concluded from section 5.1 and 5.2, the lion's share of project types and host countries will not be feasible to be implemented anymore from 2013 on. It remains to be seen whether the remaining EU ETS-eligible project types in LDC have the potential to generate the CER supply; according to calculations of the World Bank (2011b, p.48), the share of so far issued CER from projects in LDC only accounts for 0.003 percent. As about 70 percent of CER issued to date are from industrial gas capture projects, the extent of scaling up needed for EU ETS-eligible projects seems hardly achievable**.** The supply of EU ETS-eligible projects like renewable energy projects is further limited, since CER prices are just too low to sufficiently increase IRR and thus profitability. Still, the question about the potential for up-scaling projects generating EU ETS-eligible CER is currently of no true relevance. As long as the EU retains its 20 percent target, the EC sees no need for import of CER for European actors throughout phase III (GIZ, 2011b). The World Bank (2011b) agrees that if no additional demand is about to emerge soon, there will be hardly any incentive to invest in CDM projects in phase III anymore.

6 CDM Reform

As elaborated in section 5, the CDM has turned out to be an arrangement with limited capability to cope with its objectives in various regards. Still, different actors have acclaimed the CDM to be a tremendous success, mostly referencing to the striking development of the project pipeline and the generated amount of emission reduction units for compliance. As the previous analysis reveals however, assessing the CDM's success is not that simple; looking at the sheer numbers obscures the fact that the mechanism bears fundamental design flaws, implicating constant trade-offs between its individual objectives. That is why in recent years a growing number of actors have called for revision and reform of the CDM, see among others Sterk et al. (2009) and Butzengeiger-Geyer et al. (2010). While individual participants in the process solely pursue the goal of minimizing their compliance costs disregarding all other effects, different actors try to spotlight climate protection as the original and primary goal of the UNFCCC and the KP. As they argue, Annex I Parties' efficiency considerations must not be given preference over the EE of the whole climate protection process.[20] Consequently, there have been huge efforts in research in recent years and many reform proposals have been elaborated trying to adjust and fine-tune the CDM. The overall intention is enabling the mechanism to improve and balance its performance, fostering each EI and SD as well as enhancing efficiency without dampening the other objectives.

This section evaluates the most prominent and promising reform proposals, some of which are already implemented or at least agreed, others that are frequently discussed in the international discourse. Although all refining efforts will hardly be able to completely dispel the CDM's fundamental shortcomings, there are promising opportunities for crucial improvement.

6.1 Procedural Reform - Standardized Baselines

Asked for possible measures to overcome barriers and shortcomings of the CDM, the vast majority of participants in the Delphi Survey pointed out the need for simplified and clarified procedures and modalities for the CDM as well as the importance of strengthening the capacity of all relevant actors and institutions (Cames et al., 2007, p.82ff). Regarding this request, the most notable improvement of the CDM procedures is the adoption of standardized baselines and monitoring methodologies. Agreed upon during COP 16 in Cancun in December 2010 the development of standardized baselines under the CDM was approved on the 62nd meeting of the CDM EB in Marrakesh in July 2011 (UNFCCC 2010; UNFCCC 2011a).

As Sterk et al. (2009) explain, the concept of standardized baselines basically aims at abolishing the project-specific establishment of the reference scenario. Calculation of

[20] Critique comes mostly from actors without economic considerations like researchers and civil society organizations.

standardized baselines can be achieved through the elaboration of emission intensity benchmarks for certain industries and project types, e.g. by defining a cap for GHG emissions per output unit. Any GHG emission level beneath that cap is rewarded with CER. The cap itself can be determined by setting those emission levels of a certain percentage of best performing installations in a given time as benchmark. Project approval can be automated and thus accelerated by defining those technologies and measures that are applicable to reduce emissions below that baseline level. With the adoption of these innovations, the CDM EB seeks to significantly improve the process of determining additionality (UNFCCC, 2011a). Indeed, the standardized methodology and overcoming of the project-specific decision-making has the potential of limiting the room for manoeuvre for participants and hence increasing the level of objectivity and accordingly the CDM's EI. Still, as pointed out in section 5.3, the setting of a reference scenario always stays hypothetical and thus will never be an exact approach. Referring to the finding of Cames et al. (2007) that PDD development including baseline determination are the most important drivers of transaction costs, the adoption of standardized baselines bears the opportunity to significantly reduce them.

