10 lessons from 10 years of the CDM

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10 LESSONS FROM 10 YEARS OF THE CDM

Igor Shishlov[1] and Valentin Bellassen[2]

The Clean Development Mechanism (CDM) is the first and by far the largest carbon offset instrument in the world. To date, it is the only market based on an environmental commodity which managed to attract several billions of euros of private capital on an annual basis. Being the first-of-a-kind climate change mitigation instrument, the CDM followed a "learning by doing" pattern undergoing numerous reforms throughout its more than 10-year history. Although the post-2012 fate of the mechanism remains uncertain, one should not "throw out the baby with the bath water" as the lessons from the CDM experience may be useful not only for the CDM reform but also for new market instruments.

- One of the widely discussed topics is the **economic efficiency** of the CDM. Despite being largely concentrated on the supply side (93% of all issued credits come from 5 countries), the CDM provided a useful "search tool" to identify new greenhouse gas abatement opportunities although in most cases failed to scale them up across the economies. The lion's share of the demand for carbon offsets comes from the European Union Emissions Trading System (EU ETS), where the CDM helped companies save millions of euros by reducing emissions where it was the cheapest. With the quantitative restrictions in place, the demand for CDM offsets from projects registered after 2012 will likely dwindle to a few public buyers, dwarfed by the size of supply.
- The CDM has also raised criticism regarding its **environmental integrity**. For example, there is strong evidence that HFC-23 destruction projects provided perverse incentives for installations to engage in strategic behavior. Besides, there are concerns over the additionality of some large renewable energy projects, in particular in China and India. The transparency of the framework has allowed identifying loopholes and implementing the reforms that have been ongoing since the inception of the CDM.
- Finally, the evaluations of the **contribution of the CDM to sustainable development** are mixed and largely depend on the project type and national circumstances. The principle of national sovereignty dominates the existing sustainability assessment which fully rests on the host country without any standardized criteria or monitoring.

These issues have been and keep being addressed in reforms that have not ceased since the inception of the CDM. The gradual introduction of more stringent baselines has been one of the tools used to reinforce environmental integrity. Standardized baselines and positive lists help simplify and speed up the registration of projects, and hence the scaling up of local projects.

This paper reviews the CDM's achievements and challenges and derives 10 key lessons that should be taken into account while reforming the mechanism as well as while designing new instruments to tackle climate change. As the Green Climate Fund is still wondering how to raise the pledged 100 billion dollars until 2020, the CDM recipe for attracting private investments in the billions of euros per year to climate action is worth some attention.

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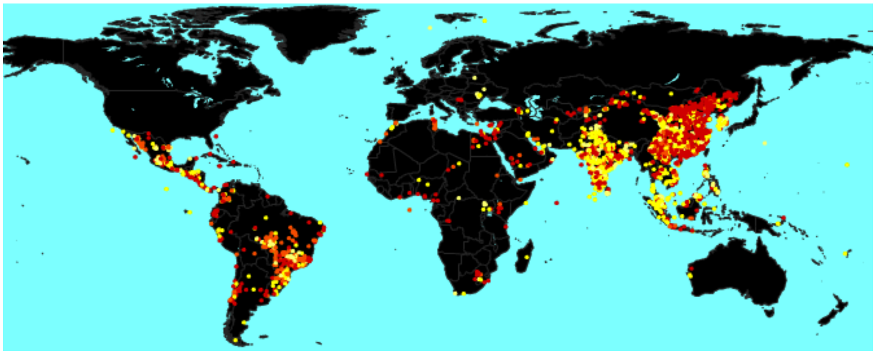
INTRODUCTION

With over 4 500 registered projects in developing countries (Figure 1), the Clean Development Mechanism (CDM) is by far the largest carbon offset mechanism in the world. It is also the only multi-billion euro global market based on an environmental commodity and supervised by the United Nations. As of September 1st, 2012, it had already generated over a billion carbon credits (UNFCCC 2012) and is expected to generate 1 265 million credits by April 30th, 2013 – the date of surrendering credits for the compliance for the second phase of the European Union Emissions Trading Scheme (EU ETS) – according to the model developed by CDC Climat research (Cormier and Bellassen 2012). The global volume of the Certified Emissions Reductions (CER) primary and secondary market reached 16 billion euros in 2011 (World Bank 2012).The sheer size of the CDM as well as the transparency of the mechanism – all project-related information and data regarding the issuance of CERs is publicly available through the UNFCCC website and other open sources such as the UNEP Risoe CDM Pipeline – triggered substantial research interest in both academic and business circles.

Figure 1 – Geographical distribution of CDM projects registered by September 2012



Source: UNFCCC (2012)

There have been numerous publications on different topics related to the CDM, namely the environmental integrity and economic efficiency of the mechanism, its baselines and additionality, the controversy around its contribution to sustainable development and the protection of human rights – to name only a few. With the end of the first Kyoto commitment period (2008-2012) approaching, it is high time to review this research and summarize the key lessons that can be drawn from more than 10 years of experience with the CDM. Although the fate of the CDM and its role in the future climate regime remains uncertain, the lessons derived in this paper may prove to be useful not only for the CDM reform, but also for new mechanisms, such as NAMAs[3], REDD+[4], sectoral crediting or bilateral agreements, as well as the New Market Mechanism, which was discussed during negotiations in Durban in December 2011. As the Green Climate Fund is still wondering how to raise the pledged 100 billion dollars until 2020, the CDM recipe for attracting private investments in the billions of euros per year to climate action is worth some attention.

The first part of this paper examines the way the CDM works, reviews the legal framework and its evolution over time and discusses the issues of environmental integrity and economic efficiency of the CDM. The second part explores the market for CERs and draws lessons from the supply and demand sides. The last part discusses how sustainable development has been incorporated in the CDM so far.

The research methodology includes literature review, case studies and quantitative analysis of CDM projects using public databases (UNFCCC CDM database, UNEP Risoe CDM pipeline, ITL) and the results of the CER and ERU supply forecasting models developed by CDC Climat Research.

[3] Nationally Appropriate Mitigation Actions – a set of domestic climate change mitigation policies.

[4] Reducing Emissions from Deforestation and Forest Degradation and enhancing carbon sinks.

I. LEARNING BY DOING: THE EVOLUTION OF THE CDM

Since its inception back in 1997, the CDM has been subject to numerous discussions regarding its governance structure, environmental integrity, geographic and sectoral distribution, etc. At the same time the legal framework of the CDM has seen many changes over the past ten years, reflecting the approach often dubbed as "learning by doing". This part attempts to shed light on this evolution and analyze how the CDM reforms responded to challenges.

