Strengths and weaknesses of the CDM in comparison with new and emerging market mechanisms

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Abstract

Project-based crediting mechanisms for greenhouse gases have to show environmental integrity, which manifests itself in determination of project additionality and the emissions baseline used to calculate credit volumes. A mechanism should mobilize the lowest mitigation cost options first and have minimal transaction costs. Governance should be effective, and include capacity building. The mechanism should lead to flows of investment and technology transfer. Finally, it is more and more recognized that crediting mechanisms should not just provide offset credits but also contribute to global emission reductions.

The CDM has been surprisingly effective in mobilizing thousands of mitigation projects in developing countries, and has also been able to reform itself continuously. Nevertheless, it has been criticized for weak environmental integrity, high transaction costs and complex governance. New market mechanisms (NMM) have been proposed to avoid these shortcomings. It would be inappropriate to compare the CDM with the proposed mechanisms, as their design remains unclear and the real problems of a mechanism only emerge once it has been implemented for a significant period of time.

But already now, a number of baseline and credit mechanisms exists on different levels with whom the CDM can be compared. Domestic offset schemes in the US and Australia, as well as standards on the voluntary market apply standardized approaches to additionality and baseline determination; several of them audit projects only before credits are issued. The impact of these simplifications on environmental integrity seems to be negative, at least as long no restrictions of project types exist. The problems with overallocation in emissions trading systems have shown that political decisions on baselines – which are envisaged in the context of the NMM - are likely to lead to an outcome with weak environmental integrity. There is no simple solution for standardization across project types and geographic locations which can guarantee environmental integrity. It remains to be seen how the current strong standardization drive of the CDM performs in that respect.

The CDM with its inherent ability to reform itself is well placed to inform the design of NMM. While the CDM is contributing to global emissions reductions because crediting periods are shorter than technical lifetimes of project equipment, a targeted contribution could be generated through discounting of emissions credits.

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Contents

1. Background

The Clean Development Mechanism (CDM) under the Kyoto Protocol is the largest international carbon market mechanism. It has been operational for almost a decade. By June 2012 over 4000 projects in developing countries had been formally registered with the UNFCCC Secretariat, while almost a billion of Certified Emission Reductions (CERs) had been issued. Despite this numerical success which had not been expected when the mechanism had been included in the Kyoto Protocol, the CDM has been heavily criticized by media[1], researchers[2] and NGOs[3] alike.

This study assesses the CDM according to a set of criteria and compares it with other – existing or emerging – market mechanisms for mitigation of greenhouse gases, including the voluntary market, national/bilateral mechanisms, and to the extent possible (given that these are still in early stages of development), the New Market-based Mechanism (NMM)[4] and Nationally Appropriate Mitigation Actions (NAMAs)[5] that generate emission credits. On the basis of these assessments, it discusses whether and how the CDM could become a standard setter for the new market mechanisms. It tries not to duplicate assessments of the CDM such as Gillenwater and Seres (2011) or EPRI (2011a).

2. Key criteria used to assess the mechanisms

According to the Kyoto Protocol (Art 12, para 2), the CDM is to "assist" Annex 1 countries in reaching their emissions commitments. This is generally understood as harnessing the most cost-effective emissions reduction options. Moreover, according to the same paragraph the CDM is to promote sustainable development in host countries. Para 5 b) of Art. 12 further specifies that CDM shall generate "real, measurable, and long-term benefits related to the mitigation of climate change", whereas para 5 c) states that emissions reductions are to be "additional to any that would occur in the absence of the certified project activity".

The New Market Mechanism (NMM) is to operate according to the principles laid out in paragraph 79 of Decision 2/CP.17 (UNFCCC 2012a), i.e. meet standards that deliver real, permanent, additional and

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[1] For some of the key media attacks on the CDM see the summary in Michaelowa and Buen (2012).

[2] Probably the broadest compilation of criticism from researchers and NGOs can be found in Böhm and Dabhi (2009). Political scientist Newell (2012) provides a somewhat less strident, but nevertheless scathing criticism.

[3] The NGO "CDM Watch" is regularly challenging the CDM and has gained a substantial stature by singlehandedly pushing the EU to exclude CERs from industrial gas projects from 2013 onwards in its emissions trading scheme; see www.cdmwatch.org.

[4] Given that we do not know yet how the NMM will look like, this study uses the design of the NMM specified in the standard and high demand scenarios developed in my parallel paper No. 1 for the CDM Policy Dialogue.

[5] The term NAMA has been used in a very broad sense but is generally understood to cover any policy instrument that leads to the mitigation of greenhouse gases. NAMAs themselves are not a market mechanism. The term NAMA crediting has recently become contested in UNFCCC negotiations and thus this study assesses crediting of policies under the new market mechanism (NMM)

verified mitigation outcomes, avoid double counting of efforts, and achieve a net decrease and/or avoidance of greenhouse gas emissions.

Based on those policy decisions and criteria for evaluation of climate policy instruments applied by Gupta et al. (2007)[6], a set of criteria is established which will be explained in detail below.

2.1. *Safeguarding environmental integrity*

Any market mechanism that does not operate under a binding emissions commitment might generate emissions credits that are not backed by real emissions reductions. This is due to the fact that emission reductions can also occur in a business-as-usual situation. For example renewable energy such as hydropower could be the lowest cost option to generate electricity, or equipment that improves energy efficiency would pay back the investment in a shorter period, and generate a higher profit, than any alternative. Crediting such business-as-usual reductions would mean that the emissions commitments would be weakened by the corresponding volume of credits. Therefore, the concept of additionality (see the literature review of Gillenwater 2011a) plays the key role in assessing environmental integrity of all market mechanisms other than cap and trade and project-based crediting under a cap. A mechanism with high environmental integrity will have to apply procedures that do not issue credits to business-as-usual activities.

Besides additionality, a realistic definition of baseline emissions, robust monitoring of project emissions and a clear interface towards other policy instruments supporting the projects in question are crucial for environmental integrity. Determination of baselines is a challenge as it requires specification of a counterfactual whose correctness cannot be checked. Baseline emission factors that are higher than those of the actual business-as-usual case will lead to an overcrediting. Unclear or lenient monitoring procedures invite project developers to choose the monitoring approach that delivers the highest credit volume. If not properly taken into account in baseline and additionality determination, policy instruments other than the market mechanism itself could render the project in question economically viable without carbon revenues.

2.2. *Minimizing mitigation and transaction cost*

A market mechanism is cost-effective if it mobilizes the lowest cost options first and once they are exhausted identifies the options with the second lowest costs. Of course, over time costs of options change as fuel and technology costs change; an efficient mechanism is versatile to exploit newly arising low-cost options while sidelining options whose costs have increased.

The cost-effectiveness of a market mechanism is reduced through transaction costs for locating reduction opportunities, partners and counterparties, the development of documentation, third party audits, covering costs of regulatory scrutiny etc. (see Jotzo and Michaelowa 2005). The more complicated the rules and the higher the number of steps of scrutiny, the higher transaction costs will be. Given that transaction costs are minimal if credits are generated without any scrutiny, some trade-off between transaction costs and environmental integrity seems unavoidable.

2.3. *Having effective governance*

The credibility of a market mechanism depends on its governance procedures. A governance structure should allow all stakeholders to provide input in order to increase credibility. Information should be publicly available unless it is of commercially confidential nature. Rules should be consistent and applied in an unbiased manner. A transparent and participatory system with a clear set of rules can be described as effective.

[6] An alternative criteria set can be found in Offset Quality Initiative (2008, p. 3-5)

2.4. Providing capacity building

A market mechanism should contribute to the development of capacity for emissions mitigation that can be used in the future for mitigation activities beyond those mobilized through the mechanism.

2.5. Generating investment or other financial flows

A market mechanism generates benefits for the host country and project owner if it generates financial flows that would not have taken place in the absence of the mechanism. Flows can include the revenue from the sale of emission reduction credits but also investments that are mobilized through the availability of such sales revenues. Financial flows can also be generated if donors are willing to support preparatory activities or capacity building (see Okubo and Michaelowa 2010).

2.6. Promoting technology transfer

A commonly noted criterion for the performance of market mechanisms is their contribution to technology transfer, which would enable sustainable development in the host country. For an in depth discussion of technology transfer in the context of climate change mitigation see IPCC (2000).

2.7. Contributing to global emissions reduction

Initially, market mechanisms were seen as pure offset mechanisms, to reduce the costs of reaching the emission commitments of the buyer countries. Only more recently, the criterion of contribution to global emissions reduction was brought into the UNFCCC negotiations by the EU. The criterion is justified by the need for a massive global emissions reduction to reach the 2°C target agreed by COP 16 in Cancun, as well as the perception that existing project-based carbon market mechanisms' lack scale and have too high transaction costs. A perpetuation of a pure offset mechanism would eventually make it impossible to achieve the reduction required unless many Non-Annex B countries take up emissions commitments.

3. Key features of the assessed mechanisms

The market mechanisms introduced to date internationally and nationally can be differentiated into two generic types. Baseline and credit mechanisms compare the situation after implementation of an emission reduction activity with a counterfactual baseline. Among the existing mechanisms they include the CDM, JI, the Japanese bilateral offset crediting mechanism (BOCM), domestic offsets usable in national and subnational emissions trading schemes, and offsets on the voluntary market.

Cap and trade mechanisms specify a binding emissions cap and then allow the trade of emissions allowances that can be used by emitters to comply with their commitments under the cap. Existing cap and trade schemes include International Emissions Trading (IET), national emissions trading schemes in Australia, the EU and New Zealand and sub-national emissions trading (Regional Greenhouse Gas Initiative (RGGI), and Tokyo's municipal trading scheme). New cap and trade schemes include sectoral trading, national emissions trading (China, South Korea) and sub-national trading (California, Quebec, diverse Brazilian states, diverse Chinese provinces).

With regards the NMM, essentially three baseline and credit concepts are under discussion in the UNFCCC negotiations: expansion of project-based approaches (position of China), sectoral crediting on the basis of a no-lose target (position of the EU) and crediting of the effects of emission reduction policies (mostly called NAMA crediting, South Korea). The fourth variant is sectoral trading on the basis of a binding target (position of the EU), which would thus be a cap and trade scheme.

There is no agreement on the degree of UN oversight versus host country flexibility in rule setting (see Sterk 2012 for an updated analysis on country submissions on NMM).

3.1. Nature of emissions units

The three Kyoto Mechanisms CDM, JI and IET each have their own type of emissions units – Certified Emission Reductions (CERs), Emission Reduction Units (ERUs) and Assigned Amount Units (AAUs). Formally, they are interchangeable, but banking of CERs from the first to the second commitment period is limited to 2.5% of a country's initial emissions budget; the same limit applies to ERUs. De facto this limitation can be circumvented by submitting all CERs and ERUs for compliance, and banking AAUs. Forestry projects under the CDM can generate two special types of CERs – temporary or long-term CERs. None of them is bankable.

Emissions units under the Japanese BOCM are unlikely to be fungible and can only be used to comply with the Japanese post-2012 pledge unless the BOCM is accepted as one form of the New Market Mechanism (NMM).

Domestic offsets are developed in many schemes around the world. Australia's Carbon Farming Initiative (CFI) generates Australian Carbon Credit Units (ACCUs) which are differentiated in Kyoto-compliant and non-Kyoto compliant types of which only the former can be used in the Australian ETS (see the detailed assessment of CFI rules in my parallel paper "Linking the CDM with new and emerging carbon markets"). Domestic offsets could theoretically be introduced in the EU under the Emissions Trading Directive but the implementing legislation has not been developed. The Spanish government wants to purchase domestic offsets generated through the fund FES-CO2 (OECC 2012). RGGI theoretically allows offsets from five project types[7] once a price threshold for RGGI allowances is exceeded, but the price has never been reached. The Californian ETS will accept offsets from offsets projects in the US and Mexico using methodologies approved by the Climate Action Registry (CAR).

Emissions units in the voluntary market, which are commonly called VERs (Verified or Voluntary Emission Reductions), are differentiated according to the registry and verification type. There are over 20 different unit types, with the most widely traded one being the Voluntary Carbon Units (VCUs) issued under the Voluntary Carbon Standard (VCS), followed by CAR and the Gold Standard (Peters-Stanley 2012). While having a relatively small market share, the Gold Standard is renowned as the most credible of the voluntary market approaches. The Thai government has introduced a domestic voluntary market standard "Crown Standard" in collaboration with the Gold Standard (TGO 2012).

Each national cap and trade system has defined its specific allowance unit. The EU ETS uses the EUA (European Union Allowance) which is always backed by an AAU. New Zealand has created NZU (New Zealand Units), while Australia will use Carbon Units. The new trading schemes are likely to continue along this route and create their own units.

Whether units under the NMM would be differentiated into units for each of the three possible forms remains to be seen.

[7] Landfill gas destruction, SF_6 destruction, afforestation, non-electricity related efficiency improvement in buildings, methane emissions reduction through manure management.

3.2. *Additionality determination*

3.2.1. **CDM**

Over time, the CDM has developed an elaborate body of rules to check additionality of projects (see Michaelowa 2009 for the history of additionality testing under the CDM). Generally, additionality testing involves the check whether the project is not the most attractive alternative, or whether the internal rate of return remains below a pre-defined threshold. Principally, additionality testing can also be done through the proof of prohibitive barriers, but this approach has been sidelined after a significant share of projects using this approach were rejected in 2008 and 2009. Since 2011 for small-scale renewables projects the "positive list" approach is used; it currently includes solar PV and solar thermal, offshore wind and marine technologies (CDM Executive Board 2011b).