Special emphasis for the development of standardized baselines is placed on the prioritization of methodologies particularly applicable to LDC, SIDS and all regions and project types underrepresented in the CDM so far (UNFCCC, 2010, p.5). This decision is of particular relevance since the EU decision that only CER generated in LDC will be chargeable for compliance from 2013. Recalling the findings from chapter 5, the impact can be twofold: The emphasis on LDC in combination with reduced transaction costs has the opportunity to increase the share of small scale project types and projects in underrepresented regions that are particularly desirable from a SD view. Secondly, lower transaction costs induce lower abatement costs and hence improve the overall static efficiency and thus compliance opportunities. Altogether, the implementation of standardized baselines seems to be capable of improving the CDM in all regards by fostering both the effectiveness regarding emission reduction and SD at an increased efficiency.

Regarding the Delphi Survey participants' claim for simplified procedures and strengthened capacity of relevant actors, more work has been done in recent time. With the ambition to limit the constraint imposed by high transaction costs, the CDM EB has adopted simplified procedures and modalities especially for small-scale projects, facilitating important steps in the project cycle like PDD development as well as monitoring and verification procedures (Sterk et al. 2009, p.203)

CDM Board Chair Martin Hession gives quite an optimistic resume of the decisions recently adopted and particularly their implications for the SD impact: With the new guidelines, providing for a "[…] clearer, more straightforward path to project development and approval." he finds it "[…] reasonable to expect that this will lead to life-improving projects in countries and regions that have so far missed out on the benefits of the CDM." (UNFCCC, 2011b). It has yet to be proven, whether the described measures are actually capable to improve the overall CDM performance to a satisfying extent or whether they are just an attempt trying to keep a constructional defect alive. The subsequent sections will therefore illustrate innovative and promising approaches demonstrating possible ways to fundamentally change basic principles of the CDM in order to overcome hitherto existing weaknesses.

6.2 CER Discounting & Ambitious Baselines

Two proposals for safeguarding the CDM's EI and even enabling the mechanism in achieving net emission reductions are inter alia illustrated by Sterk et al. (2009) and Butzengeiger-Geyer et al. (2010). Both approaches, CER discounting and ambitious baselines, untighten the fundamental relationship that the reduction of one ton of CO_2e generally leads to the issuance of one CER. In this way, these approaches are not only capable to dispel doubts about a project's EI by applying a "conservativeness factor" (Butzengeiger-Geyer et al., 2010, p.33); depending on the level of ambition, the ratio between actual emission reductions and issued CER can be reduced to an extent creating global net emission reductions. Sterk et al. (2009) illustrate the approach of applying discounting factors on CER. The idea behind this method is to reduce the amount of issued CER for achieved emission reductions by specified factors. There are different feasible scenarios to be considered. One imaginable scenario involves CER discounting with the intention to warrant the CDM's EI. Assuming that a certain percentage of projects is non-additional, a discount on every issued CER of the same percentage would compensate for the accreditation of non-additional projects. For example, Schneider (2007) estimates that 40 percent of all registered projects are unlikely to be additional, accounting for 20 percent of generated CER. This quota consequently advocates for a 20 percent discount rate on every generated CER, restoring the overall EI of the mechanism. By setting a higher discount rate, a net ecologic benefit can be achieved (Sterk et al., 2009).

The concept of setting ambitious baselines can be applied in a quite similar way. As Butzengeiger-Geyer et al. (2010) show, this measure calculates the amount of emission reduction against a more conservative than the BAU scenario. This approach is consistent with scenario 3 in Figure 3. By setting Designated Baseline B as BAU scenario, a lower share of achieved emission reductions is credited. Equivalent to the application of discount factors, the CDM's EI can be safeguarded by setting an ambitious baseline and even net ecologic effects can be created, depending on the level of ambition. It has to be kept in mind though that neither approach increases EI by preventing non-additional projects from getting registered. Rather, the entity of projects compensates for the share of non-additional projects in the pipeline. (Butzengeiger-Geyer et al., 2010, p.80).