A. *The CDM involves developing countries in climate change mitigation*

The existing international climate regime is regulated by the Kyoto Protocol to the United Nations Convention on Climate Change (UNFCCC), which was signed in 1997 and entered into force in 2005 after its ratification by Russia. The Kyoto Protocol set binding GHG emissions reduction targets for 37 developed countries and economies in transition – Annex I parties[5] to the UNFCCC. These countries pledged to reduce their total GHG emissions during the first Kyoto commitment period (2008-2012) by an average 5% compared to the 1990 baseline, although individual countries' commitments were differentiated. These targets were materialized in the form of quotas assigned to each Annex I country – Assigned Amount Units (AAU) – that represent the maximum amount of GHG emissions allowed during the commitment period.

Besides, three flexibility mechanisms that are meant to assist countries in achieving their emissions reduction targets at the least possible cost were introduced by Articles 17, 6 and 12 of the Kyoto Protocol respectively (Kyoto Protocol 1997):

- *International Emissions Trading* (IET) allows Annex I countries to trade their AAUs with an aim to redistribute abatement efforts among Annex I countries in a cost-effective way following Ricardian principles[6]. AAU trade, however, similar to the use of international project-based offsets is meant to be "supplemental to domestic action" to reduce GHG emissions. The intention of this principle is to ensure a certain level of domestic mitigation action and avoid achieving Kyoto targets solely through AAU trade. Nevertheless, there is neither a clear definition of "supplementarity", nor a quantitative limit on the use of imported AAUs for compliance.
- *Joint Implementation* (JI) allows Annex I countries to host projects aimed at reducing emissions and generate Emission Reduction Units (ERU), which can then be used by other Annex I countries to contribute to meeting their commitments. The ERUs have to be converted from the host countries' AAUs or Removal Units (RMUs)[7], i.e. deducted from their carbon budgets, thereby maintaining the overall emissions cap for Annex I countries unchanged.
- *The Clean Development Mechanism* (CDM) allows non-Annex I (i.e. developing) countries to host projects aimed at reducing emissions and generate Certified Emission Reductions (CER), which can then be used by Annex I countries to contribute to their commitments. The mechanism is also meant to contribute to sustainable development of a host country (see section IV).

The principal difference between JI and the CDM stems from the fact that developing countries do not have quantified emissions reduction targets under the Kyoto Protocol, which means that the CERs generated by CDM projects and transferred to Annex I countries represent a net increase of the total amount of Kyoto units (Figure 2). CER issuance is therefore akin to money emission: it must go on par

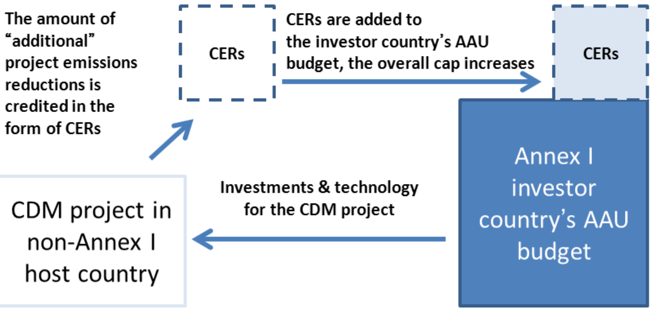
[5] Annex I refers to the annex to the UNFCCC, while Annex B refers to the annex to the Kyoto Protocol. Both annexes are largely similar with the only difference being Belarus and Turkey that are included in Annex I but not in Annex B. In order to avoid confusion only the term "Annex I" is used throughout this report.

[6] The theory of comparative advantage was first put forward by David Ricardo in his book "On the Principles of Political Economy and Taxation" (1817). Ricardo argued that the free trade enables countries to achieve economic gains through specializing in the industries where they have comparative advantage in production costs.

[7] RMUs represent emissions reduction due to land use, land-use change and forestry (LULUCF) activities.

with value creation – in this case emissions reductions – to avoid that the overall Kyoto cap becomes “inflated”. In reality, however, the Kyoto cap became inflated due to large AAU surpluses granted to Russia and Ukraine further aggravated by non-participation of the US and the withdrawal of Canada from the Kyoto Protocol.

Figure 2 – The basic CDM scheme



Source: CDC Climat Research (2012)

The seven key quality criteria for the CDM certification are meant to guarantee that each CER corresponds to one tCO_2e of real emissions reductions:

- *Baseline setting*: a scenario that reasonably represents anthropogenic GHG emissions that would most likely have occurred in the absence of the project has to be established.
- *Additionality*: a CDM project must prove that it is different from the baseline, i.e. that it was not the most likely or profitable option anyway or that there were barriers for its implementation.
- *Monitoring*: a monitoring plan to identify and regularly measure (or estimate) anthropogenic GHG emissions from sources within the boundaries of a project has to be established and implemented over the lifetime of the project.
- *Verification*: the consistency between project description and the relevant methodology to compute emissions reductions, the monitoring plan, and the correct implementation of the project have to be periodically verified by an independent UNFCCC accredited auditor.
- *Transparency*: all the documents related to the project – project design document including the geographical coordinates of the project and the names of project participants, methodology, validation and verification reports etc. (see part I.B for details) – are public and available on the UNFCCC website. All CERs get issued on a registry, with a serial number that allows tracking down the project and period to which they correspond.
- *Timeline*: carbon credits are issued for the emissions reductions achieved, i.e. ex-post.
- *Permanence*: emissions reductions have to be permanent. This may not be the case for reforestation projects, which is why these projects may only issue temporary CERs – tCERs – or long-term CERs – lCER (Guigon et al. 2009).

B. CDM governance: a mix of private and public stakeholders

The Kyoto Protocol set out the general principles of the flexibility mechanisms while the technical details and procedures were further elaborated through subsequent climate negotiations. The most notable package of rules was established at the seventh Conference of the Parties to the UNFCCC (COP7) in Marrakech in 2001, and is therefore often referred to as “Marrakech Accords” (UNFCCC 2002). COP7 established *inter alia* modalities and procedures for the implementation of the CDM (17/CP.7) marking the official birth of the mechanism. These rules were confirmed at the first Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) at Montreal in 2005 (UNFCCC 2006).

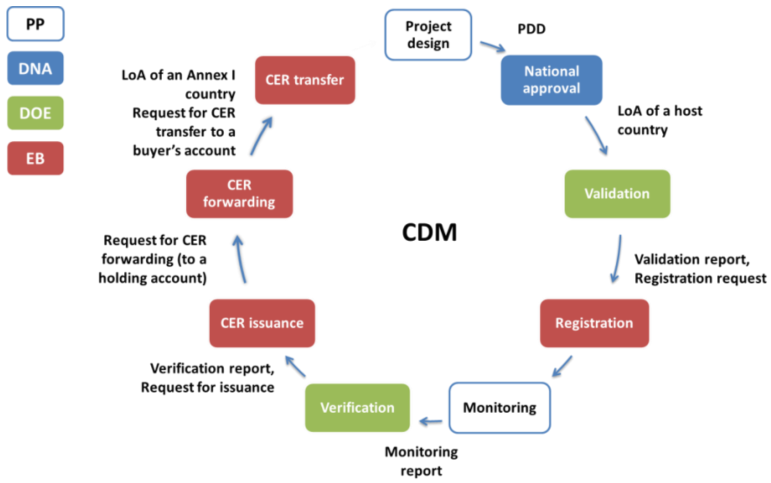
The governance of the CDM and its decision-making has been the object of multiple research papers, many of them from a research program dedicated to this topic undertaken by the University of East Anglia in 2009[8].