Under certain conditions, for so-called "micro-scale" projects, i.e. renewable energy below 5 MW[8], energy efficiency improvements of less than 20 GWh per year[9] and other project types generating less than 20,000 CERs per year[10] additionality is automatically assumed (CDM Executive Board 2011a).

For some large-scale project types such as the introduction of improved refrigerators or emissions reductions in new buildings, a performance benchmark approach is now used where any project that "beats" the benchmark is deemed additional.

3.2.2. **JI**

The second track of JI applies a similar project-based additionality test as the CDM, whereas in the first track, additionality testing is at the discretion of the host country and thus differing substantially. Generally, Western European host countries apply a more stringent additionality test than countries in transition. For example, the German government rejected 46 coal mine methane recovery and use projects for lacking additionality because it argued that the projects were already economically attractive due to the renewable electricity feed-in tariff. The government successfully fought legal cases brought against it by angry project developers (Verwaltungsgericht Berlin 2009). The French government specified that additionality should be determined according to an investment or barrier test, with the barrier test specifying clearly that the revenues from ERU sales would have to be sufficient to overcome the barriers (Ministère de l'écologie et du développement durable 2007).

3.2.3. **BOCM**

The Japanese BOCM has not specified its additionality rules yet, but statements from the Japanese government give the impression that positive lists and performance benchmarks are preferred (Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, Ministry of the Environment 2012).

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[8] Projects qualify if located in a LDC or small island developing state, or are offgrid serving households, off-grid serving small and medium enterprises if each installation is < 1.5 MW, or the technology has been notified by the DNA to the UNFCCC and penetration is below 3%.

[9] Projects qualify if located in a LDC or small island developing state, consist of installations each saving <0.6 GWh and serve households, communities or small and medium enterprises

[10] Projects qualify if located in a LDC or small island developing state, consist of installations each generating < 600 CERs and serve households, communities or small and medium enterprises.

3.2.4. Domestic offset programmes

Methodologies developed under the Climate Action Reserve (CAR) for Californian offsets check whether a technology is required by regulation, and if this is not the case it is automatically additional if it beats a performance benchmark or the market penetration of a technology remains below a certain threshold. However, in practice the additionality criteria are defined much more broadly and relatively ad hoc; often just a positive list is used that may or may not be derived from a penetration threshold (see Table 1).

Table 1: Additionality criteria in CAR methodologies.

Methodology	Additionality criterion
Afforestation/reforestation	Land has had less than 10% forestry cover for over 10 years
Avoided forest conversion	Market value of land for alternative use is at least 40% higher than forest land value
Coal Mine Methane	All projects except those feeding into natural gas pipelines are deemed additional
Improved forest management	Eligible project types as per positive list
Landfill gas capture US	Landfill < 0.72 million t accumulated waste in wet and <2.17 million t accumulated waste in arid regions, if energy is produced
Landfill gas capture Mexico	New equipment has been installed beyond existing equipment
Livestock methane capture US	Technology as per positive list
Livestock methane capture Mexico	Technology as per positive list
N_2O destruction in nitric acid plants	Technology as per positive list
Organic Waste Diversion	Eligible waste streams as per positive list
Organic Waste Digestion	Eligible waste streams as per positive list
Ozone depleting substances	ODS types as per positive list
Rice field methane reduction	Eligible project types as per positive list
Urban forestry	Net tree gain >0

Source: Approved CAR methodologies (http://www.climateactionreserve.org/how/protocols/, accessed June 27, 2012)

Additionality of RGGI offsets is evaluated according to the principles used by CAR. As so far no offsets have been generated under RGGI, no experience has been accumulated. The Carbon Farming Initiative applies a positive list approach to additionality (Australian Government 2011).

3.2.5. Voluntary market

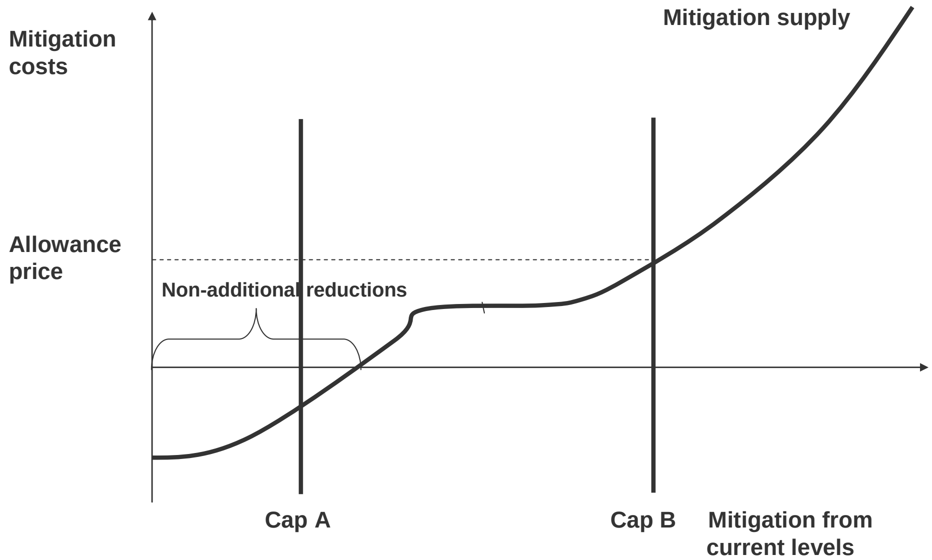
The Gold Standard applies CDM additionality testing also for its VER programmes.

The VCS allows developers of methodologies to choose between a project-specific additionality test, performance benchmark or a positive list. Additionality benchmarks shall be more stringent than baseline benchmarks (VCS 2012a, para 4.1.11). Benchmark determination shall be based on an analysis of the current distribution of performance within the sector as well as stakeholder consultation (VCS 2012a, para 4.1.14). Disaggregation of benchmarks on an appropriate level is seen as very important (VCS 2012c, para 4.1.16). Positive lists can be developed in conjunction with a methodology or as standalone elements valid for several methodologies (VCS 2012a, para 4.1.16).

3.2.6. Emissions trading

Cap and trade schemes do generally not test additionality of mitigation activities implemented under the trading scheme. However, additionality of reductions achieved under the cap depends on the stringency of the cap level, as shown in Figure 1.

Figure 1: Additionality under cap and trade schemes



A lenient cap (cap A) only triggers a small amount of emissions mitigation, at negative costs, i.e. non-additional reductions. A more stringent cap requires more reductions and triggers additional, positive cost mitigation, leading to a positive allowance price.

3.2.7. New Market Mechanisms

The sectoral and NAMA crediting versions of the NMM will suffer from similar additionality challenges as the project-based approaches applied to date. Due to their characteristics of aggregating many emissions reduction activities, they might be able to safeguard overall additionality by setting of a stringent baseline. But this would not prevent the adverse selection of mitigation projects – the non-additional projects would crowd out additional ones.

The additionality of the sectoral trading version would depend on the stringency of the cap, as discussed in section 3.2.6.

3.3. Baseline determination

3.3.1. CDM

For the CDM an elaborate set of baseline methodologies has been developed both through bottom-up and top-down procedures; currently more than 200 methodologies have been approved. Initially, all baseline methodologies for large projects had to be submitted by project developers while small-scale methodologies were defined by the regulators. Later, small-scale methodology proposals also have been submitted by project developers, while regulators have recently taken a more active role towards large-scale methodologies (see below). Rejection rates for large-scale methodology submissions have remained high over the years; over half of the proposed methodologies have been rejected. Project developers complain about the cumbersome regulatory process. Frequently, the approved versions of the methodologies are very different from the original submission, which often means that the project developers cannot use them. For some project types, it has been very difficult to get methodologies approved (see Michaelowa et al 2009 for the case of energy efficiency improvements). Regulators have combined similar methodologies into "consolidated" ones. They frequently revise approved methodologies to take into account experiences made by project developers. Increasingly, baseline methodologies use default parameters to avoid complicated data gathering. For example, baseline utilization rates of lightbulbs have been fixed at 3.5 hours per day. A benchmark approach has been applied in a number of methodologies. In the last years, a top-down drive for standardization of baseline methodologies has been undertaken, which has culminated in principles for standardized baselines agreed in late 2011. Also, recently the concept of suppressed demand has started to be operationalized in CDM baseline methodologies. It essentially means that the baseline needs to take into account the fact that a specific service would have been used by the population if it had the purchasing power to do so. For example, in the context of wastewater management, suppressed demand would be taken into account if the baseline emission factor assumes anaerobic digestion even if in the actual baseline situation wastewater is directly discharged into waterbodies and does not undergo anaerobic digestion.

3.3.2. JI

While other baseline approaches can be used, in practice the second track of JI uses the baseline methodologies approved under the CDM. Under the first track, host countries are free to choose the baseline methodologies they want to use. Some countries such as France have set up an internal regulatory process for methodology approval (Ministère de l'écologie et du développement durable 2007).

3.3.3. BOCM

The kind of baseline methodologies to be utilized by the BOCM has not yet been specified, but are likely to include highly standardized procedures such as predefined Excel templates where project developers only need to fill in certain cells and the spreadsheet then automatically calculates baseline emissions (Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, Ministry of the Environment 2012). However, a number of simplified methodologies have been proposed by a number of feasibility studies (Ministry of Environment Japan and Global Environment Centre Foundation 2012). While some of them are simplified versions of CDM methodologies, others are more innovative. For example, in the case of transport projects, a traffic demand forecast using a transport model is used to derive the baseline. For an energy efficiency improvement activity, a default autonomous energy efficiency improvement o 1% per year is specified as the baseline. For REDD+ projects, historical deforestation rates have been used.

3.3.4. Domestic offset programmes

Baseline methodologies under CAR are developed through a top down procedure (CAR 2011a, 2012). They are to be standardized, ideally applying benchmarks. CFI methodologies are currently project-based and developed in a bottom-up procedure (Department of Climate Change and Energy Efficiency 2011). They are published for stakeholder comments and assessed by the Domestic Offsets Integrity Committee (DOIC).

3.3.5. Voluntary market

On the voluntary market, the Gold Standard (Gold Standard 2012) and VCS (VCS 2012 a-c) have their own procedure of approving baseline methodologies, which is based on bottom-up submissions.

3.3.6. Emissions trading

The allocation process under cap and trade systems has often been based on baseline estimates. Most commonly, these baselines have been emissions projections. In the context of the EU ETS's pilot phase 2005-2007 allocation was based on historical emissions with data provided by companies. Generally, the "baseline" period centered around 2002 with each country having its own methodology. Due to the absence of verification, data overreporting seems to have been common (Anderson and Di Maria 2011, p. 90, 98). Unsurprisingly, the pilot phase was severely overallocated and EUA prices collapsed. The EU Commission quickly learned from this lesson and centralized allocation for the period 2008-2012, reducing allocation levels that the Commission felt to be close to business-as-usual (EU Commission 2006) by over 200 million EUAs. In 2008, the EU Commission fully centralized allocation for the third phase 2013-2020, specifying a 21% reduction from 2005 allocations. Analysts at this time forecast a shortage of EU allowances of 2.4 billion over the full period 2008-2020 (Deutsche Bank 2008). But now the financial crisis broke in 2008 which led to a reduction of emissions under the EU ETS by 250 million t in 2009. This made clear that also phase 2 from 2008-2012 would end in an overallocation and led to immediate criticism by observers (Sandbag 2010). Currently, analysts foresee that the overallocation will last long beyond 2020 (Deutsche Bank 2012 forecasts a surplus of 0.7 billion EUAs).

Overallocation has also been observed with the RGGI scheme (Zetterberg et al. 2012), but the system still functions due to auctioning of 90% of allowances and a price floor applied to the auctions.

Given the key role of baseline setting for sectoral mechanisms as well as the political challenges in agreeing on such baselines in the UNFCCC context, the negative experiences with baseline setting in the context of emission trading schemes should serve as a warning.

3.3.7. NMM

At the current state of negotiations the baseline approach of the NMM has not yet been defined. Prag and Briner (2012) discuss how baselines for the NMM could be developed. They assume that baselines for the NMM would be standardized for specific groups of emitters.

3.4. Monitoring

3.4.1. CDM and JI

Each CDM Project Design Document (PDD) has to include a monitoring plan which is based on an approved monitoring methodology. In the case of the CDM and the second track of JI, monitoring methodologies are "Siamese twins" of baseline methodologies. Standardization has also been undertaken regarding monitoring. In 2011, a detailed guideline on sampling was approved (CDM Executive Board 2011c).

3.4.2. BOCM

BOCM monitoring requirements have not been formalized, but Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, Ministry of the Environment (2012) indicates that they are to be included in baseline methodologies, and will make extensive use of conservative default values, data from manufacturers, and estimations, for the purpose of simplification and avoiding the cost and time of actual measurements.

3.4.3. Domestic offset programmes

CAR has specified detailed monitoring requirements in its methodologies for four project types generating offsets. For example, for landfill gas projects flow meters must be calibrated maximally two months before the end of a monitoring period, and need to undergo adjustments if the calibration shows a difference of more than 5% (CAR 2011b, section 6.2).

Under the CFI, monitoring reports need to follow the rules of the National Greenhouse and Energy Reporting Act 2007 (Australian Government 2011).

Monitoring rules for RGGI offsets have not been specified to date.

3.4.4. Voluntary market

Besides following the CDM's monitoring methodologies, the Gold Standard requires monitoring of sustainable development indicators in case they are particularly sensitive to changes or stakeholders have raised an issue that can be checked by the indicator (Gold Standard 2012a,b).