As Butzengeiger-Geyer et al. (2010) point out, both approaches can be furthermore applied as steering instruments serving to place emphasis on certain targets like SD contribution. By discriminating certain host countries and project types, a more balanced distribution of CDM projects can be fostered. One possibility to increase the participation of regions that have been underrepresented so far is applying comparatively higher discount factors or baseline ambitions for countries with a high CDM participation. Beyond the described positive ecologic impact, this way of implementation can enhance the competitiveness of projects in LDC and other underrepresented countries that have potential high SD impacts. In the same way, varying discount factors or ambitious baseline scenarios can be applied to increase incentives for different project types, according to their average EI or SD contribution.

Both CER discounting and ambitious baseline setting offer the possibility to simultaneously increase the CDM's effectiveness in emission reduction and other SD objectives. These positive effects are generated at the expense of static efficiency though; both approaches imply a reduction of revenues from CDM projects by reducing the amount of disposable CER. Consequently these methods prevent certain additional projects from being carried out, while only reducing the revenues of other non-additional projects (Sterk et al., 2009, p.22). Recalling the definition from section 4.3, lower revenues mean an increase of specific abatement costs, dampening the CDM's static efficiency.[21] As demonstrated in section 4.2.2, a positive impulse from CER discounting and ambitious baseline setting is however imaginable from a dynamic perspective; leading to a lower supply of CER on the carbon markets, both approaches ceteris paribus increase CER prices. Accordingly, Annex I Parties are incentivized to increase domestic abatement efforts and hence to push technology.

Summing up, both approaches presented in this section seem to constitute feasible opportunities to place stronger emphasis on the CDM's effectiveness.

[21] Specific abatement cost are described by the ratio of the investment costs and the generated reduction units. If CER are generally discounted, higher investments are required to achieve the same amount of CER.

6.3 Sectoral Approaches

Based on the concept of standardized baselines, the concept of sectoral approaches has established and frequently been discussed in literature in recent years. Different voices were raised, especially from the EU, demanding a replacement of the CDM through a sectoral mechanism (GIZ, 2011b). A corresponding proposal has been elaborated by the Chair of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (UNFCCC, 2009). This approach offers Non-Annex I Parties the opportunity to establish sectoral baselines. Any entity in this sector is automatically included in the boundary of the mechanism. Consequently, emission reduction units are not generated in and issued to individual projects; rather, credits are issued if the aggregated emissions within the sector boundary are reduced below the sectoral baseline in a given time.[22] The development and establishment of such a sectoral mechanism is proposed by the host country to the COP and can be either supervised by the CDM EB or another dedicated body operating under the supervision of the COP (UNFCCC, 2009).

The implementation of such sectoral approaches bears a number of remarkable opportunities for a post-2012 climate framework. Most interesting, Dransfeld et al. (2011, p.1) regard the sectoral mechanism as a possible bridge for the transition of Non-Annex I Countries to become Annex I countries. As stated in section 5.5, there is overall uncertainty over the likelihood of a second commitment period for the KP with continuative QELRO for Annex I Parties. Following recent years' discussions, it furthermore seems everything but likely that any government of Non-Annex I Countries will commit to a national obligation under a legally binding international agreement in the foreseeable future. A sectoral approach might therefore be the intermediary step for Non-Annex I governments to get aboard the international climate protection efforts at an individual and self-determined pace. Each Non-Annex I Party can start identifying single domestic sectors and include them into the global carbon market while other sectors stay unaffected. Increasing the coverage of sectors, governments are able to move towards a comprehensive commitment of the whole economy (Dransfeld et al., 2011, p.1ff).