The governance structure of the CDM includes four main governing bodies (Appendix 1):

- The CDM Executive Board (CDM EB) supervises the CDM. It is the main governing body responsible for all technical elements of the mechanism: the validation of methodologies, the accreditation of auditors, the registration of projects and the issuance of CERs. The Executive Board counts 10 members and 10 alternate members representing different regions and is supported by the staff from the UNFCCC Secretariat and several expert panels, such as the Methodologies Panel, which is responsible for reviewing and providing a recommendation on the approval of methodologies[9] and methodological changes, or the Accreditation Panel responsible for accrediting auditors.
- The CMP takes the political decisions and annually provides political guidance to the CDM EB. These decisions include the work plan of the CDM EB, the types of projects allowed, etc.
- Designated Operational Entities (DOE) are independent auditors accredited by the Executive Board (and confirmed by the CMP) that perform two functions: validating that a proposed CDM project initially complies with all CDM requirements – that is its relevant methodology – and verifying the pursued implementation of the project and its requirements – that is the actual GHG emissions reductions.
- Designated National Authorities (DNA) are the official interlocutors, most often a part of a ministry, of the UNFCCC in the countries that have ratified the Kyoto Protocol. The DNA of a host country issues the Letter of Approval (LoA) which is necessary for the registration of a CDM project. The DNA of a host country also plays a key role in assessing the sustainable development benefits of a CDM project as well as defining standardized baselines for all or part of its jurisdiction. An LoA from a DNA of an Annex I country is also necessary for the transfer of CERs (note that the latter LoA is not required for registration of a CDM project).

The CDM project cycle (Figure 3) consists of several main stages that involve these and other stakeholders as well as different types of documentation (UNFCCC 2012).

Figure 3 – CDM project lifecycle



PP: project participant, DNA: designated national authority, DOE: designated operational entity, EB: CDM Executive Board. Source: CDC Climat Research (2012)

[8] http://www.uea.ac.uk/dev/gcd/working-paper-series

[9] A methodology is specific to a type of project. It contains the precise criteria and parameters to assess if a project complies with the general CDM guidelines and to quantify the amount of emissions reductions.

- *Project design*. The project participant submits the Project Design Document (PDD) following a template developed by the Executive Board. A PDD mainly follows an approved methodology to demonstrate that the project complies with the CDM requirements.
- *National approval*. DNAs of countries participating in a project issue Letters of Approval (LoA), confirming that they have ratified the Kyoto Protocol and that their participation in the mechanism is voluntary, i.e. is a result of a sovereign decision. In addition, the host country's DNA has to confirm that a project contributes to the national sustainable development policy.
- *Validation*. A DOE validates the PDD, confirming that it complies with all requirements stipulated by the relevant CDM methodology and submits it to the Executive Board for registration. The validation stage often takes place in parallel with national approval.
- *Registration*. Formal registration is preceded by the completeness check by the Secretariat, vetting (i.e. checking the correctness of data) by the Secretariat and vetting by the Executive Board. A thorough review is conducted in case one party or at least three members of the Executive Board request it, otherwise the project proceeds to registration.
- *Monitoring*. The project participant monitors the actual emissions reductions according to the methodology used in the PDD.
- *Verification*. A different DOE[10] provides a written certification of emissions reductions after conducting an ex-post review confirming that the emissions reductions took place in the amount claimed by the monitoring plan. The DOE then submits the verification report together with a request for CER issuance to the Executive Board.
- *CER issuance*. Similar to the registration, issuance of CERs is preceded by completeness check by the secretariat, vetting by the secretariat and vetting by the Executive Board. A party or at least three members of the Executive Board may request a review. The CERs are then issued to the pending account of the Executive Board of the CDM registry.
- *CER forwarding*. The project participant submits a request for CER forwarding to the Executive Board. The CDM registry administrator then forwards CERs to the respective holdings accounts. 98% of CERs go to project participants while 2% go to the adaptation fund that finances measures related to adaptation to the negative effects of climate change in developing countries.
- *CER transfer*. An LoA of an Annex I country is necessary for the transfer of CERs to the national registry of this country, i.e. to a buyer's account.

At each stage of its lifecycle the CDM project is exposed to different types of risks that may delay or even impede CER issuance as well as affect the issuance success rate: Cormier and Bellassen (2012) quantified that only 30% of initially planned CERs actually get issued. Although all types of investments face a risk of failure, CDM projects incur additional bottlenecks during the registration and the CER issuance process, which is further discussed in section II.C.

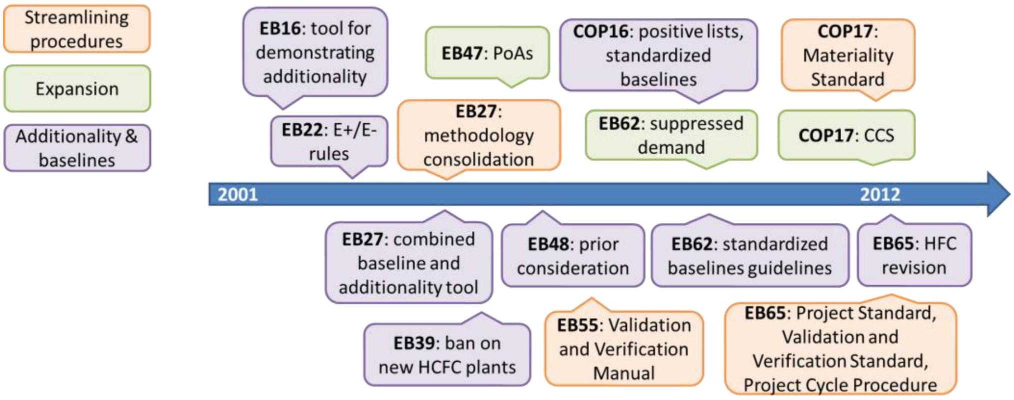
C. CDM reform, at work since 2001

Despite its complexity, the CDM framework is extremely transparent as all the information about the projects is audited and made publicly available. This transparency enabled constructive criticism to emerge from a great variety of stakeholders: project developers, e.g. through the International Emissions Trading Association (IETA), auditors, e.g. through the Designated Operational Entities and Independent Entities Association (DIA) and NGOs such as CDM Watch or Sandbag. This criticism helped the Executive Board identify pitfalls and loopholes in the framework and spurred reforms. The complexity and constantly evolving nature of the CDM framework triggered the creation of a dedicated website by the law

[10] Upon request the Executive Board may allow the same DOE to perform both validation and verification. The simplified procedure for small-scale projects – less than 15 MW capacity for energy projects, less than 15 GWh for energy efficiency projects or less than 15 $KtCO_2e$ of emissions reductions per year for other projects – also allows the same DOE to perform both validation and verification (UNFCCC 2006).

firm Baker & McKenzie that tracks all changes in the CDM rules[11]. The most important changes reflecting the "learning by doing" nature of the CDM are presented on Figure 4. Three key areas of the ongoing CDM reform can be identified.