VCS projects need to specify a monitoring plan consistent with an approved methodology (VCS 2012a, para 3.17). Monitoring reports are to be verified by a Validation and Verification Body (VVB), who can follow a "risk-based" approach as per ISO 14064 and 14065 standards, with general materiality thresholds of 5%, and 1% for projects generating more than 1 million VCUs per year (VCS 2012a, para 5.3.1) .

3.4.5. Emissions trading

Emission trading systems generally put a lot of effort in monitoring. Under the EU ETS monitoring reporting and verification guidelines, industrial installations and aircraft operators need to have an approved monitoring plan. For the former, the monitoring plan forms part of the approved permit that is also required. For each phase of the EU ETS, new monitoring guidelines have been specified that had to be transposed into national law by each member state; from 2013 onwards an EU-wide Monitoring and Reporting Regulation (MRR) will apply. Either, fuel consumption is monitored (and emissions are calculated applying emission factors and oxidation factors) or stack emissions are directly monitored through Continuous Emissions Monitoring Systems (CEMS). Companies fall into three tiers of monitoring stringency, depending on their emissions level and technology/ fuel type. For example lower tiers can use a default value for fuel emission factor, but higher tiers must analyze fuel samples. The uncertainty thresholds are 7.5% for the lowest, 5% for the intermediate and 2.5% for the highest tier. While in the past, companies could use a lower tier than the one required if the methodology was seen as technically not feasible or generating unreasonable costs, from 2013 they need to show that the benefits of the improved monitoring – i.e. the increased availability of EUAs due to a lower uncertainty z multiplied by a reference price of 20 €/EUA - are lower than the costs of the monitoring. Companies that nevertheless cannot reach their tier need to submit improvement plans to the regulators. The new methodologies also require that an adjustment factor be applied after each calibration of measurement equipment. All analyses, sampling and calibrations have to apply methods based on European Norms (EN); if no EN is available ISO standards or national standards are to be used.

RGGI requires power plant operators to install CEMS and to operate those according to the federal US standards (CFR 40 part 75). The Californian ETS monitoring will be based on the California Mandatory Greenhouse Gas Reporting Regulation, which also refers to the federal standards; it is currently being revised.

The Australian ETS monitoring will be based on methodologies specified in the National Greenhouse and Energy Reporting (NGER) system, which contains four methods: a default method (method 1), facility specific methods (methods 2 and 3) and direct monitoring (method 4). The default will only be allowed for landfill gas emissions. The accuracy of emissions estimates shall be improved by increasing the stringency of monitoring requirements over time after consultation with companies covered by the ETS regarding monitoring costs.

The New Zealand ETS applies project-specific monitoring methodologies that allow the use of default emission factors. Companies wanting to apply a specific emission factor need to monitor fuel samples.

3.5. Independent audit

The CDM requires validation of project documentation as well as verification of monitoring reports by independent auditors (Designated Operational Entities, DOEs) accredited by the CDM Executive

Board. Currently, 41 companies are accredited. Second track JI also requires validation (called "determination") and verification by Accredited Independent Entities (AIEs); accreditation is done by the JI Supervisory Committee. Currently, 14 AIEs exist.

Under the BOCM, verification shall be done by DOEs and ISO-accredited certifiers (Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, Ministry of the Environment 2012).

CAR accepts companies as Verification Bodies once they have both completed CAR's training requirements and achieved an ISO 14065: 2007, ISO 14064-3: 2006, and IAF MD 6: 2009 accreditation (CAR 2011a). 16 companies are accredited. There is no validation under CAR.

Under CFI, verification is implemented by auditors registered under the National Greenhouse and Energy Reporting Act 2007

The Gold Standard requires audit by DOEs (Gold Standard (2012a). The VCS has its own accreditation procedure for Validation and Verification Bodies (VVBs) (VCS 2012a). Principally, DOEs, AIEs, and companies accredited by the American National Standards Institute (ANSI) under ISO 14065 with scope VCS are eligible. CAR Verification Bodies are eligible for verification.

Under many mandatory emission trading schemes, third party audits of monitoring reports are required. In the EU ETS, an annual monitoring report must be verified by an accredited verifier. In the first two phases member states accredited auditors, which led to different requirements from member state to member state. From 2013, an EU-wide Accreditation and Verification Regulation (AVR) will be in force that specifies requirements for national accreditation bodies.

In New Zealand's ETS, the sampling for definition of a specific emission factor needs to be verified by a recognized verifier. In Australia, under the National Greenhouse and Energy Reporting legislation utilized for the Carbon Pricing Mechanism, audits can be decided at discretion by the Clean Energy Regulator but are not mandatory.

3.6. Governance structures

The CDM is governed by the Conference of the Parties (COP) to the UNFCCC regarding its groundrules. The CDM Executive Board is the actual decisionmaking body regarding decisions of projects, baseline and monitoring methodologies and specific rules to interpret the groundrules given by the COP. It has set up a number of panels and working groups (the Meth Panel, SSC WG, A&R WG, CCS WG) to provide technical decision support, and also benefits from staff of more than 150 people in the UNFCCC Secretariat.

JI is governed by the COP, with the specific rules for the second track decided by the JI Supervisory committee. First track JI is essentially governed by each host country.

Japan's BOCM is jointly governed by Japan and the partner country in question, through a bilateral agreement and a joint committee providing guidance for third party validators and verifiers (Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, Ministry of the Environment 2012). It is not fully clear whether the partner country has sole responsibility for project approval and carbon credit issuance, or Japan needs to be directly involved. Both are to govern methodology development as well as validation and verification, but division of responsibilities remains unclear.

CAR is governed by a Board that defines for which project types protocols are to be developed. Once a project type has been identified, the Board sets up a balanced multi-stakeholder voluntary workgroup, consisting of industry experts, state and federal agencies, environmental organizations, and various other stakeholders (CAR 2011a, para 4.2.1).

The emissions trading systems are usually governed by national legislation. The EU case is specific inasmuch it has changed from a process dominated by member state legislation, e.g. regarding National Allocation Plans to a EU-wide legislation.

4. Strengths and weaknesses of the assessed mechanisms

This section provides a comparative analysis of how different key issues are addressed in each mechanism and identifies pros and cons to different approaches.

4.1. Safeguarding environmental integrity

As discussed in section 2.1, additionality and baseline determination are the key factors influencing environmental integrity of a carbon market mechanism.

Generally, the scientific literature has engaged in an intense debate on additionality. Some authors (Lohmann 2006, Haya 2007, Millarad-Ball and Ortolano 2010, Böhm and Dabhi 2009) argue that additionality cannot be tested objectively. While it is clear that additionality is not a clear-cut black and white concept, it is generally possible to test the financial attractiveness of a project in the same way banks check the profitability of projects that apply for loans (see Greiner and Michaelowa 2003). Trexler et al. (2006) argue that additionality testing always leads to "false positives" – i.e. projects that are not additional but pass the test - and "false negatives", i.e. projects that are additional but fail the test. A lenient additionality test will lead to a low number of false negatives and a high number of false positives, whereas a stringent test will yield the opposite result. On an aggregate level, according to Trexler et al. (2006) a test is good if the volume of credits from false positives and false negatives is equal, because then aggregate additionality of the CDM would be safeguarded. However, this would essentially mean that a test that leads to 100 million CERs from non-additional projects while rejecting projects that would have been additional and would have generated 100 million CERs would make sense, which obviously is not the case. A test would be better, the more it reduces the volume of both false positives and false negatives.

Gillenwater (2011b. p. 28) criticizes the focus of current offset programmes on assessing the intentions of each individual actor through "case-by-case adjudication by offset program administrators" which pushes the cost, burden, and uncertainty of the process on project developers and independent auditors auditing bodies (i.e., verifiers). His alternative of a "regulatory standard setting that is based on causal inference investigations, evidence, and carefully elicited expert judgment" does however not look that different from the more recent procedures adopted by the market mechanisms, as has been shown above.

Regarding baseline assessment, Offsets Quality Initiative (2008) argues for a hybrid of project-specific and standardized methodologies. Given the results of Hayashi et al. (2010) this recommendation can be upheld because standardized baselines are no panacea.

4.1.1. **CDM**

When in 2005 the CDM witnessed a real gold rush, the regulatory capacity to apply the additionality test was not there, compounded by the fact that auditors did not thoroughly check the additionality argumentation. Only when critical media and analyst reports started to surface (e.g. Michaelowa and Purohit 2007), the CDM EB assessed the situation and introduced a second level of check of project documentation through the "Registration and Issuance Team" as well as by UNFCCC Secretariat staff. This cumbersome system of check and balances led to repetition of additionality checks. Immediately, rejection rates by the CDM EB soared from zero to around 10% in 2008-2009 (see

Michaelowa 2009, Streck 2010). Still, many analysts find that a relevant share of registered projects continues to be non-additional - Schneider (2009b) concludes that about 40% of projects and 20% of the CER volume is unlikely to be additional. So the CDM EB eventually suspended Det Norske Veritas, the market leader in validation for rule-non conformities in late 2008 and published the "Validation and Verification Manual" to make validators adhere to the same standards. While rejection rates have come down substantially since then, the question of how to differentiate business-as-usual projects from projects that are only mobilized through the CDM incentive thus continues to generate controversies.

Empirically, many researchers have found that a significant share of projects is not additional. Schneider (2009b) assessed how 93 registered CDM projects applied the regulatory tool for additionality determination. He found that the barrier analysis was generally done in a highly subjective manner that was difficult to validate in an objective and transparent way. Key assumptions regarding additionality were often not substantiated with credible, documented evidence. Alexeew et al. (2010) look at a sample of 40 registered projects in India and find a negative correlation between their additionality and contribution to sustainable development. This shows that there might be a tradeoff between two key targets of the CDM.

On a different note, Lewis (2010) finds a clear contribution of the CDM to the rapid upswing of the renewable energy sector in China.

A specific additionality issue relates to projects where CER revenues are so high that they might dwarf revenues from the sale of the good whose production generates the greenhouse gas emissions abated through the CDM project. Under such a situation, production of the good would be expanded beyond the level which would have been produced under business-as-usual. Such a situation would have existed for new plants producing the refrigerant HCFC-22 because the CER revenue from destruction of the HFC-23 waste stream from the HCFC-22 production process would make the plant profitable even if the HCFC-22 were given away for free. Therefore already in 2005, the methodology for HFC-23 projects was changed to limit eligibility to existing HCFC-22 plants. Since 2010, CDM Watch (2010a,b) has repeatedly criticized industrial gas projects for leading to leakage of emissions from industrialized to developing countries. This has led to the EU prohibiting the use of CERs from such projects after April 2013 (EU Commission 2011). Recently, CDM Watch has attacked coal power plant projects for being not additional and the methodology ACM 13 being flawed due to use of obsolete data (see the study by Lazarus and Chandler 2011, which was commissioned by CDM Watch). The EB subsequently put the methodology on hold.

Baseline development under the CDM has been cumbersome, with rejection rates remaining stubbornly above 50%, long lead times and changes of proposed methodologies by the regulators which made them difficult to apply in the context of real projects (Michaelowa et al. 2009). Since 2009, there has been a strong drive to standardize baselines which has led to the approval of benchmarks and default factors for selected project types. Compared to the situation described by Michaelowa et al. (2009), it is for example now much easier to specify the baseline for a efficient lighting project, which has led to a substantial increase of inflow of such projects. Remaining challenges are inconsistent approaches across project types, frequent revisions of approved methodologies and the desire of the UNFCCC Secretariat to "cut the Gordian Knot" by introducing universal benchmarks (see the decision of the CDM EB to set the benchmark at 80% / 90% of the performance curve, CDM EB 2011d). The challenges in defining technologies, collecting robust data and selecting the correct level of aggregation should not be underestimated.

4.1.2. JI

A separate assessment of additionality of JI projects lacks in the literature. This is rather surprising given the discussion in Germany about the rejection of coal mine methane projects (see section 3.2 above). Generally the same kind of criticism has been targeted at JI as in the case of the CDM, somewhat mitigated by the fact that JI is operating under a cap and thus allocation of ERUs to non-additional projects means that additional emission reductions have to be achieved elsewhere, as long as the country does not have a generic AAU surplus.