At the same time, a sectoral approach bears the potential to overcome some of the CDM's fundamental shortcomings. The hypothetical and counterfactual question about additionality does not have to be answered for each and every single project anymore. By setting ambitious

[22] Different approaches for how to create incentives or obligations to reduce emissions for entities within the sectors are not further addressed in this thesis. For a detailed illustration of different possibilities see Dransfeld et al. (2011, p.8ff).

sector baselines, the omnipresent doubts about EI can be overcome and even net ecologic impacts can be achieved. EI is further strengthened by a lower risk of leakage resulting from the larger scope of the mechanism covering whole sectors; consequently the potential for substitution of emissions from one place to another is impeded (Dransfeld et al., 2011, p.2). Beyond the described advantages regarding EI, a sectoral approach is also capable of enhancing efficiency and SD impacts; as shown above, standardized baselines can lead to a significant drop of transaction costs. Consequently, as Sterk (2008, p.14) argues, a sectoral approach could finally be the key to include small-scale projects that have additional desirable SD impacts but have so far not been cost-efficient enough for the CDM. Especially sectors as transport, building and small-scale energy supply that have so far not been attractive for the CDM can be encompassed by sectoral approaches. Besides unlocking new emission reduction potentials, these sectors imply social and economic SD benefits such as improved mobility, adequate housing and increased access to energy services (Sterk, 2008, p.18).

Altogether, sectoral approaches offer the opportunity for scaling-up national mitigation efforts to levels exceeding those of the CDM as a project-based mechanism by far (World Bank, 2010, p.48). At the same time, they offer the potential to operate both at an overall preferable level of effectiveness and efficiency. Still, a series of concerns regarding the transformation to sectoral approaches can be raised. As Sterk (2008) ponders, equivalent to the traditional CDM, the assessment of baselines as well as emissions and reductions has to rely on modelling and projections, always involving a given level of uncertainty. At an aggregate level, it is therefore an even stronger prerequisite to establish robust baselines and monitor involved entities' emissions correctly. According to Dransfeld et al. (2011), only few Non-Annex I Countries, if any, are currently likely to have the sufficient capacity to make it up to these requirements. Assuming that only the more advanced Non-Annex I economies possess the necessary capacity, the introduction of sectoral approaches might also further increase the already unbalanced geographical distribution. The same applies to the international institutions; recalling the CDM EB's problems to deal with the supervision of traditional CDM projects, it can hardly be assumed that the Board disposes of the capacity to additionally cope with sectoral mechanisms. Strengthening the capacity as well as increased staffing both of the CDM EB and at host country level is therefore a key prerequisite for the implementation of sectoral approaches. An alternative could be to establish a separate body apart from the CDM EB only for sectoral mechanisms (Sterk, 2008, p.17).

Demonstrating a possible and promising alternative to the existing CDM framework, sectoral approaches would not yet alter the CDM's basic design of giving a monetary value only to emission reduction but not to other SD benefits. The following section presents a possible approach to carbon offsetting dispelling this unbalanced incentive scheme.

6.4 The Gold Standard

Developed under the leadership of the WWF, the Gold Standard (GS) is a quality label for both CDM and voluntary offsetting projects (Kollmuss et al., 2008, p.54). Basically, it assesses and rewards projects' contributions to all different levels of SD presented in Table 1. The intention of the GS is, in contrary to the conventional CDM, to create monetary values for the SD benefits a project generates. GS emission reductions can be purchased by buyers who are willing to pay higher prices for reduction units generated in projects that have certified benefits additional to those of conventional CDM projects. GS certified emission reduction units can be traded both on the compliance market as GS CER and on the voluntary offset market as GS Verified or Voluntary Emissions Reductions (GS VER) at a price including a premium to the conventional market prices (Kollmuss et al., 2008).

As Sterk et al. (2009) describe, the GS imposes a series of restrictions and requirements to categorize GS-applicable projects in order to achieve the desired additional benefits. In general, only renewable energy as well as energy efficiency projects are eligible to get GS certified, in order to select those projects with a supposedly high SD impact. Potential projects must be assessed ex ante against the SD indicators presented in Table 1. Projects with negative impacts on individual criteria are generally disqualified (Kollmuss et al., 2008, p.32). Throughout the entire crediting period, the achievement of the proposed SD impacts must be closely monitored and reported in verification reports. With the help of these reports, the achievement of the intended SD impact is also monitored ex post; only if the achievement is confirmed, GS reduction units are issued. Regarding additionality assessment, the GS uses the official additionality tool provided by the CDM EB (Sterk et al., 2009).