Figure 4 – Key changes in the CDM rules



Source: CDC Climat Research (2012) based on the EB and COP reports.

Streamlining the administrative procedures

Transactions costs incurred due to the administrative process were estimated between €50 thousand and €200 thousand per project (Guigon et al. 2009). Bottlenecks, delays and excessive bureaucracy have been target for multiple criticism of the CDM (see for example Mizuno et al. 2010), which helped the Executive Board identify rooms for improvement. The main reforms in this area include:

- *Consolidation of methodologies* (EB27) aims at creating a concise list of broadly applicable methodologies and eliminating inconsistencies among them. It responds to a shortcoming of the "bottom-up" process of methodology development: project developers submit their methodologies with their own specific project in mind, with little incentive to think broadly and make it applicable to similar projects.
- *Project Standard* (EB65) aims at improving consistency of requirements across all types of CDM projects, improving the quality of PDDs and monitoring reports. This standard replaces 23 different guidelines, procedures and clarifications governing different stages of the CDM with a single 43-page document applicable to all projects.
- *Validation and Verification Standard* (EB65) aims at improving consistency and clarity of validation and verification activities. This standard replaces 26 different guidelines, procedures and clarifications governing validation and verification activities with a single 62-page document applicable to all projects.
- *Project Cycle Procedure* (EB65) aims at improving consistency and clarity of processing of documents by the Executive Board and the UNFCCC Secretariat with regards to the project registration and the CER issuance. This procedure replaces 25 different procedures, guidelines and forms governing the processing of documentation with a single 46-page document. Notably, under the new procedures, project participants can request private telephone consultations with the secretariat, which should further improve transparency of projects' assessment.
- *Materiality Standard* (COP17) defines the material information as information which, if omitted or misstated, warrants rejection by the DOE and/or the Executive Board. A piece of information is considered material if its omission or misstatement may lead to an overestimation of emissions reductions by more than a given threshold which depends on project size: from 0.5% for projects

[11] http://cdmrulebook.org/

with annual emissions reductions of over 500 ktCO_2e to 10% for renewable energy projects of up to 5 MW and for energy efficiency projects of up to 20 GWh of energy savings per year. The idea behind this standard is to focus the work of DOEs and the EB on the most important flaws of a project.

Another often quoted criticism of the CDM is the length of the administrative procedure for certification, which stems from lack of capacity at the UNFCCC level and the lack of DOEs. Until 2010, the UNFCCC indeed failed to keep up with the increasingly large number of projects in the pipeline. The average time between the start of public comments and registration increased steadily from 250 days in 2005 to over 600 days by the end of 2009. For the same period the average time between the registration request and registration also increased from 75 days to over 200 days (UNEP Risoe 2012). Nevertheless, the situation reversed sharply in 2010 with the average time between the start of public comments and registration dropping to below 400 days and the average time between the request for registration and registration to below 100 days by the end of 2010. This was achieved thanks to the Executive Board hiring extra consultants to clear the backlog. In addition, the CMP in 2010 moved the start of the crediting period back to the request for registration, rather than the registration itself, thus removing the loss of credits due to the administrative delays[12]. Stakeholders now seem to be satisfied with the length of the UNFCCC process, although there is some worry about the shortage of DOEs until the end of 2012, as project developers rush to meet the EU ETS eligibility criteria for the registration date (Lancaster 2012). The competence and availability of EB members has also been criticized: the members of the Board used to be elected from a pool of candidates designated by the Parties to the Kyoto Protocol. A proven level of competence in the CDM for would-be members was introduced in 2010 (Decision 3/CMP.6). Yet, board members are still in general civil servants for whom EB membership is only one of the multiple tasks they have to perform. A CDM EB including full-time positions for independent experts is another option on the table (Ruthner et al. 2011).

Standardization of additionality demonstration and baseline setting

The second area of the CDM reform is focused on the standardization of the additionality demonstration and baseline setting. Despite the 13-page long “additionality tool” revised several times per year to frame the demonstration of additionality and multiple-page tools for determining baselines, a large degree of subjectivity remains when these assessments are project-specific. Indeed, 33% of the PDDs deemed compliant by the project developer are not validated by the DOE, and 7% of those validated by the DOE are not registered by the EB (Cormier and Bellassen 2012). Different proposals to substitute project-by-project demonstration of additionality were put forward even before the Marrakech accords, such as positive lists – a list of project types or a threshold of project size which are deemed automatically additional – or standardized baselines.

- Positive lists were not retained in the Marrakech accords (Mizuno et al. 2010), but they kept being discussed and came back on board at the COP16 in Cancun in December 2010 (UNFCCC 2011b). Currently the list of projects automatically deemed additional includes small scale (<15 MW of installed capacity) grid connected renewable energy (solar, offshore wind and marine), mass transit and bus lane in Least Developed Countries (LDCs), and “first of its kind” projects. At its 67th meeting (EB66) in May 2012, the Executive Board recommended the secretariat to include small scale off-grid renewable energy projects in the positive list. Besides, DNAs of host countries may submit proposed positive lists of micro-scale renewable projects in their jurisdiction. So far South Korea and Chile got their lists approved, while Uruguay and Brazil are waiting for a decision.
- Another dimension of standardization and hence the reduction of judgment is the implementation of so-called “default values” used in investment analyses. For example, the latest version of the “Guidelines on the assessment of investment analysis” (EB62) provides for the default values for the expected return on equity by country and by project type.

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[12] This change only applies to projects which are automatically registered, without a review request.

- Finally, the introduction of standardized baselines should further reduce the uncertainty with regards to additionality and the emissions reductions calculation (see section III).