There is also no assessment of the stringency of baselines applied under Track 1 JI. Baselines under Track 2 have essentially the same characteristics as CDM baselines and thus

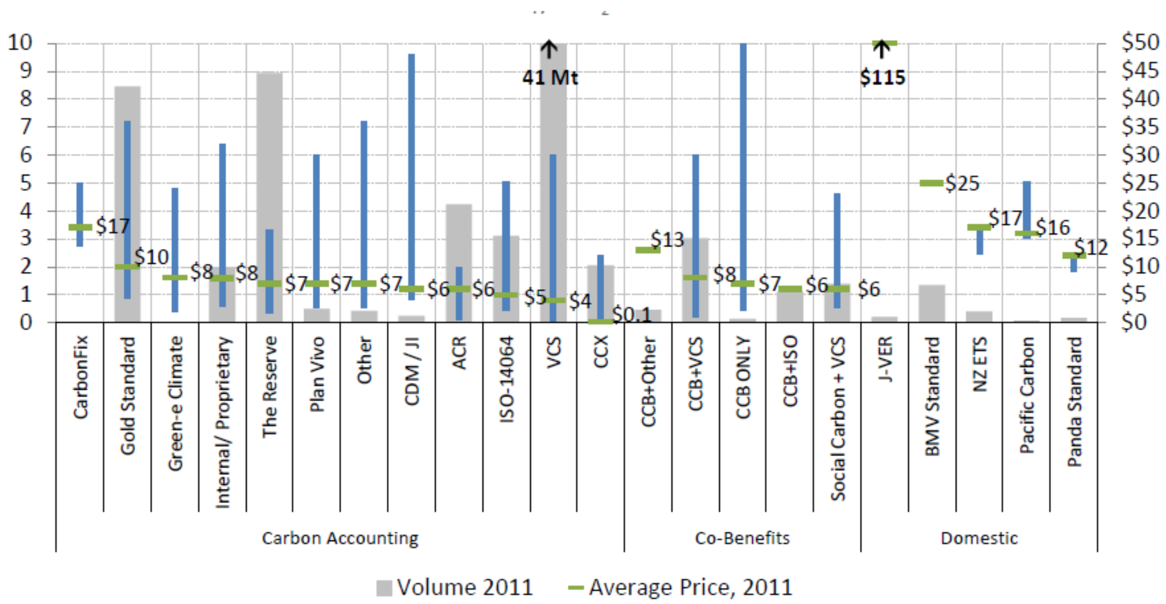
4.1.3. Domestic offsets

The different additionality approaches under the domestic offset programmes CAR and CFI have not yet been assessed in the literature. This may be due to the short period of experience with application of these programmes.

4.1.4. Voluntary market

According to Peters-Stanley and Hamilton (2012), prices differ massively both within and between the different voluntary market segments (see Figure 2). This shows how strong perceived differences in quality are even for projects from the same standard.

Figure 2: Prices and transaction volumes of different voluntary market standards



Notes: Blue: Price range ($/VER, right hand scale), grey: volume (million VERs, left-hand scale)

Source: Peters-Stanley and Hamilton (2012, p. 31)

Dhanda and Hartman (2011) find that the quality of 117 offset providers in the voluntary market differs substantially, using qualitative criteria. In their view, additionality of a significant share of projects is doubtful. While Gold Standard projects are found to be of high quality, VCS projects have been criticized. This is in contrast with an earlier study by Kollmuss et al (2008) who find differences for various voluntary standards differ, but see many – including VCS – as comparable to CDM in quality.

4.1.5. Emissions trading schemes

The environmental integrity of emissions trading systems has so far not been attacked on grounds of monitoring and verification failures, but due to overly lenient allocation of allowances that was often compounded with lack of robust historical data that then led to the possibility to increase initial allocation compared to a situation where data collection is audited externally (see section 3.3 above).

4.1.6. New Market Mechanism

Given that the rules of the NMM are still undefined, its environmental integrity cannot yet be assessed. It strongly depends on the way additionality rules are set or the baseline and credit-based NMM types and whether the caps selected for the sectoral trading version would be stringent enough.

4.2. Minimizing mitigation and transaction cost

There are only few studies on the efficiency of those market mechanisms that have actually been utilized to a large extent, which are the CDM and emissions trading.

4.2.1. CDM

Castro (2012) has assessed whether the CDM mobilized the abatement options with the lowest cost and finds that many low-cost opportunities have not yet taken up. However, the largest CDM projects that abate the industrial gases HFC-23 and N_2O have very low cost and had been ignored before the CDM incentive mobilized them, as discussed by Wara (2007). Promising activities in energy efficiency and other sectors have been hampered by regulatory challenges in baseline determination and monitoring (Michaelowa et al. 2009, Sirohi and Michaelowa 2008). Mitigation cost strongly depends on the possibility to identify truly additional projects (see the discussion on the Leverage Paradox, section 4.5.1).

Mitigation cost also depends on the performance of projects compared to their expectations. While average performance of CDM projects in terms of the ratio of expected CERs to actually issued ones has remained high with 95-100% (UNEP Riso Centre 2012), which would indicate that the expected mitigation cost could actually be achieved. However, this hides a big difference between industrial gas projects, which overachieve, and a significant number of project types that achieve less than half of expected CERs (UNEP Riso Centre 2012). The latter include methane destruction from landfills and agricultural waste. Chen et al. (2010) discuss reasons for bad performance of landfill gas projects in China among which there is inappropriateness of default factors used in the model to forecast mitigation volumes, as well as problems in managing .the landfills.

A significant number of registered CDM projects does apparently not materialize (10% according to Cormier and Bellassen 2012). One reason may be the inability of the projects to achieve financial closure after the financial crisis struck in 2008.

Transaction costs of the CDM include project documentation, fees charged by DOEs for validation and verification and fees charged by the UNFCCC for project registration and CER issuance.

Table 2: Key transaction costs of the CDM

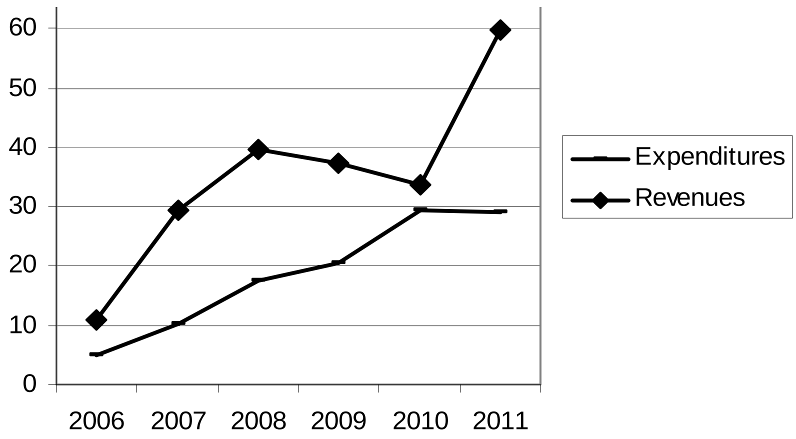
Item	Current level	Recipient
Feasibility study	10-20,000 €	Consultant
Methodology development	70-120,000 € 1000 $	Consultant UNFCCC Secretariat
PDD development	15-75,000 €	Consultant
Letter of approval	0-2000 €	DNA
Validation	20-50,000 €	DOE
ERPA negotiation	Depends on type of contract	Lawyer
Registration	No fee for projects < 15,000 annual CERs. 0.1 $/forecast	UNFCCC Secretariat

Item	Current level	Recipient
	annual CER <15,000; 0.2$/forecast annual CERs >15,000, capped at 350,000 $. Projects in LDCs and countries with <10 registered projects are exempt.	
Monitoring	Depends on equipment	Consultant
Verification	10-15,000, first verification higher	DOE
Issuance	0.1 $/annual CER <15,000; 0.2$/annual CERs >15,000. Paid registration fee is deducted.	UNFCCC Secretariat

Source: for registration fees UNFCCC (2010b) and issuance fees UNFCCC (2005, para 37).

Total registration and issuance fees paid to the UNFCCC Secretariat and total expenditures of the CDM department are shown in Figure 3. Total accumulated fees have passed the 200 million $ mark. Gelöscht

Figure 3: Revenues and expenditures of the UNFCCC Secretariat due to CDM (million $)



Source: 2006/7 values: EB 38 Annotated Agenda, Annex 2, 2008 values: EB 45 Annotated Agenda, Annex 2, 2009 values: EB 52 Annotated Agenda, Annex 13, 2010 values: EB 59 Annotated Agenda, Annex 5, 2011 values until October 31: EB 65 Annotated Agenda, Annex 4

Michaelowa and Jotzo (2005) had analyzed transaction costs of early CDM and found that projects with less than 10,000 CERs per year would be unable to recoup transaction costs by CER revenues. Nevertheless, by June 2012 949 projects estimating less than 10,000 CERs per year - i.e. 9.2% of all projects -, had been submitted (UNEP Riso Centre 2012). This shows that either the transaction cost burden must have been lower than expected, it has declined over time, CER sales prices were higher and thus brought more revenues, or motivations other than profit must have guided investment decisions. The second reason might be relevant especially in India and China where the emergence of a large number of local CDM consultants led to competitive pressure on consultancy fees. Publicly available sources are scarce and quote very wide ranges, but indeed a very low value for India in the mid-2000s (see Table 3). Gelöscht

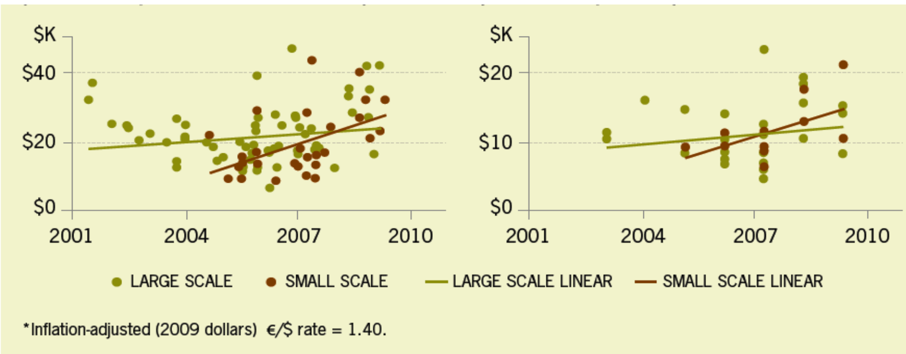
Table 3: Selected elements of transaction costs of CDM over time and in different locations

Source	Project type	Host countries	PDD (1000 €)	Validation (1000 €)	Verification (1000 €)
Martens (2004), p. 14	Renewable (small)	Malaysia	8-20	4-8	4-11
Martens (2004), p. 13	Renewable (large)	Malaysia	12-50	8-16	4-11
Ahonen and Hämekoski (2005), p. 14	Renewable (small)	India, Central America	3-15	3-14	3-18
UNEP Riso Centre and Ecosecurities (2007), p. 55f	Any (small)	Any	7.5-18.5	5-7.5	4-7.5
UNEP Riso Centre and Ecosecurities (2007), p. 55f	Any (large)	Any	11-74	6-22	4-18.5
Baker & Mc Kenzie (2008), p. 90	Renewable (large)	India	1.5-2.3 +5% CERs	4.5-6	3-4.5
Chan et al. (2009), p. 4	Biomass (small)	China	27.5	20	5
Guigon et al. (2009), p. 20	Any (small)	Any	30	13	5-6
Guigon et al. (2009), p. 20	Any (large)	Any	40	13	6-8
UNFCCC (2010a), p. 4	Any	Without domestic CDM consultants	40-80	20-45	17-20

The only robust source covering a large project portfolio over a longer period is World Bank (2009), which exhibits a U shape for validation costs, and a rise in verification costs over time.

Figure 4: Validation and verification costs of the World Bank CDM portfolio

a) Validation b) Verification

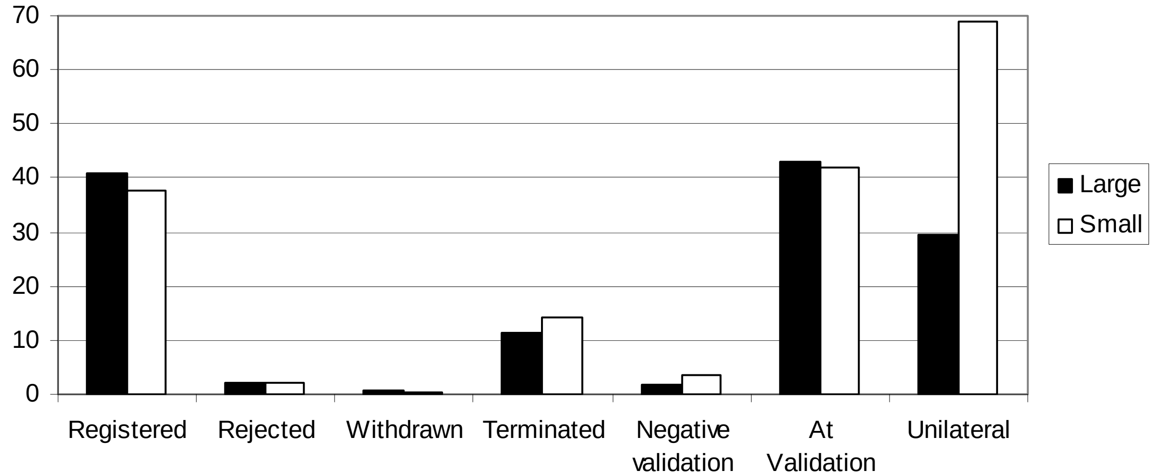


Source: World Bank (2009), p. 8

The small projects that overcome the transaction costs are not significantly more likely to fail than the larger ones. However, they are much more likely to be unilateral, which shows that host country entrepreneurs are less risk averse than CER buyers (Figure 5).

Gelöscht

Figure 5: Share of projects (%) above and below 10,000 CERs per year in different CDM status categories



Source: Data from UNEP Riso Centre (2012). The share of unilateral projects only relates to registered projects and projects under validation.

The introduction of programmatic CDM (PoAs) was an attempt to reduce transaction costs by requiring only one set of documents for registration of a whole series of projects that can stretch over 28 years. Initially the development of PoAs was slowed by the unwillingness of DOEs to validate them linked to an unprecedented level of liability for wrong validation. After adjustments in the rules PoAs have seen a rapid development. Compared to standard CDM, PoAs achieve a lower transaction cost once three to four projects are bundled in a PoA.

4.2.2. BOCM

Under the BOCM, some 100 feasibility studies have been funded so far, but since the projects are not yet operational it is too early to conclude on transaction cost.