Burian (2006, p.71) regards the GS as a tool trying to "balance between environmental rigor with practicality in terms of application by project developers and operational entities" by enhancing the SD impact without an exorbitant elevation of complexity and involved transaction costs. In fact Sterk et al. (2009), having evaluated different voluntary standards and projects in the GS pipeline, attest the GS an above average user-friendliness, providing for a flexible and standardized procedure for the assessment of a project's SD impact. In their case studies, all involved actors state that the GS requirements are quite manageable and "do not impose an undue burden on project participants" (Sterk et al. 2009, p.130).

Still, the GS does not overcome every single weakness associated with the conventional CDM. Although the SD matrix has shown to be a flexible tool to assess a project's SD impact, it implies a trade-off between effectiveness and efficiency; increasing requirements for quantitative SD assessments also increases involved transaction costs and hence reduces the amount of GS-feasible projects (Kollmuss et al., 2008, p.58). Sterk et al. (2009) furthermore criticize the positive list, excluding the lion's share of project types. As they argue, there are certainly more project types with high positive SD impacts that are a priori not GS-eligible. Regarding EI, GS approved projects show the same weaknesses as conventional CDM projects as they use the same imperfect additionality tool provided by the CDM EB. Although the GS seems to be quite a feasible tool to promote projects with strong SD impacts at sufferable transaction costs, it has not played a significant role in the compliance market in recent years (World Bank, 2011b). As can be expected from the findings throughout this thesis, compliance buyers give sole priority to minimizing compliance costs and are not willing to pay any premium for SD impacts. Still, the GS plays a remarkable role on the voluntary markets, having doubled its market volume from 2009 to 2010 accounting for a remarkable market value of $ 55 million (World Bank 2011b, p.54). Hence, while the GS does not account for noteworthy global GHG reductions, it can be seen as an appropriate mechanism especially generating investments in SD projects.

7 Conclusion

The CDM can be considered a mixed success. It has certainly generated impressive investment flows to projects in developing countries in a short period, mostly from the private sector. Moreover, it has promoted remarkable breaks in emission trends in areas like energy supply. Even industrial gas capture projects, although certainly misused, have led to fundamental cuts in emission of several potential GHG (Sterk, 2008).

Still, the assessment of the CDM carried out in this thesis has detected fundamental weaknesses of the mechanism. Most notably, the CDM has not proved to assure for a high effectiveness in regard to SD and the emission reduction goal of the KP. Rather, participants have given overall preference to efficiency considerations. Accordingly, Dutschke and Michaelowa (1998, p.26) confirm the findings in this paper: "The most striking notion is that […] no actor's role depends on the mitigation of climate change. […] The trade of GHG mitigation between industrialized and developing countries implies many different partners that pursue a great variety of goals, least of which is the reduction of the greenhouse effect." As the findings in section 5 expose, mainly those projects have been conducted generating the largest revenues and hence minimizing the cost of Annex I emission reduction efforts. Given the freedom to do so, participants have exploited the mechanisms' weaknesses and loopholes in order to minimize compliance cost, neglecting both EI and SD benefits of CDM projects. Bringing these findings to a point, the UNFCCC supported by Annex I governments has created a rather dishonest mechanism.

As shown in section 5, the CDM's target system in combination with its incentive scheme does not promote both effectiveness and efficiency simultaneously; enhancing EI or SD of CDM projects is typically achieved at the expense of efficiency and vice versa. As these findings suggest, the target system should be reconsidered.