Another issue that may affect the additionality of the CDM is a potential conflict of interests. When checking baselines and additionality of projects the Executive Board relies on independent DOEs, who are paid and selected by project developers. Therefore the DOEs face contradictory incentives: to be stringent enough to keep their accreditation – and therefore their business – and to be lenient with their direct client, the project developer. Wara and Victor (2008) deemed that the balance tilted toward leniency, due to a lack of enforcement mechanisms to punish the DOEs for misconduct. Since then however, the Executive Board has become more active in this respect, temporary suspending four DOEs, including one of the largest auditors TUEV SUED in 2010. One more DOE (KPMG-AZSA) was suspended in March 2012 (UNFCCC 2012).

Other key innovations here include *inter alia*: tools for demonstrating additionality (EB16 and EB 27), E+/E- rules (EB22), prior consideration (EB48), the launch of standardized baselines and positive lists (COP16) followed by guidelines for standardized baselines (EB62) as well as changes in the methodology for HFC-23 destruction projects (EB65). The issues of additionality and baseline setting will be discussed in a greater detail in section III.

Expanding the CDM

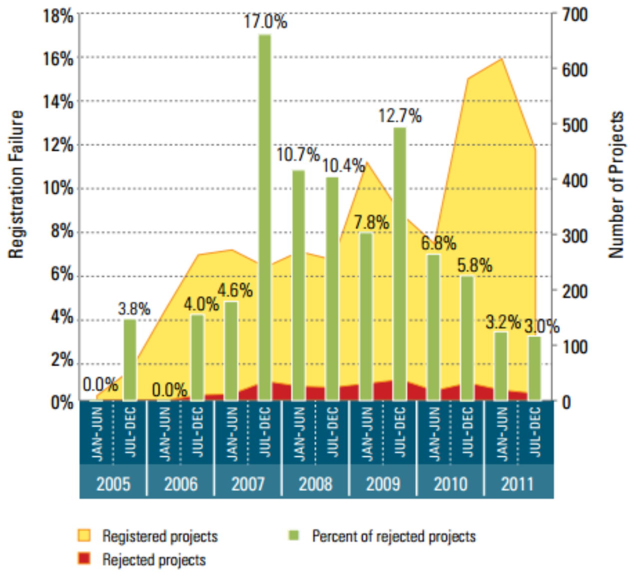
Finally, a number of reforms have focused on expanding the CDM into previously untapped areas such as Programs of Activities (PoAs, EB47), a framework that allows implementing unlimited number of usually small single CDM programme activities (CPAs) under one registered PoA, or Suppressed Demand guidelines (EB62) that provide for incorporating a scenario of increasing emissions in the baseline. These two initiatives are particularly important for Least Developed Countries (LDCs) and will be further discussed in section IV. Carbon Capture and Storage (CCS) is another example of the CDM expansion. The possibility to include CCS in the CDM has been discussed for several years, but it was not until December 2011 when modalities and procedures for CCS were adopted at COP17.

Another important aspect of the ever-ongoing reform of the CDM is the attention paid to guarantee a minimum amount of visibility for project developers: although project developers tend to be wary of an ever-changing regulatory framework, changes are usually not retrospective. For instance, changes in methodologies such as the change in maximum HFC-23/HCFC-22 presented in section III only apply to new projects or renewed crediting periods. Hence, once a project is registered, the project developer gets a fixed set of rules for 7 to 10 years, that is the two options for the length of a crediting period.

From kick-start through scrutiny to streamlining

More generally, the World Bank identified three stages in the CDM evolution that are highlighted by the amount of rejected projects (Figure 5). The need to kick-start the mechanism before 2007 and the lack of capacity of the Executive Board resulted in a low proportion of rejections. Increasing scrutiny and ad-hoc interventions in 2007-2009 triggered by the increasing criticism over the CDM led to a peak in the amount of rejections during this period. Finally, starting from 2010 onwards, the adaptation of project developers to EB jurisprudence (Ruthner et al. 2011) and the reforms largely focused on streamlining and standardization helped improve the quality of submissions and reduce the proportion of rejections (Platonova-Oquab and Spors 2012). On the other hand the decreasing number of rejections coincides with the period when additional consultants were hired by the Executive Board to clear the backlog of pending projects, pointing at possibly less stringent assessment of projects by these consultants.

Figure 5 – Share of registered and rejected projects



Source: Platonova-Oquab and Spors (2012).

More reforms can be expected in the future as the UNFCCC launched the CDM Policy Dialogue[13] involving a wide range of stakeholders from January to September 2012. The COP17/CMP7 that took place in Durban, South Africa in December 2011 marked *inter alia* the continuation of the CDM beyond 2012, as the existence of the second commitment period confirms the mandate of the Executive Board (Morel et al. 2011). This implies that the issuance of CERs will continue for the emissions reductions that take place after 2012. The fate of the mechanism will also depend on its credibility and the availability of demand. The EU has already decided to unilaterally impose qualitative and quantitative restrictions on the use of CERs in the EU ETS. At the same time new emerging national cap-and-trade systems might provide a new source of demand in the future (see section II.D)

II. CER SUPPLY AND DEMAND: LARGELY CONCENTRATED AND PRIVATIZED

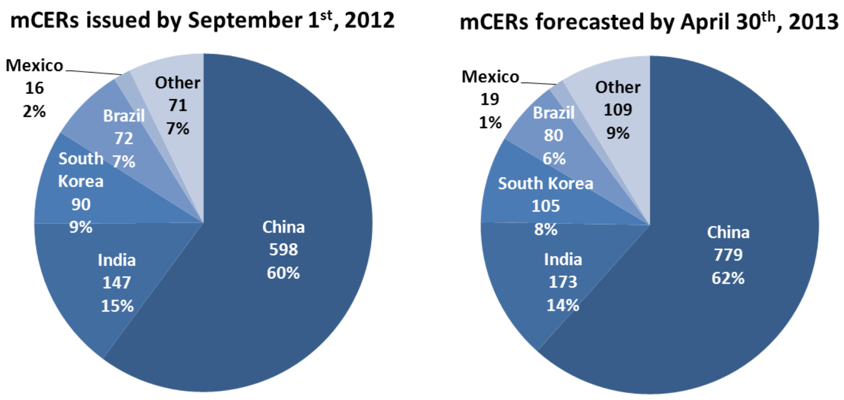
A. Uneven geographical distribution is a natural outcome of the CDM

Despite all challenges, the CDM saw rapid growth in the past ten years, quickly becoming the largest carbon offsetting mechanism in the world. As of September 1st, 2012 there were 4 546 CDM projects registered and 4 261 projects at validation stage and in the process of registration. 1 717 CDM projects had already issued 995 million CERs (UNEP Risoe 2012) while the total abatement potential of the CDM was estimated at 1.27 $GtCO_2e$ by April 30th, 2013 according to the model developed by CDC Climat Research. China and India host two thirds of all registered projects and are forecasted to issue three quarters of all CER by April 30th, 2013 (Figure 6).