4.2.3. Domestic offset programmes

CAR charges project fees of 500 $ and an issuance fee of 0.2 $ per unit. Total administration costs reach 3.7 million $ p.a. but this covers the full registry as well (Hernandez 2012). Verification costs range around 10,000 $ but there is no robust information available.

Transaction costs of CFI and RGGI offsets cannot yet be assessed as both programmes have not been operationalized to date.

4.2.4. Voluntary market

Guigon et al. (2009) provide a detailed comparison of transaction costs of voluntary market standards with the CDM, including three project size categories of the Gold Standard and the VCS (see Table 4, updated according to Gold Standard 2012c and VCS 2012d).

Gelöscht

Table 4: Transaction costs of different standards (€)

Type	Documentation	Validation	Verification	Issuance per unit
CDM large	63,000	21,000	6000	0.2$ (>15,000)
CDM small	53,000	15,000	5000	0.1$(<15,000)
Gold Standard CDM	81,000	27,000	9000	1.5%/0.05$
Gold Standard VER large	66,000	27,000	8000	2%/0.1$
Gold Standard VER small	66,000	23,000	8000	2%/0.1$
Gold Standard VER micro	64,000	4000/8000	2500	2%/0.1$
VCS	45,000	18,000	6000	0.1$

Documentation includes all consultancy needed until the project is registered/approved. Forestry projects have different cost structures.

Source: Guigon et al. (2009), p. 21, Gold Standard (2012c), VCS (2012d)

Guigon's differential between standard and Gold Standard CDM is generally confirmed by Sterk et al. (2009) who have assessed transaction costs of several CDM projects to achieve the Gold Standard certification, costs up to registration reach about 10,000 €, while verification costs increase by about 5000 €.

4.2.5. Emissions trading

In emissions trading systems, transaction costs are generally thought to be low. In the EU ETS however, the highly scale-specific transaction costs, were estimated to reach over 2 €/EUA for small companies in Ireland (Jaraitė et al. 2010), with Aether (2010) getting similar results for the UK. Given that 75% of installations were responsible for just 5% of emissions in 2005/6 (Betz et al. 2010), this is a relevant barrier to market participation and reaches levels similar to those of the project-based mechanisms.

4.2.6. New Market Mechanisms

A serious issue that determines mitigation costs of the NMM is whether the shift in responsibility for mitigation from emitters or investors to host country governments would limit or even eliminate emitters' incentives to engage in seeking mitigation options (Butzengeiger et al. 2012). In particular under sectoral crediting with mainly private-owned emitters that faces a no-lose target, incentives to invest in mitigation might be low if investors do not get guarantees to receive an equivalent for their investment, e.g. in the form of credits. Therefore the implementation of a crediting mechanism should be designed in such a way that prevents free riding and provides guaranteed performance-based revenues to investors. Otherwise private investments will be alienated by the lack of credibility.

Given that the rules of the NMM are still undefined, its transaction costs cannot yet be assessed.

4.3. Having effective governance

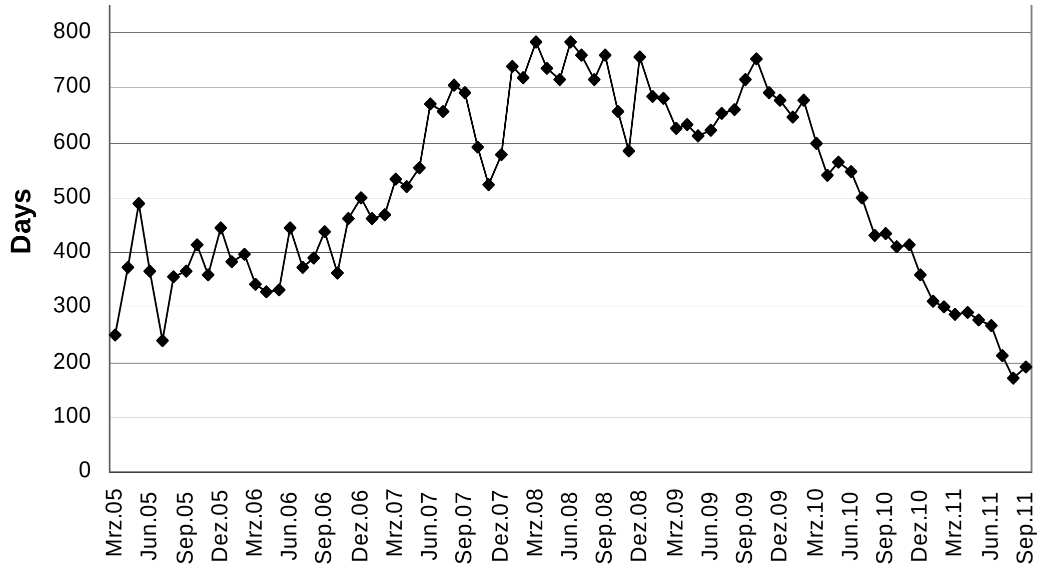
4.3.1. **CDM**

Generally, the CDM has a very transparent process and thus stakeholders can follow decisionmaking easily. For a long time, the CDM EB and the whole regulatory system were attacked by project developers for being haphazard, slow and inefficient. The International Emissions Trading Association, a lobby group of project developers and CER buyers, summarized this criticism succinctly (IETA 2009). In IETA's view, the part-time nature of governing bodies, the inappropriate division of responsibilities, inadequate standardization, and neglect of due process led to unrelenting time constraints, ineffective communication practices, lack of transparency, slow policy development and inadequate resolution of issues. A key problem contributing to this situation is that the CDM EB had lost trust in the auditors - that were to play the role of gatekeeper and thus alleviate the EB's workload - as they routinely rubber-stamped low quality project documentation in the first years of the CDM. Initially, the members of the EB also feared to reject projects due to their personal liability in case the developer of a rejected project started a legal case. While the EB members still do not have immunity against legal proceedings, they now take an increasingly bold stance. Therefore, a regulatory cat-and mouse game started with the EB introducing ever more steps of scrutiny whereas project developers tried to outwit the regulators (see Michaelowa and Buen 2012 and EPRI 2011a. From 2007 to 2010, the decisionmaking process however was cumbersome and led to multi-month delays. Krey and Santen (2009) stress that the regulatory problems are not only due to regulators. In their view, project developers and auditors alike can enhance their contribution to CDM performance by putting in place appropriate internal project management procedures that improve documentation and reduce the share of reviews.

In 2009, the CDM EB acknowledged that the arms race between regulators and project developers contributed to a clogging of the system due to the increasing need to review cases. Therefore, it introduced a much simplified review procedure and a clear hierarchy of rules. Moreover, the UNFCCC secretariat's CDM staff has been ramped up significantly since 2008. In combination, these measures have led to a significant reduction in processing times – a factor of four from the nadir in 2008 (see Figure 6).

Gelöscht

Figure 6: Time from start of validation until registration



Source: UNEP Riso Centre (2012)

In 2011, a major regulatory overhaul led to a unified validation and verification standard and integration of the many scattered decisions by the EB in the basic regulatory documentation. It remains to be seen whether this further reduces processing times and reduces transaction costs.

Despite these recent improvements, the stability of rule interpretation is a relevant concern, especially regarding the methodologies for baseline and monitoring that have to be approved by the CDM EB before they can be used by project developers. As discussed by Michaelowa (2009), over half of the proposed methodologies have been rejected and the success rate has not improved over time. While submissions by project developers have improved, the standard applied by the regulators becomes more stringent. Methodologies are revised frequently – every three months for some technologies - once their flaws become visible through use. While there is a grace period of 8 months for old methodology versions, it is insufficient given the lengthy preparatory periods for project validation and submission for registration.

Moreover, the CDM EB sometimes abruptly develops a “fashion” where certain project types suffer a high share of rejections that had previously been registered without problems. The first case was blending of cement with fly ash and slag where the additionality of such projects was put under doubt in late 2007. In 2009, the EB started to attack Chinese wind projects with the argument that feed in tariffs were reduced due to the availability of CER revenues. This was inconsistent with the EB’s earlier decision that host country policies subsidizing low-carbon development introduced after 2001 should not be taken into account in the baseline and additionality determination. China was furious and made sure the COP decision on CDM reform stressed the host country’s prerogative regarding design of policies that promote greenhouse gas reduction. A new “fashion” that has come up is the review of issuances from HFC-23 projects due to changes in project design. For many years, nobody had bothered about such changes until the NGO CDM Watch had started to attack HFC-23 projects.

Overall, the CDM has changed substantially over the nine years since registration of the first project and thus shown that institutional learning is possible even under a UN process if deficiencies of the mechanism are identified.

4.3.2. BOCM

BOCM governance is still not fully clear. It is also worth asking whether the bilateral setup is efficient if parallel structures for e.g. approval and carbon credit transfer are set up not only in Japan but in all countries entering MoUs with Japan.

4.3.3. Voluntary market

Dhanda and Hartman (2011) find that the voluntary market is highly non-transparent. Competing registries and standard providers proliferate, and it is very difficult for stakeholders to assess governance quality. Only once per year, a report on the state of the voluntary market provides information about transaction volumes and shares of the different standard providers. The competition between these has led to changes in methodologies and overall governance. One can say that it has led to a differentiation into different tiers of the market: the Gold Standard catering for the “high end”, the VCS for the “bread and butter” VER buyers, and certain niche/add on providers focusing on specific project types (e.g. Plan Vivo and CCBA for forestry, see Peters-Stanley and Hamilton (2012) It has also led to the demise of certain standard providers with the most conspicuous case being the Chicago Climate Exchange (CCX).

4.3.4. Emissions trading

In the EU ETS, the non-compliance penalty of 40 €/t CO_2 in the pilot phase 2005-2007 and 100 € since has been a highly effective means of assuring compliance. However, in other contexts, governance has been slow to react to emerging challenges. It took several years combat VAT fraud, which artificially blew up transaction volumes. Security of accounts in national registries was insufficient, leading to high-profile phishing cases transferring millions of EUAs to criminals. Only in the third phase from 2013, an EU wide registry has been set up. The problems with overly lenient allocation of EUAs (see section 4.1.5) by government of member states were initially addressed by the EU Commission reducing the allocation volumes (which led to several court cases of member states against the EU Commission) and in the third phase allocation has been centralized. This is a clear empirical argument for centralization of governance to prevent a “race to the bottom” through competition of different jurisdictions.

4.3.5. New Market Mechanisms

In the UNFCCC negotiations, so far a “top down” and a “bottom up” governance model of the NMM compete. Prag and Briner (2012, p. 24) neatly summarize governance issues of the NMM. Under a “bottom-up” approach, there might be a race to the bottom as witnessed in the context of sustainable development criteria for CDM projects, which are administered by the Designated National Authorities (DNAs) of each host country.

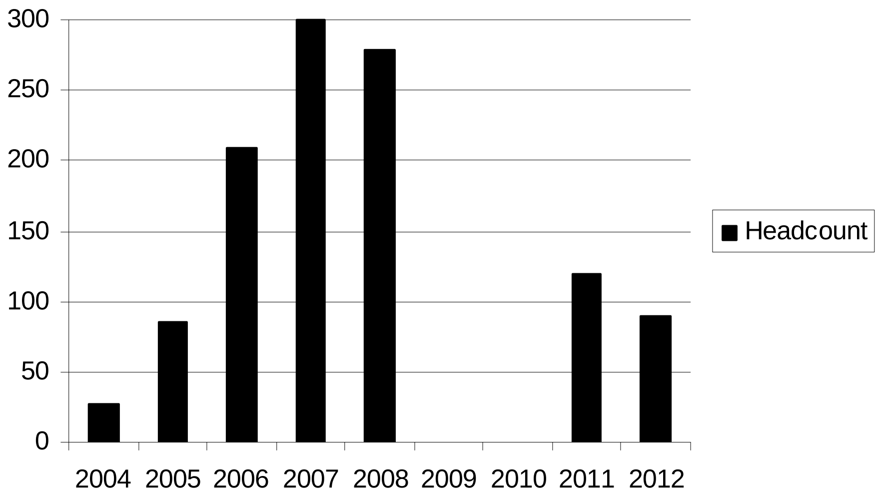
4.4. Providing capacity building

4.4.1. CDM

Okubo and Michaelowa (2010) find that capacity building in CDM host countries - with over 80 million € spent – has been a necessary but not sufficient condition for actual project implementation. Especially in the early phase of the CDM, capacity building concentrated on advanced developing countries instead of LDCs. This has changed over time, but now advanced developing countries are benefitting from capacity building support for NMM, e.g. in the context of the World Bank’s Partnership for Market Readiness or the MAIN initiative. Overall, in a number of CDM host countries, CDM has been a critical means to raise awareness of entrepreneurs regarding the possibility of greenhouse gas mitigation. For example, in India newspapers are now routinely reporting on the availability of CER revenues and the possibility of the CDM to boost business (see Michaelowa and Michaelowa 2011, p. 16).

Initially, the CDM suffered from the shortage of skilled personnel, with project developers as well as regulators poaching staff of DOEs. In 2007-2008, people with just a few years of professional experience were able to ask for and get six digit salaries in the City of London – see the survey of salaries in the carbon market business by Acona et al. (2009) . In the aftermath of the financial crisis and with a broadening of available skill, this salary bubble burst (it is no surprise that the carbon salary survey was discontinued after its 2010 edition). Several high-flying companies such as Ecosecurities had to substantially downsize after being taken over by financial institutions (Sills and Carr 2010, Nicholls 2011, Allen 2012).