Regarding SD, the question is whether it is reasonable to adhere to this objective. If this is the case, reform measures should be conducted in order to give either incentives or impose strict obligations to project developers to include SD considerations in their behaviour. Possibilities presented in section 6 are CER discounting and ambitious baseline setting for projects with low SD impacts or comprehensively adopting the Gold Standard SD assessment procedures. Although these measures ceteris paribus lead to a decreasing amount of eligible and feasible projects weakening the mechanisms static efficiency, they seem to be justified considering the CDM's unweighted incentive scheme. If none of the presented measures will be enforced in the future, it can be considered to abolish the SD objective from the CDM framework. As participants will go on to disregard SD impacts, the situation would stay the same while the mendacity would be removed from the mechanism.

The ecologic target in turn must not even enter the equation. Bearing in mind that the primary and superior goal of the UNFCCC and the KP is climate protection, the EI of the CDM must be safeguarded relentlessly. Standardized baselines as well as CER discounting and ambitious baseline setting seem to be promising possibilities to achieve a high level of EI and even to create net benefits to the atmosphere. The importance of such measures is further underlined by projections and claims from international research on climate change advocating for massive up-scaling of international emission reduction efforts. The IPCC in its fourth assessment report demands for 25 percent to 40 percent of emission reduction below 1990 emission levels until 2020 from Annex I countries plus a substantial deviation from emission paths in Non-Annex I Countries in order not to lose track of climate stabilization. (IPCC, 2007, p.776). Actual commitments of Annex I countries appear absurd regarding this claim. First of all, ambitious commitments to reduce global emissions by as many different states as possible are necessary. Furthermore, as experiences from the EU ETS show, these commitments must be enforced by restrictive issuance of emission allowances, creating a stable and strong demand for CER. To generate a sufficient supply of CER, sectoral mechanisms seem to be a promising approach, exceeding emission saving potentials of the CDM as a project-based mechanism by far. Moreover and in combination with ambitious sectoral baselines, substantial net benefits for the atmosphere are achievable. Lex de Jonge, former chair of the CDM Executive Board acknowledges: “It seems obvious that we will need new approaches to address such volumes. The options here are standardized baselines and a more standardized assessment of additionality, which to a certain extent could only be efficient if applied on a larger scale than the actual project-by-project assessment required by the Kyoto rules.” (World Bank, 2010, p.48).

At the same time, the CDM can represent another building block in climate protection shifting its focus on projects in less developed countries with explicit contributions to SD. This will certainly drive up the costs of the whole mechanism and hence lower attractiveness of CDM projects, reducing its overall market share. But as long as emission reduction obligations are forcing enough and there is cost reducing potential for Annex I countries, there will be a future for the CDM.

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Annex

Annex I: Greenhouse Gases included in Annex A to the Kyoto Protocol

Carbon dioxide (C02)

Methane (CH4)

Nitrous oxide (N20)

Hydrofluorocarbons (HFCs)

Perfluorocarbons (PFCs)

Sulphur hexafluoride (SF6)

Source: UN (1998)

Annex II: Annex I Parties included in Annex B to the Kyoto Protocol

PARTY	**QELRO (compared to base year 1990)**
Australia	+ 8%
Austria	- 13%
Belarus*	- 8%
Belgium	- 7,5%
Bulgaria*	- 8%
Canada	- 6%
Croatia*	- 5%
Czech Republic*	- 8%
Denmark	- 21%
Estonia*	- 8%
European Union	- 8%
Finland	± 0%
France	± 0%
Germany	- 21%
Greece	+ 25%
Hungary *	- 6%
Iceland	+ 10%
Ireland	+ 13%
Italy	- 6,5%
Japan	- 6%
Latvia*	- 8%
Liechtenstein	- 8%
Lithuania*	- 8%

Luxembourg	- 28%
Monaco	- 8%
Netherland	- 6%
New Zealand	± 0%
Norway	+ 1%
Poland*	- 6%
Portugal	+ 27%
Romania*	- 8%
Russian Federation*	± 0%
Slovakia*	- 8%
Slovenia*	- 8%
Spain	+ 15%
Sweden	+ 4%
Switzerland	- 8%
Ukraine*	± 0%
United Kingdom of Great Britain and Northern Ireland	- 12,5%

Source: UNFCCC (2011e)