The CER supply is highly concentrated with 93% of all issued credits coming from 5 largest CDM countries: China, India, South Korea, Brazil and Mexico, while African countries account for less than 2%. Such a concentrated distribution of CDM projects does not come as a big surprise though: at the dawn of the CDM, ex-ante studies already predicted that the largest developing countries such as China, India and Brazil would become the CDM “stars”. These countries possess the key factors influencing the CDM attractiveness of the host countries – high levels of GHG emissions, strong institutional capacity and favorable investment climate (Jung 2006).

[13] http://cdmpolicydialogue.org/

Figure 6 – CDM geographical distribution



Sources: UNEP Risoe (2012), CDC Climat (2012).

Later on, the soaring number of projects and the availability of public data on the CDM enabled conducting ex-post empirical research of factors influencing the geographical distribution of projects using regression analysis (Dinar et al. 2008; Flues 2010; Winkelman and Moore 2011) These studies helped explain the geographical distribution of CDM projects with the following determinants:

- absolute GHG emissions and relative emissions intensity;
- overall investment climate;
- level of international cooperation.

Another approach using the gravity model of international trade (Wang and Firestone 2010) studied the influence of so-called “gravity factors” (weight and distance) on the intensity of bilateral cooperation in the CDM. The weight of the country – i.e. the amount of GHG emissions – confirmed to play a key role in determining cooperation, while distance proved to be largely irrelevant.

More advanced developing countries such as China pursue an increasingly large number of unilateral CDM projects – i.e. without foreign direct investments – as their need for new technology and foreign investment is lower than less developed countries (Flues 2010). In the case of China (see Box 1), the unilateral nature of the CDM was further enhanced by the strength of Chinese state-owned enterprises that invested heavily in large CDM projects (Shen 2011).

Box 1 – China and the CDM

China has been the largest CER supplier since 2007, currently accounting for 60% of all issued CERs. Surprisingly, despite its enormous climate change mitigation potential, China was initially sceptical about the participation in the Kyoto Protocol’s flexibility mechanisms, which it perceived as a means to escape responsibility by the developed countries.

Later on, however, the position of China changed as its government realized that participating in the CDM might foster foreign investments, technology transfer and contribute to the country’s development. In 2004 the National Development and Reform Commission (NDRC) was appointed the country’s DNA and the first CDM procedures were adopted. The first CDM project in China received its LoA in late 2004.

After a fairly slow start, China managed to streamline the CDM administrative procedures, which resulted in fast and efficient approval process, especially for the priority sectors: energy efficiency, renewable energy and methane recovery and utilization.

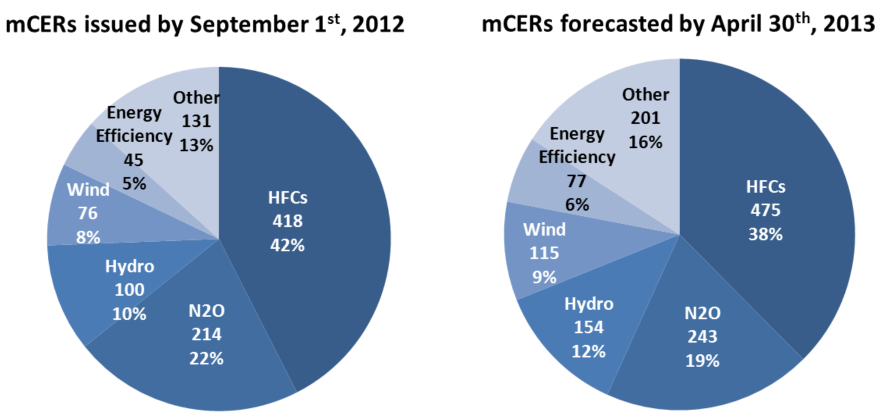
China has also announced its plan to implement a domestic ETS with pilot schemes in Beijing, Chongqing, Shanghai, Shenzhen and Tianjin and two provinces Guangdong and Hubei expected in 2013-2014. China may thus help boost demand for carbon offsets as the domestic schemes start absorbing Chinese CER and/or integrating CDM projects into their perimeter.

As for the least-developed countries (LDC), their CDM potential is significantly lower due to lower absolute levels of emissions as well as low carbon intensity of their economies (Winkelman and Moore 2011) and technological barriers (Flues 2010). Moreover, it has to be noted that the CDM investments follow similar logic as other types of foreign direct investments (FDI) that require infrastructure in place, well-functioning institutions and in general favorable investment climate. Least-developed countries often fail to provide these prerequisites, defying private investors and making the role of multilateral organizations more important. Indeed, the share of CDM projects financed by the World Bank is over 20% in Africa against only 2% globally (World Bank 2010).

B. Sectoral distribution reflects the search function of the CDM

From a sectoral perspective the CDM has also been rather concentrated – almost two thirds of CERs issued by September 1st, 2012, originated from projects focused on reducing emissions of industrial gases – HFC-23 and N_2O (UNEP Risoe 2012) – although these projects account for only 57% of CERs expected by April 30th, 2013, according to CDC Climat Research (Figure 7). This dominance can be explained by the earlier start of HFC-23 and N_2O projects, as well as their high returns on investments. Besides, the large size of these projects – the 10 biggest projects, all focused on destruction of industrial gases, have issued 45% of all CERs – enables them to benefit from the economy of scale and submit their monitoring reports more often, while smaller projects might tend to wait until a large number of emissions reductions is accumulated in order to reduce transaction costs. Other important sectors in the CDM are renewable energy, especially hydro and wind power, energy efficiency, waste (landfill gas destruction or utilization) and energy efficiency in industrial processes.

Figure 7 – CDM sectoral distribution



Sources: UNEP Risoe (2012), CDC Climat (2012).

Projects focused on reducing emissions of industrial gases and methane are usually cheaper due to high global warming potential of these gases[14]. Conversely, renewable energy projects are usually less attractive from the carbon credit sale perspective, but they yield additional economic gains thanks to the electricity production and might have other drivers for implementation, such as national energy policies, as discussed in section III. Indeed, the research by UNEP Risoe (Lütken 2012) suggests that annual carbon returns on investments may vary drastically depending on the project type: from less than 1% for wind energy to more than 1 000% for industrial gas projects (Appendix 3). Finally, energy efficiency projects may provide “negative abatement costs” due to savings in energy consumption, but may face other barriers in the absence of the CDM.

At the same time, there are four large project types that the CDM has largely failed to tap into:

- *The building* sector provides for the largest economically attractive potential to reduce GHG emissions (IPCC 2007), yet there are only 33 registered projects and 9 PoAs that focus on energy efficiency in households – mainly improved lighting and cookstoves (no projects dealing with insulation) – that have issued a mere 100 000 CERs (UNEP Risoe 2012). One of main barriers to

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[14] Global warming potential of methane CH_4 is 21, N_2O – 310 and HFC-23 – 11 700 (IPCC 1995).

this type of projects is the difficulty to measure diffuse emissions reductions in buildings. The "principal-agent problem" stemming from the fact that the capital investments are borne by the landlord, while the energy efficiency benefits are accrued by the tenant, is another barrier to implementing abatement measures in the buildings sector.