Figure 7: The rise and fall of Ecosecurities



Staff numbers at end of the year (for 2009 and 2010 no figures are publicly available)

Sources: 2004-2008: Ecosecurities annual report 2005-2008, 2011 and 2012: Allen (2012)

The downsizing of the CDM project developers has substantially alleviated the personnel shortage at auditors and regulators. Given the low price level on the market, so far overall employment has remained surprisingly stable. But the degree of robustness of this stability has not really been tested.

4.4.2. BOCM

The programme of over 100 feasibility studies launched in 28 countries since 2010 – 80 supported by the Ministry of Economy, Trade and Industry and 29 by the Ministry of Environment - has a strong capacity building component (Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, Ministry of the Environment 2012). The elaboration of monitoring methodologies and project ideas is done in close collaboration with host country agencies. In Indonesia, the setup of a MRV agency is supported while in the Mekong region, a policy dialogue with climate change officials is undertaken. METI plans seminars, expert dispatches, technical expert invitations, joint researches on MRV methodologies, and government-private sector dialogues from early 2013 through different implementing institutions, such as The Energy Conservation Center, Japan, the International Center for Environmental Technology Transfer, the Association for Overseas Technical Scholarship and the Japan Coal Energy Center. A New Mechanisms Information Platform website[11] provides documents on the BOCM.

[11] www.mmechanisms.org/e/index.html

4.4.3. **Voluntary markets and emissions trading**

Both the emissions trading systems and the voluntary markets have led to the emergence of a large set of specialized service providers such as brokers, exchanges and auditors. This was achieved without a relevant degree of government-led capacity building. The historical fall in prices has however led to a number of companies leaving the market and could lead to an erosion of capacity in case the market outlook does not improve soon.

The Gold Standard has actively trained auditors and held regional capacity building workshops since its inception. The participation in these workshops is free of charge. Moreover, webinars are held to attract NGO supporters.

4.4.4. **New market mechanisms**[12]

An array of large-scale capacity building exercises for new market mechanisms has been developed over the last years including the World Bank´s Partnership for Market Readiness (PMR), the Mitigation Action Implementation Network (MAIN) and the International Carbon Action Partnership (ICAP). The PMR clearly is the flagship of these exercises and has been operational since 2010; it can allocate 76 million $ granted by 11 industrialized countries. It supports 15 countries in the setup of domestic market mechanisms or in preparation for the NMM under the UNFCCC.

The PMR's remit is relatively broad, covering identification of suitable market instruments and sectors, coordination with relevant ministries and key domestic stakeholders, facilitation of data collection/management and establishment of reference levels, development of MRV elements, registries and transaction logs. It also wants to help setting goals and preparing legal and regulatory frameworks as well as supporting government engagement, responsibility, and institutional capacity for managing technical and policy components. Finally, pilot initiatives for domestic cap and trade schemes, scaled-up crediting or other new, innovative instruments are to be supported. The PMR is overseen by the Partnership Assembly consisting of all donors and recipients; it has met four times. Each participating country will receive at least 3 million $.

There are three stages of the PMR process (see Wang 2012). After initial selection, which is closed since October 2011, selected countries develop an Expression of Interest. They then get a grant of 35,000 $ to prepare an organizing framework for the scoping of the PMR activities, which needs to be vetted by the Partnership Assembly. Once this has been done, 315,000 $ are available to develop a Market Readiness Proposal. As per June 2012, all 15 countries had reached this phase. Brazil, China, Turkey and Ukraine aim towards emission trading, Chile and Thailand pursue both approaches, while Colombia, Costa Rica, India, Indonesia, Jordan, Mexico, Morocco, South Africa and Vietnam pursue scaled up crediting mechanisms. The Market Readiness Proposals are now to be developed in the next 2 years.

The Mitigation Action Implementation Network (MAIN) is coordinated by the Center for Clean Air Policy (CCAP), a US-based think tank that has a long history in supporting capacity building for market mechanisms. CCAP is especially known for its high-level dialogue approach, while its analytical capacity is more limited; it builds essentially on meta-analysis of research done in other institutions. MAIN, which is also supported by the World Bank and the German Ministry of Environment, has the target to support the design and implementation of NAMAs and Low-Emissions Development Strategies (LEDS) in developing countries through regionally-based dialogues, web-based exchanges, and practitioner's networks; it thus follows CCAP's core approach. The most successful developing country mitigation policies implemented to date are to be identified and used as lessons for other countries to achieve ambitious mitigation actions. Sub-targets are improvement of countries'

[12] This section is based on input to a Background Paper for the German Federal Environment Agency "Stocktaking of Capacity Building Initiatives for New Market Mechanisms".

capacity to design, plan and implement NAMAs that are consistent with any LEDS or national sustainable development plans. Moreover, collaborative financing is to be mobilized by providing strategies to make NAMAs attractive to possible funders from donor countries, including meeting expectations for monitoring, reporting and verification (MRV). MAIN is thus much broader than capacity building for NMM. To date, MAIN is limited to Asia (China, Indonesia, Malaysia, Pakistan, Philippines, Thailand and Vietnam) and Latin America (Argentina, Chile, Colombia, Costa Rica, Dominican Republic, Panama, Peru and Uruguay) bypassing Africa.

MAIN is based on regional “academies” with a duration of 4 days bringing together policymakers from key ministries focusing on finance, climate negotiators, finance and MRV experts, and industry representatives, where NAMA successes as identified by CCAP will be discussed. These sessions are complemented by policy lunches and virtual “knowledge sharing” sessions through videoconferencing, webinars and e-learning courses.

So far, two academies were held in Latin America and one in Asia, with about 30 participants each. They discussed a template for supported NAMAs developed by CCAP, included role plays on NAMA scrutinizing by senior policymakers and assessments of the state of climate finance.

Overall it seems that MAIN is focusing on generating NAMA proposals for subsidies from industrialized countries out of the 30 billion $ fast start finance, and that the role of market mechanisms in leveraging NAMAs is not addressed in detail.

The International Carbon Action Partnership (ICAP), which was founded in 2007, is a partnership of public authorities and governments wanting to introduce mandatory emission trading systems with an absolute cap. Besides the EU member states, it includes the states of the Regional Greenhouse Gas Initiative (RGGI) in the Eastern US and of the Western Climate Initiative (WCI) in the US and Canada, as well as Australia, New Zealand and the municipality of Tokyo. Japan, Korea and the Ukraine are observers.

ICAP does capacity building for developing countries through dedicated Summer Schools, of which three have been held to date. They bring together for 25 to 30 carefully selected policy makers and other stakeholders from the non-governmental, academic and private sectors – traditionally less than 15% of applicants - for two weeks. Alumni work will help promote active virtual discussions among participants beyond the duration of the course.

Moreover, an 8-day training course on design, implementation, and administration of national and regional emission trading systems was held in Costa Rica in March 2012 where only about 20% of applicants were selected. Two conferences were held in 2010 (Tokyo) and China (2009); the latter focused on emissions data management. ICAP is the only one of the surveyed initiatives providing hard-core technical training in a highly competitive environment. On the other hand, it is the most limited one regarding its scope.

4.5. Generating investment or other financial flows

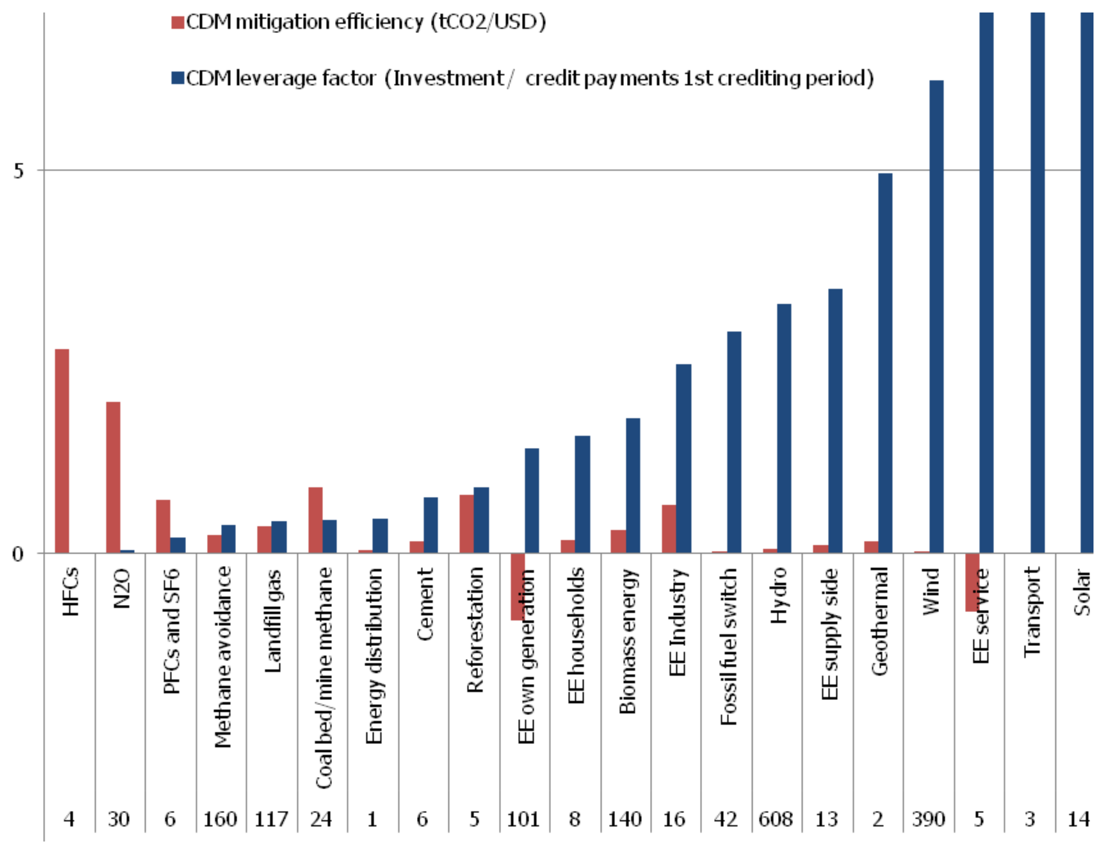
4.5.1. **CDM**

Initially, the CDM was universally assumed to generate investment flows from companies in industrialized countries to implement projects in developing countries. However, the dominating business model became the generation of CERs as an export commodity through projects financed by entrepreneurs in the host countries. Lütken and Michaelowa (2008) assess the reasons for that and see risk aversion of companies from industrialized countries as primary culprit. The dominance of “unilateral” CDM has persisted.

CDM project development companies based in industrialized countries have tried to capture rent by paying a low price for primary CER forward contracts, and selling these CERs at a high price to compliance buyers in the North. Initially, this business model thrived and led to several high-profile IPOs on the London Stock Exchange, such as AgCert, Ecosecurities, CAMCO, Trading Emissions and Climate Change Capital. In order to prevent exploitation of Chinese project developers, the Chinese DNA made project approval contingent on the existence of a CER sales contract with a price above a “floor price” informally specified by the DNA. This floor price initially set at 8 €/CER increased up to 12 € for wind energy projects but had to be reduced after the CER price crash in 2008-9. Still, the requirement of a forward contract meant that Chinese CDM developers could not capture the entire rent. Indian CDM entrepreneurs overwhelmingly chose to sell CERs only after issuance, in order to keep the full rent; many of them banked considerable amounts in order to speculate on price increases. However, this strategy failed when secondary CER prices fell to historical lows in late 2011. The long delays in CER issuance in 2007-2009 and the decline in CER prices since 2011 also squeezed the CDM project developers, especially those that had not hedged their portfolio. AgCert went virtually bankrupt in early 2008 with debts of 90 million € and was taken over by US utility AES. Ecosecurities was bought for 204 million $ by JP Morgan in September 2009 (see also section 4.4.1).

The role of the CDM in leveraging private investments has been estimated by Hepburn (2009) and Hosier et al. (2010) at ten to eleven times the value of the CERs. Stadelmann et al. (2011) see these estimates as overly optimistic and estimate the leverage factor at 3-4.5. If projects are not additional, the leverage will be much lower. There might even be a Leverage Paradox: a high leverage factor can mean lower mitigation efficiency

Figure 8: The Leverage Paradox in the CDM



Source: Stadelmann et al. (2011, p. 15).

Projects with low mitigation costs will have a low leverage because the CER revenue is higher than the investment cost. A high leverage factor means that the revenue from CER sales is minuscule compared to the investment cost. This is more likely an indicator of lacking additionality than an indicator for efficient abatement. The only type of project where high leverage factors may mean higher efficiency in mitigating greenhouse gases are energy efficiency projects with negative incremental costs. In those cases, very low (or no) payments are needed to cover incremental costs. However, in such cases, other barriers like risks or information barriers exist and overcoming those barriers will require further funding.

Using the volumes of primary CER transactions collected by Kossoy and Guigon (2012), Kossoy and Ambrosi (2010) and Capoor and Ambrosi (2008, 2006), the cumulated value of primary CER contracts has reached 31.1 billion $ between 2004 and 2011. Assuming that all these contracts will be honoured[13] and 25% of transaction volume covers CERs from non-additional projects[14], a leverage factor of 9 would generate investment flows of 210 billion $; at a leverage factor of 3 still 70 billion $ would flow.