* classified as Economies in Transition by the International Monetary Fund

Annex III: List of Non-Annex I Parties to the Convention

Non-Annex I	DNA established	CDM projects
Afghanistan **		
Albania *	X	X
Algeria	X	X
Angola **	X	
Antigua and Barbuda	X	
Argentina	X	X
Armenia *	X	X
Azerbaijan *	X	X
Bahamas	X	X
Bahrain	X	
Bangladesh **	X	X
Barbados	X	
Belize	X	
Benin **	X	
Bhutan **	X	X
Bolivia	X	X
Botswana	X	X

Brazil	X	X
Burkina Faso **	X	
Burundi **	X	
Cambodia **	X	X
Cameroon	X	X
Cape Verde **	X	X
Central African Republic **		
Chad **	X	
Chile	X	X
China *	X	X
Colombia	X	X
Comoros **		
Congo	X	X
Congo DR **	X	X
Cook Islands		
Costa Rica	X	X
Cuba	X	X
Côte d'Ivoire	X	X
Democratic People's Republic Korea	X	X
Djibouti **	X	
Dominica		
Dominican Republic	X	X
Ecuador	X	X
Egypt	X	X
El Salvador	X	X
Equatorial Guinea **	X	X
Eritrea **	X	
Ethiopia **	X	X
Fiji	X	X
Gabon	X	X
Gambia **	X	
Ghana	X	X
Grenada	X	
Guatemala	X	X
Guinea **	X	
Guinea-Bissau **	X	
Guyana	X	X
Haiti **	X	
Honduras	X	X
India	X	X
Indonesia	X	X
Iran (Islamic Republic of)	X	X
Israel	X	X

Jamaica	X	X
Jordan	X	X
Kazakhstan *	X	X
Kenya	X	X
Kiribati **		
Kuwait	X	X
Kyrgyzstan *	X	X
Lao People's Democratic Republic **	X	X
Lebanon	X	X
Lesotho **	X	X
Liberia **	X	X
Libyan Arab Jamahiriya	X	X
Macedonia (The former Yugoslav Republic of) *	X	X
Madagascar **	X	X
Malawi **	X	
Malaysia	X	X
Maldives **	X	
Mali **	X	X
Marshall Islands		
Mauritania **	X	
Mauritius	X	X
Mexico	X	X
Micronesia (Federated States of)		
Mongolia	X	X
Morocco	X	X
Mozambique **	X	X
Myanmar **	X	
Namibia	X	X
Nauru		
Nepal **	X	X
Nicaragua	X	X
Niger **	X	
Nigeria	X	X
Niue		
Oman	X	X
Pakistan	X	X
Palau		
Panama	X	X
Papua New Guinea	X	X
Paraguay	X	X
Peru	X	X
Phillipines	X	X
Qatar	X	X
Republic of Korea	X	X
Republic of Moldova *	X	X
Rwanda **	X	X

Saint Lucia	X	
Saint Vincent and The Grenadines		
Saint Kitts and Nevis		
Samoa **	X	
Sao Tome and Principe **		
Saudi Arabia	X	X
Senegal **	X	X
Seychelles		
Sierra Leone **	X	
Singapore	X	X
Solomon Islands **		
Somalia **		
South Africa	X	X
Sri Lanka	X	X
Sudan **	X	X
Suriname	X	
Swaziland	X	X
Syrian Arab Republic	X	X
Tajikistan *	X	X
Thailand	X	X
Timor-Leste **		
Togo **	X	
Tonga		
Trinidad and Tobago	X	
Tunisia	X	X
Turkmenistan *	X	X
Tuvalu **		
Uganda **	X	X
United Arab Emirates	X	X
United Republic of Tanzania **	X	X
Uruguay	X	X
Uzbekistan *	X	X
Vanuatu **		
Venezuela	X	X
Vietnam *	X	X
Yemen **	X	X
Zambia **	X	X
Zimbabwe	X	X

Source: UNFCCC (2011e) and UNEP (2011)

* classified as Economies in Transition by the International Monetary Fund

** classified as Least Developed Countries by the United Nations

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