- *The transportation* sector has so far registered only 15 CDM projects (UNEP Risoe 2012). The main barriers for implementation of projects in this sector are the diffuse nature of emissions (Sterk 2008) and concerns about additionality due to largely public funding for transport infrastructure.
- *The agriculture* sector is responsible for 14% of global GHG emissions and 30% if upstream and downstream emissions are taken into account (Foucherot and Bellassen 2011). These emissions are, however, highly diffuse and difficult to monitor precisely, which results in a relatively low number of offset projects in this sector. By July 1st, 2011 the CDM pipeline included 310 registered bio-energy projects, mainly the valorization of previously unused crop residues, and 215 animal waste projects (e.g. manure management) responsible for annual emissions reductions of 4.1 and 1.8 $MtCO_2e$ respectively (Foucherot and Bellassen 2011).
- *The forestry* sector suffers from a number of obstacles namely: restrictions on types of projects (only afforestation and reforestation projects are allowed under the CDM, while improved forest management and REDD[15] are not), slowly yielding nature of projects (trees take long time to grow), temporary nature of credits[16], ineligibility of this type of offsets for use in the EU ETS, as well as the complexity of monitoring. By September 1st, 2012 there were only 39 forestry CDM projects registered while only one project (Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil) issued tCERs (UNEP Risoe 2012). CMP17 requested the Subsidiary Body for Scientific and Technological Advice to work on the expansion of the CDM in forestry and soil carbon sectors. Decisions are expected in 2013 (Morel et al. 2011).

The availability of information regarding the investments in the CDM enabled to plot the abatement costs for different sectors and technologies and juxtapose them against ex-ante theoretical marginal abatement cost curves (MACC). This comparison showed that in many cases CDM projects managed to capture more abatement opportunities than estimated by the theoretical studies. For example, Castro (2012) estimated that the CDM captured seven times the theoretical abatement potential of renewable energy projects in China for 13-14 euros per tCO_2e. At the same time on a wider country level, the CDM has not taken up a large share of the theoretical abatement potential in developing countries, as many sectors remained untapped. The sole exception is once more China, where CDM projects (registered and at validation) captured almost a third of the theoretical abatement potential for 13-14 euros per tCO_2e in 2010 (Castro 2012). One has to note, however, that the theoretical potential was likely underestimated as it did not include new abatement opportunities found by the CDM. These findings highlight that, generally, unlike non-project mechanisms like NAMAs[17] or sectoral crediting, the CDM is not tailored to capture a large share of the abatement potential in a given country.

It can be concluded that the "search function" of the CDM works well in terms of identifying the cheapest and easily accessible abatement opportunities, although there are barriers that hamper implementation of offsetting projects in certain sectors. The search function also works in terms of identifying new abatement opportunities such as industrial gases or renewable energy projects. The fact that the CDM over-performed the theoretical abatement potential in China and some other countries shows that unforeseen opportunities have been tapped.

[15] Reducing Emissions from Deforestation and Forest Degradation.

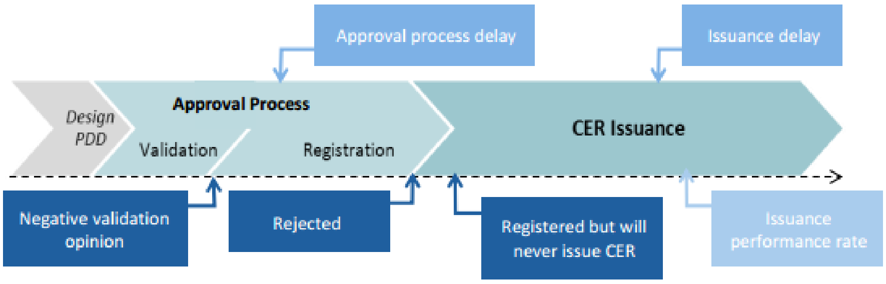
[16] tCERs expire at the end of the commitment period following the one in which they were issued.

[17] NAMA stands for Nationally Appropriate Mitigation Actions and refers to domestic climate change mitigation policies implemented in developing countries with the assistance of developed countries. Unlike the CDM, NAMA is a national-scale mechanism.

C. Issuance of CERs involves risks at all stages of the project cycle

Not all credits planned in the projects' PDDs get issued. The average CER issuance performance by project – i.e. not weighted by the project size – is 80% as of September 1st 2012 (UNEP Risoe 2012). With the exception of HFC-23 destruction and transport projects, which on average issue more credits per monitoring period than planned in their PDDs, all other types of projects underperform in terms of CER issuance. Due to the large share of HFC projects, the total average weighted issuance success of all CDM projects is 93%. This estimation, however, does not take into account the delays and project failures at different stages of the lifecycle. These risks are accounted for in the model developed by CDC Climat Research (Figure 8).

Figure 8 – Risks at different stages of the CDM project cycle



Source: Cormier and Bellassen (2012).

Based on this model it was calculated that in fact only 30% of initially planned CERs had been issued by April 2011. 30% of all planned CER would never be issued, mainly due to the failure of projects, and 40% had not been issued on time due to delays during the approval process or at issuance. It was also identified that technology (i.e. project type) is the most important factor, influencing risks at all stages, while other factors such as time, location, size of the project, PDD consultant and auditor can be relatively important at certain stages (Cormier and Bellassen 2012). Based on a risk-adjusted model, CDC Climat Research forecasts that 1.27 billion CERs shall be issued by April 30th, 2013[18]. Together with another 0.49 billion ERUs that are expected from JI projects, the total amount of Kyoto-based offsets will exceed the quantitative import limit set under the EU ETS – the main market for carbon offsets (see Figure 10 in section II.D).

D. Europe is the key CDM driver on the demand side

The CDM, initially designed as an instrument aimed at helping Annex I countries achieve their Kyoto targets, quickly became a largely private sector mechanism. European industry subject to the EU ETS quickly became the main source of end-demand for CERs. 77% of all CERs issued by January 1st, 2012 were transferred to the accounts of the European countries. Five European countries – the United Kingdom, Switzerland, the Netherlands, France and Italy – represent two thirds of the primary CER demand, while Japan accounts for 13% and the remaining 22% is shared by other Annex I countries or not transferred from the CDM registry yet.

The EU is also the largest "consumer" of CERs: 56% of all CERs issued by the end of 2011 were surrendered by installations under the EU ETS (CITL 2012), with the largest buyers being utilities located in Germany, Spain, Poland, Italy, France and the United Kingdom, while Japanese entities held 15% CERs (Japan's Carbon Registry 2012). Most of the remaining 29% were held in the EU accounts – either for use by governments or not yet surrendered under the EU ETS (Figure 9).