4.5.2. **Voluntary market**

The volume of transaction on all segments of the voluntary market since its inception until 2011 has been estimated at 3.1 billion $ (Peters-Stanley and Hamilton 2012, p. 10). Assuming the same leverage factors as for CDM projects and a non-additionality share of 50% due to lower additionality safeguards of the majority of voluntary market standards, the underlying investment flows would range from 5 to 14 billion $

Emissions trading systemsWhether after the 2005 and 2009 crashs price levels of EUAs have been sufficiently high to drive emissions reduction, has been contested. The first phase of the EU ETS is estimated to have achieved emission reductions between 85 million t CO_2 (Ellerman and Buchner 2008, whose analysis is extremely detailed) up to over 170 million t CO_2 (Anderson and Di Maria 2011). Assuming that these reductions require investments of 5 €/t reduction, the total range of investments would reach 0.6 to 1.3 billion $.

All researchers agree that prices in the EU ETS have not been high enough to drive renewable energy investment in the absence of feed-in tariffs (Blanco and Rodrigues 2008). Engels et al. (2008) surveyed companies covered by the EU ETS and found widespread evidence of irrational behaviour. Engels (2009) even finds that many companies did not know their abatement costs.

4.6. Promoting technology transfer

4.6.1. **CDM**

The question whether CDM contributes to technology transfer has led to a flurry of research. Assessing a dataset of 644 registered CDM projects econometrically, Dechezleprêtre et al. (2008) find that likelihood of technology transfer is higher for projects operated by subsidiaries of companies from industrialized countries, and projects that are larger than average, while for unilateral projects it is lower. Using the same data, Dechezleprêtre et al. (2009) find that projects in Mexico, China and Brazil involved significantly more technology transfer than projects in India. While in the first two countries foreign companies are strongly involved, in India and China investment opportunities generated by fast growing economies seem to be more relevant. Seres et al. (2009) find that 36% of

[13] This is by no means clear. In the phase of the CER price crash since 2011, many buyers are trying to use legal loopholes to escape from their contractual obligations or to renegotiate lower prices.

[14] While no research on additionality quantifies the share of non-additional CERs on a robust empirical basis, Schneider (2009b, p. 250f) quotes literature that sees a high share of non-additional projects especially in the energy sector. I assume that 40% of all projects except industrial gas, methane avoidance and landfill gas projects are non-additional. Given the share of these project types of 78.1% in all expected pre-2013 CERs (UNEP Riso Centre 2012), the share of non-additional CERs would amount to 24.6%.

3296 registered and proposed projects accounting for 59% of the annual emission reductions claim to involve technology transfer and confirm Dechezleprêtre et al. (2008)'s results. A problem with all these technology transfer studies is that they limit themselves to assessment of project documents without checking whether the statements in the documents are true. Any project developer obviously has the incentive to argue that there is technology transfer even if there is none. Wang (2010) is an exception inasmuch he underpins his analyses of a large number of project documents with background interviews and a careful assessment of government policies. He finds that in all but one industrial gas projects in China technology transfer happened, but only in about a quarter of wind and coal mine methane projects. In those, the cost differential between foreign and domestic technology reached 50-100%, whereas the performance of the foreign technology was around 30% better. Thus the performance differential could not cover the cost disadvantage of the foreign technology. Wang also notes that the structure of the CDM market limits incentives for CDM project developers to actually engage in technology transfer, as most CDM consultants have no direct links to technology producers and lack the competence to offer an integrated package. Also, most CER buyers are neither linked to technology providers nor to investments in the actual project generating the CERs, which weakens the project's international component, and hence its potential to transfer technology.

4.6.2. BOCM

Technology transfer from Japanese companies to entities in the host countries is an essential element of Japan's BOCM (Ministry of Foreign Affairs, Ministry of Economy, Trade and Industry, Ministry of the Environment 2012).

4.6.3. Voluntary market

The technology transfer contribution of the voluntary markets has not been assessed to any extent.

4.6.4. Emissions trading systems

Emissions trading systems have contributed to emissions reductions, but the relatively low prices of allowances have led to a dominance of simple technologies, such as cofiring of biomass in coal power plants.

4.7. Contributing to global emissions reduction

The CDM, JI and voluntary markets have been designed as pure offset mechanisms. This means that they do not have the purpose to contribute to global emissions reduction, as specified in the context of the NMM. But the mechanisms might have indirect effects that lead to non-credited emission reductions.

4.7.1. CDM

The key argument of the supporters of the project-based market mechanisms in the run-up to the Kyoto Conference was that the availability of cheap emissions credits would increase the willingness of policymakers in industrialized countries to embark on more stringent national emissions commitments and thus increase overall mitigation ambition. It is impossible to test this argument empirically as the baseline for emissions commitments in the absence of the availability of project-based mechanisms cannot be assessed. However, since the CDM has been implemented on a large scale, commitments of industrialized countries have actually weakened in the wake of the failed Copenhagen conference. Even the recent price crash on the CER market has not triggered a ramp-up of targets but instead has led to an emergence of CER import restrictions to protect the domestic market for emissions allowances. So the argument of a virtuous circle of increases in commitment stringency which generates demand for emission credits that in turn mobilizes projects, leads to the dissemination of technology, a reduction of emissions mitigation costs, and a new round of increased commitment stringency is unfortunately not supported by evidence.

Another contribution to global reduction can be achieved by spillover of technologies that is due to the demonstration effect of technologies used in CDM projects. This would be relevant if there have been non-monetary barriers to these technologies – and once the barriers are removed they become economically attractive. Of course, once the spillover has been achieved, this technology would no longer qualify for the CDM in that host country.

A related argument is that a successful implementation of the CDM increases the willingness of host country policymakers to introduce mitigation policies. For example in China, the strong performance of the CDM in the renewable energy sector from 2005 onwards preceded the introduction of a nationwide feed-in tariff legislation in 2007 and a renewable portfolio standard for large utilities. Of course the projects supported by the policy then expect generation of CERs so the policy itself will only generate global emission reductions if not all projects claim CERs.

The final possibility to contribute to global reductions are emission reductions accruing after the end of the crediting period of the technology continues to operate and still achieves lower emissions than a realistic baseline. Most renewable energy technologies have lifetimes of 15 to 25 years, hydro power plants even up to 100 years (ETSAP 2010). By June 2012, 30% of CDM projects had chosen a non-renewable 10-year crediting period (UNEP Riso Centre 2012) and are very likely to generate benefits.

UNFCCC (2009) specifies default technical lifetimes for different types of technology. I use these to estimate global emission reduction contributions of the current CDM pipeline. I assume that all end of the pipe technologies as used for industrial gas and methane abatement projects would not continue to operate if they do not receive emissions credits or are covered by environmental regulation. Regarding fuel switch projects, the effect depends on the investment costs required to reverse the fuel switch once credit flow stops. As this is difficult to estimate, I exclude this category.

Table 5: Contribution of major CDM technologies to emissions reductions after the end of project crediting periods (million t CO_2)

Technology	Technical lifetime	Registered projects	Under validation	Total
Thermal power plants	25 years[1]	149	658	807
Wind and solar power plants	25 years[1]	588	747	1335
Hydropower and geothermal plants	50 years[2]	3916	5533	9449
Waste heat recovery	25 years[3]	426	404	830
Total		5079	7342	12421

Note: Assumption that average annual emissions reduction as specified by UNEP Riso Centre (2012) for all projects will continue until the end of the technical lifetime; the volume counted here starts to accrue after 21 years in the case of projects having chosen a 7 year renewable crediting period and after 10 years for the projects with a 10-year period.

[1]: UNFCCC (2009) for wind and thermal plants, IEA (2010) for solar PV, [2]: ETSAP (2010) for small-scale hydro plants, [3]: I take the values of UNFCCC (2009) for thermal power plants given waste gas-based power generation uses the same technology

If one assumes that 40% of energy-related projects are not additional (see discussion in section 4.1.1), the volume of additional reductions reaches 3 billion t CO_2 for the registered and 4 billion for those under validation.

4.7.2. NMM

So far, no experience has been made regarding implementation of options discussed under the NMM to achieve global reductions. The cornerstone of such an approach would be to specify a baseline which is more stringent than the business-as-usual emissions development in the sector covered by the NMM (Prag and Briner 2012). The decisionmaking on the stringency level will be a major political challenge.

One observation, though, is that in order to avoid peaking of CO_2 concentrations above the 2°C target, emission reductions now count even more than reductions done in 10 years. NAMA crediting and NMM are unlikely to be operational within the next few years, hence other type of reduction efforts, e.g. through CDM, will likely be needed.

5. Comparative evaluation of the strengths and weaknesses of the different carbon market mechanisms

The evaluation of the different mechanisms is not easy given their widely varying degree of utilization and development to date. Essentially one has to compare apples with pears and will be biased against the existing mechanisms, as for the new market mechanisms only "ideal" design ideas are available whereas the CDM and some of the domestic mechanisms have seen intense day-to-day operation.

Generally, the environmental integrity of baseline and credit systems depends on the stringency of additionality testing as well as the stringency of the baseline. A stringent additionality test coupled with a lenient baseline leads to a limited amount of projects generating high credit volumes each, whereas stringent baseline setting with weak additionality testing leads to a high number of projects with a low credit volume per project. For cap and trade systems, environment integrity only depends on the stringency of the cap. If a baseline and credit system operates under a cap, like in the case of JI, the stringency of the cap determines overall integrity. Looking at the baseline and credit systems, the CDM and the Gold Standard have the highest degree of additionality due to their multiple safeguards in the additionality test, followed by CAR and CFI who limit their project types to those that have a higher likelihood of additionality – but then apply a positive list approach. VCS and the BOCM are trailing because they accept all technologies while not really specifying a robust additionality check. Regarding baseline methodologies, the CDM has the highest degree of elaboration, but stringency varies strongly among project types. Ongoing standardization might lead to a convergence of stringency but the overall effect strongly depends on political choices made, e.g. regarding the benchmark level. Therefore, an overall assessment of baseline stringency is impossible.

Under standardized methodologies, also under the NMM, the stringency level is chosen at a very early stage, without knowing what the repercussions on the market are. This might lead to decisions with low levels of stringency, as has been the case for cap levels of cap and trade systems that so far have been very lenient. Overallocation has been a feature of most trading systems.

Mobilization of cheapest cost options has been very effective under the CDM which is covering a wide range of technologies. However, the CDM has so far not been successful in mobilizing activities in transport, forestry and agriculture. Here, the VCS is the leading mechanism; it includes a lot of agriculture section activities. The limitation of the BOCM to Japanese technologies will drive up mitigation costs as will the limitation of CAR, CFI and Gold Standard to selected technologies. Cap and trade schemes usually are excellent in mobilizing the cheapest options.

The Gold Standard, followed by the CDM, has shown very high transaction costs, but empirical evidence exists that they have not inhibited submission of very small mitigation projects. Recently, attempts have been made to reduce transaction costs by streamlining processes; processing time have been reduced to a quarter of 2009 levels. Due to the absence of a validation of project documentation, CAR and CFI as well as the BOCM will have lower costs. Domestic trading has substantial fixed transaction costs, especially to set up the system and govern it, but overall costs of trading are low.

Governance of the CDM has been cumbersome, with frequent rule changes and conflicts between different elements of the regulatory system. However, since 2009 the CDM rules have been simplified substantially, and the internal ability to reform governance has been surprisingly strong. JI has had massive differences in governance between the first and the second track, with the first track being essentially completely decentralized, while the second track was a carbon copy of the CDM. The result was a lack of transparency in the first track, and strong differences in host country regulatory approaches. Domestic offset systems have developed relatively slim governance systems but it remains to be seen how these systems will react on challenges. The voluntary market has developed devoid of all centralized governance, but the CDM rules have at least indirectly served as orientation. The Gold Standard has built upon CDM rules, while the VCS tried to simplify approaches compared to the CDM. Governance of trading schemes has evolved substantially, especially in the case of the EU ETS. The decentralized system of the first phase has been replaced by a centralized system from the third phase, not least as a reaction on the lack of stringency of national allocation plans.

The CDM has a long history of capacity building through development agencies, which however initially focused on the most advanced developing countries, and only at a late stage covered less and least developed countries. The Japanese BOCM uses feasibility studies and other means to entice potential host countries. Domestic offset programmes do outreach through well designed websites but do not have dedicated capacity building initiatives. Of the voluntary market players, the Gold Standard has the most elaborate capacity building programme. Massive capacity building activities have been launched in the context of the NMM. The World Bank's Partnership for Market Readiness alone is funded with as much money as all CDM capacity building programmes had throughout a decade. More bilateral capacity programmes are to be expected.

Financial flows from industrialized to developing countries through the CDM have been much less than initially expected due to the emergence of "unilateral" projects wholly financed through host country entrepreneurs. These projects essentially generate CERs as another kind of cash crop. Total primary market volume for the CDM has reached 31.1 billion $ until 2011. The total effect on investment flows now depends on the “leverage ratio” and the share of additional projects, as non-additional projects do not need to any new investment flows; it could reach 70 to 210 billion $. For the voluntary market, these figures could reach 5 to 14 billion $. For emissions trading systems, these values are much lower.

Technology transfer seems have to been lacklustre both under the CDM and emissions trading schemes. The BOCM puts a high emphasis on transfer of Japanese technologies.

Global emission reductions have not been an explicit target of the project-based offset mechanisms. However, there are several paths through which these mechanisms can contribute to such reductions. The first is a strengthening of country emission commitments through the availability of cheap emission credits but unfortunately no evidence can be found. Technology spillover might exist if the mechanism removes non-monetary barriers. The mechanism revenues could increase the willingness of host countries to introduce mitigation support policies; there is evidence for such effects in large, advanced developing countries. The final path is accrual of reductions after the end of the mechanism crediting period; for the CDM the volume could reach several billion t of CO_2.

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Table 6 provides a comparison of the mechanisms. For mechanisms in which a lot of experience has accrued, evaluation is based on the current status; for mechanisms which are still to be tested, the currently available design options are assessed.

Gelöscht: Table 6

To summarize, the key flaws of project-based mechanisms are high transaction costs due to registration, monitoring and verification procedures, lack of environmental integrity due to an inappropriate additionality test and/or inflated baselines and limitations in the mitigation potentials which could be addressed by them (e.g. closure of activities without replacement at the same site) (see Butzengeiger et al. 2012).

Table 6: Comparative evaluation of the different mechanisms

	CDM	JI	BOCM	CAR	CFI	Gold Standard	VCS	Domestic trading	Sectoral crediting	NAMA crediting	Sect
Type	B-C	B-C	B-C	B-C	B-C	B-C	B-C	C-T	B-C	B-C	
Environmental integrity	++++	+++	??	+++	+++	++++	++	++	???	???	
Mitigation cost minimisation	++++	+++	+++	++	???	+	+++++	+++++	???	???	
Transaction cost minimisation	+	+++	?????	+++	????	+	+++	++++	?	?	
Effective governance	++	++	?	+++	???	++	+++	++	??	??	
Capacity building	+++	++	++++	???	???	+++	+	+++	+++	???	
Financial flows	++++	++	??	+	?	++	++	++	???	???	
Tech transfer	++	++	????	??	??	++	++	++	??	??	
Global emission reduction	++	++	??	+	+	++	+	+++	????	????	

Note: B-C = Baseline and credit, C-T= Cap and trade. Scale from + to +++++ for mechanisms with experience, ? to ????? for mechanisms where experience is lacking

6. Options for improving the CDM in order to serve as standard setter for new market mechanisms

There is a number of options to reform the CDM which can also be used to set the rules for the NMM. None of them is cutting the Gordian Knot, but in combination they can contribute to a reduction in transaction costs, improvements in environmental integrity and coverage of new project types.

6.1. Standardization

In 2011, the CDM EB and the UNFCCC Secretariat took bold steps towards standardization of CDM baselines; these steps still remain to be digested by the CDM community. Besides benchmarks, standardization can also mean use of default factors for baseline service levels, such as utilization hours. Key reasons for allowing the use of default factors for baseline service levels were pressure from Least Developed Countries to facilitate their participation in the CDM and the threat of new market mechanisms with simplified rules becoming more attractive than the CDM.

First, four generic project categories – fuel switch, switch of technology and energy source, methane destruction and GHG formation avoidance – for which standardization would be undertaken were defined by the CDM EB. Without any consultation with CDM stakeholders, the CDM EB decided on generic benchmarks for additionality determination and baseline setting. When compared to the earlier Secretariat proposal for the benchmarks, the EB increased the benchmark stringency by ten percentage points – to 80% for energy for households, energy generation in isolated systems, and agriculture and 90% for all other sectors. This high level means that, in most cases, the benchmark will be more stringent than baseline emission factors calculated through project-specific baselines. Generally, host country DNAs are responsible for submitting proposals for standardized baselines; the first such proposal was for charcoal production, submitted by the Ugandan DNA in early 2012.

2012 will see further leaps concerning standardization of baselines; the UNFCCC Secretariat has recently asked a consortium of consultants to assist with the development of benchmarks of an appropriate stringency level for a number of sectors and countries. This work will be challenging, as we have to find how technology performance curves look like in different sectors, and whether one can really separate at a specific benchmark level non-additional projects from additional ones. For default utilization or baseline emission factors other than benchmarks, the bottom-up route through DNAs is likely to be cumbersome, as rules for data quality agreed upon at EB 66 are very stringent and complex and unlikely to be manageable for any but the most advanced DNAs. This could lead to the paradoxical outcome that poorer countries, especially LDCs, would further lose competitiveness compared to advanced countries that can generate data of the required quality and which have DNAs who can undertake the required quality control procedures. It is clear that standardisation of baselines will not be a panacea for the CDM, and that it could turn into a Pandora's Box if not managed carefully. The dream of simple, global benchmarks is not realistic and eventually the difficult questions regarding additionality determination will have to be addressed on a rather disaggregated level. Regarding environmental integrity, it would be a catastrophe if a hastily decided benchmark led to a large loophole for non-additional projects. However, in contrast, given the lacklustre performance of project-specific additionality testing to date, standardised baselines might become much more stringent than the current project-specific methodologies. If so, and project-specific methodologies were then withdrawn, the project developers' dream of being relieved from the day-to-day hassle of collecting data would be turned into a nightmare. Given this conundrum, the work on standardised baselines should proceed carefully and with the best technical advice possible. It is clear that it will take several years to find out for which sectors and countries standardised baselines are appropriate and where the good old workhorses of project-based methodologies remain preferable.

Standardization of additionality testing could take the form of positive lists which have been widely used by several offset programmes. However, given the key role of renewable energy resource availability for renewable energy projects, it cannot be said convincingly that all types of renewable energy are less commercially attractive than fossil fuel alternatives in all locations in all host countries. Therefore, positive lists need to be complemented with the assessment of project-specific parameters such as the plant load factor. Similarly for demand-side energy efficiency positive lists are not universally applicable; it might be more appropriate to require a simplified investment test with a benchmark of a three-year payback period.

6.2. Discounting of CERs

The idea of discounting to safeguard overall additionality of the CDM originates from Greenpeace (2000). There are basically two different options for CER discounting (Buen and Røine 2009): First, discounts can target the amount of CERs issued from single projects. In this approach, developing countries would foot part of the bill for every CDM project coming off the ground. For this to happen, an international agreement is needed. Second, discounting can be applied on the demand side when Annex I countries or companies use CERs for compliance. The latter was proposed in the draft Waxman Markey bill discussed by US Congress; it would require 5 CERs to offset 4 U.S. allowances.

In addition, the discounting can be applied on a more detailed level taking into account one or more of the factors below:

- Country
- Project type
- Technology
- Sustainability components

Chung (2007) proposed discounting as contribution of developing countries to global emission reductions without having to resort to country-specific commitments. Discounting could reflect the principle of "common but differentiated responsibilities" enshrined in the UNFCCC. This could best be achieved if the discount factor would be progressively linked to the level of development of the host country according to parameters that describe the development status of a host country as objectively as possible.

One option for discounting would be to define a simple development index as a combination of per capita income (measured in PPP) and per capita emissions thresholds, which captures both ability to pay and the 'polluter pays' principle. Each criterion should get the same weight as both principles are equally important and are not directly correlated. If both figures are weighted with 50%, we get the results shown in Table 7. The world average for GDP per capita (8492 $ in 2005) and CO_2 eq. per capita (4.22 t in 2005) are equal to the index value 1 for the respective component (data are taken from IEA 2007). Gelöscht

Table 7: Discounting CERs according to levels of emissions and per capita in-come for selected countries

	Development index	1 t CO_2 eq. reduction gives x CERs
Qatar	7.6	0.13
Saudi Arabia	2.5	0.40
Israel	2.4	0.42
Korea	2.3	0.43
South Africa	1.4	0.71
Argentina	1.2	0.83
Malaysia	1.2	0.83
Chile	1.1	0.91
Iran	1.1	0.91
Mexico	1.0	1
Thailand	0.8	1
China	0.8	1
Brazil	0.7	1
Indonesia	0.4	1
India	0.3	1

The development index can of course be used for different degrees of discounting, i.e. that more countries get a discount and the discount becomes steeper. It of course can be designed in a way to assure a contribution to global reductions by advanced developing countries. As many industrialized countries have argued that China should participate in the global effort, and China has an index level of 0.8, discounting could start from an index level of 0.5. The outcome is shown in Table 8,

Gelöscht

Table 8: Discounting CERs from on the basis of a development index starting at half of the global average

	Development index	1 t CO_2 eq. reduction gives x CERs
Qatar	7.6	0.07
Saudi Arabia	2.5	0.2
Israel	2.4	0.21
Korea	2.3	0.22
South Africa	1.4	0.36
Argentina	1.2	0.42
Malaysia	1.2	0.42
Chile	1.1	0.45
Iran	1.1	0.45
Mexico	1.0	0.5
Thailand	0.8	0.63
China	0.8	0.63
Brazil	0.7	0.71
Indonesia	0.4	1
India	0.3	1

Discounting is also discussed by Schneider (2009a) and Castro and Michaelowa (2010).

6.3. Contribution to global reductions

The CDM could contribute to global emissions reductions in several ways. The approach which would be most consistent with the approach applied by the NMM would mean that baselines are selected that are below the business-as-usual level of emissions. In this way, a part of the emission reduction achieved by the CDM project (as compared to the business-as-usual baseline) is not issued as CERs but provides a net benefit to the atmosphere. The key challenge here is to negotiate the difference between the business-s-usual level and the baseline actually applied.

Alternatively, Annex I countries could purchase CERs from the market and cancel them without using them for compliance. The purchase could be financed from the revenues of auctioning emission allowances or through public funding. The level of purchases could be mandatory for certain countries under the international climate regime or voluntary. Finally, one could require CDM host countries to re-invest a part of CDM revenues in emission reduction projects: This option would be similar to the concept of Green Investment Scheme (GIS) developed for achieving environmental benefits from trading hot air from countries in transition. The revenues from the AAU sales are used for financing projects for either reducing greenhouse gas emissions or building up the necessary framework for this process. Within the CDM framework, the revenues from an additional taxation on CER issuance are re-invested in projects mitigating greenhouse gas (GHG) emissions in non-Annex I countries. China's funneling of the proceeds from a differentiated tax on CER revenues into its CDM Fund, whose aim is partly to provide capacity building for new CDM projects, is one example of this.

6.4. Simplification of governance

One might think that competition between market mechanisms will lead to an outcome where complex mechanisms will fall into disuse and simple ones survive. The voluntary market would be such a laboratory of competition. However, Corbera et al. (2009) conclude that the voluntary market does not perform better than the CDM.

Platonova-Oqab et al. (2012) propose to do away with validation if CDM projects follow a standardized approach and to limit independent audit to verification. From an incentive point of view, this is unlikely to improve audit performance compared to the current situation as a verifier will not like to give a negative statement on a project at such a late point in time, especially as the contract will usually remunerate the verifier for further verifications in the future.

In contrast, it might be possible to reduce regulatory scrutiny of audits if auditors are hired and paid by the regulators. Then the auditors no longer have an incentive to please the project developers.

7. Conclusions

With an increasingly explosive mix consisting of accelerating global greenhouse gas emissions and fatigue regarding the implementation of greenhouse gas mitigation policies, it becomes imperative to assess whether policy instruments applied in the first two decades of international climate policy have been able to achieve emissions reductions. This requires to judge the environmental integrity of policy instruments, their ability to minimize mitigation and transaction costs, the effectiveness of governance, the provision of capacity building, their contribution to investment flows and technology transfer and, finally, their ability to contribute to global emissions reductions.

In the context of international post-2012 climate policy, one or several new market mechanisms (NMM) are under development. While their rules are still uncertain, the implementation of baseline- and credit mechanisms on the international and national level, both for compliance with emissions commitments under the Kyoto Protocol as well as generation of emissions credits for the voluntary market has provided valuable lessons that should inform the design of NMM. Moreover, cap and trade systems have been applied in several jurisdictions and can be assessed according to the same criteria as the project-based mechanisms.

The CDM is by far the most developed of all project-based market mechanisms for climate change mitigation, dwarfing Joint Implementation and domestic offset schemes. Only the mandatory cap and trade system of the EU is larger in terms of turnover and has played a relevant role in mobilizing the CDM. While the CDM has been target of much criticism for performing badly with regards to environmental integrity, transaction costs and governance, the performance of alternatives has either not been tested to date – for example in the case of the Japanese Bilateral Offset Crediting Mechanism or the Australian Carbon Farming Initiative - or is clearly worse, as in the case of several standards on the voluntary market. Moreover, the CDM has been able to reform its rules in reaction on criticisms, with its performance with regards to transaction costs and governance improving significantly since 2009. These reforms have accelerated in 2011 when a massive standardization drive started, with the impacts on CDM performance still unclear.

The main difference between market mechanisms outside of the CDM and the CDM is that many of the latter have tried to standardize and simplify regulatory oversight. The – relatively few – evaluations of the outcome seem to suggest a tradeoff between the transaction costs of a market mechanism and its environmental integrity. While there might be ways to apply standardized approaches to baseline and additionality determination, there will not be the simple global “Gordian Knot”-cutting solution. Researchers and practitioners need to assess carefully, ideally on the basis of empirical evidence which project types lend themselves to standardization under which circumstances. A blind stampede toward standardization will not be a solution.

To increase the contribution of the CDM to global emissions reductions beyond the several billion tonnes CO_2 that will accrue after the end of the crediting periods of CDM projects, a discount could be introduced, so that one t of emissions reductions from a CDM project would yield less than one CER. A discount factor that increases with the level of development of a country would reflect the principle of “common but differentiated responsibilities”. The short-term price that would have to be paid in terms of economic efficiency would be a differentiation of marginal abatement cost of CDM projects according to the discount rate. This would however be offset by the improved overall efficiency of emissions reduction due to a higher EU import of CERs.

During its 10-year history, the CDM has been able to flexibly adjust to eliminate weaknesses and improve strengths. It is thus well placed to serve as a laboratory for up-scaled market mechanisms. But eventually all reforms are in vein if no robust demand for emissions credits is generated by strengthened commitments for an increasing number of countries.

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