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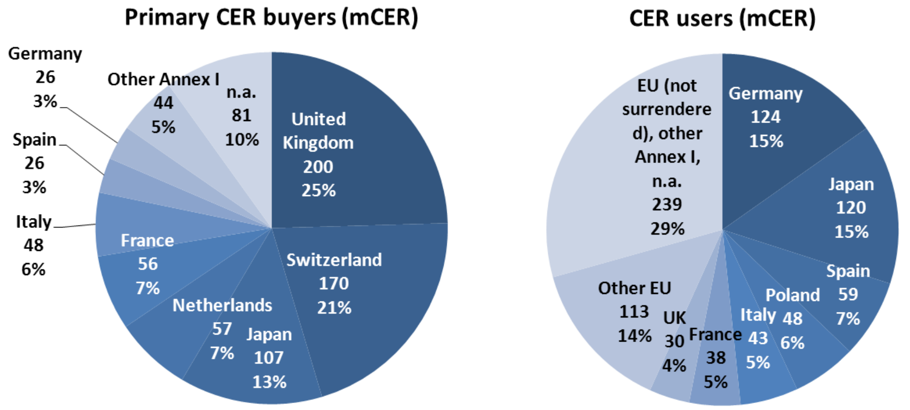
[18] The deadline for surrendering carbon units under the EU ETS Phase II.

Figure 9 – Cumulative CER demand by January 1st, 2012



Source: UNEP Risoe (2012), CITL (2012), National Carbon Registries (2012).

This reliable source of private demand spurred private investment in CDM projects from western industrial and financial groups as well as from local investors in developing countries (see Box 1 on the dominance of unilateral projects in China). On this investment front, it is worth noting that the UK and Switzerland act as commodity trading hubs and account for almost half of the total primary CER demand. Indeed, the largest primary CDM investors – Eco Securities, EDF Trading, Camco, Vitol etc. – are based in the UK or Switzerland. The attractiveness of these countries is further increased due to the easiness of obtaining LoAs. The data on CER transfer confirms that more than half of all secondary CERs were traded through these two countries.

The CDM became a largely private sector mechanism on both sides of the spectrum – demand and supply. Some investors prefer the limited scope of a CDM project, which allows sectoral experts to identify and manage most risks. This is different to the broader scope of other green investments such as for example green bonds[19], for which risk is mainly assessed based on the general reputation of the bond issuer.

The share of governmental investments in the CDM (and JI) is substantially lower: according to the World Bank (2012), 316 million Kyoto offsets had been contracted by governments as of April 1st 2012 against 2 267 million contracted by the private sector (note that these numbers are not adjusted for performance). Most of these – 259 million – had been contracted by the EU-15 governments with the remaining 57 million being shared between the governments of Japan and other Annex I countries.

The use of CERs in the EU ETS serves installations as a cost containment tool, as the market price for CERs has been historically lower that the price of European Union Allowance Units – EUA (Appendix 4). It was estimated that due to this spread the European installations saved an average of 283 million euros over the first two years (2008-2009) of the EU ETS Phase II by importing CERs (Trotignon 2010). As it is based on the price of secondary CERs, this figure probably underestimates the actual savings: some installations may have invested directly in CDM projects thus obtaining cheaper primary CERs to use for compliance. Another reason for underestimation is that it does not take into consideration higher prices for EUAs that would have occurred in the absence of foreign offsets, due to a lower supply/demand ratio. The use of CERs under the EU ETS is more concentrated than the actual emissions of the installations (ibid). This may be attributed to the fact that some countries – notably Germany – allow its large power producers to use more offsets than are allowed in other sectors. Transaction costs, which are lower in the case of large installations, as well as the availability of expertise and market knowledge – large companies usually employ dedicated carbon professionals – is another reason.

[19] For more information on green bonds please refer to Morel and Bordier (2012)

Demand-side restrictions

The link between the EU ETS and Kyoto offsets is regulated by the so-called "Linking Directive" (Directive 2004/101/EC). Under this directive the installations covered by the scheme may surrender carbon offsets generated by CDM and JI projects – CERs and ERUs (but not AAUs) – up to a limit set by each country's National Allocation Plan (NAP). Countries have differentiated limits depending on the ambition of their emissions reductions commitments (Appendix 5). The aggregated limit for the use of Kyoto offsets is around 1.45 billion tCO_2e in Phase II (2008-2012) (Delbosc et al. 2011).

Besides the quantitative limit on the use of Kyoto offsets in the EU ETS, several qualitative restrictions apply to CERs and ERUs (Directive 2004/101/EC):

- carbon credits generated by nuclear facilities are not eligible;
- carbon credits generated by land use, land-use change and forestry (LULUCF) projects are not eligible;
- large hydro-power projects (exceeding 20 MW) have to comply with international environmental and social regulations under the World Commission on Dams (WCD) to be eligible.

Further qualitative and quantitative restrictions will enter into force as of the beginning of the third phase of the EU ETS (2013-2020) banning the following types of credits:

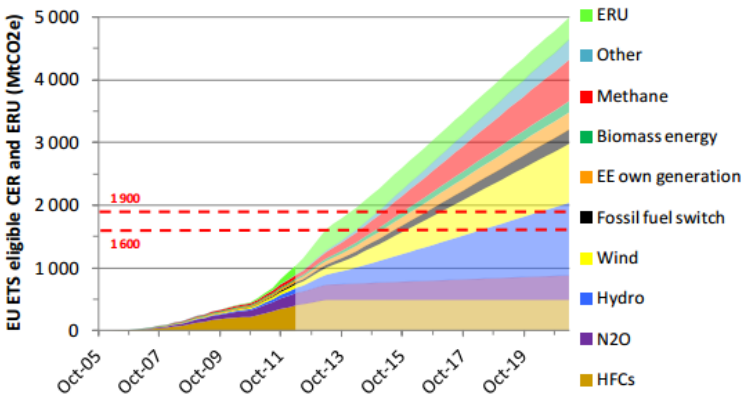
- carbon credits from projects involving the destruction of HFC-23 and N2O from the adipic acid production;
- carbon credits from projects registered after 2012 in countries other than Least Developed Countries (LDCs) unless there are intergovernmental agreements with other host countries in place.

The CER/ERU import limit is barely increased after 2012 compared to 2008-2012: only new entrants to the EU ETS represent a new source of demand over 2013-2020. The use of Kyoto credits from CDM and JI projects under the EU ETS is therefore subject to qualitative and quantitative restrictions which do not apply to European Union Allowance Units (EUA). As a result, CER owners face an additional risk, the risk that their property becomes useless as end-users reach their quantitative limit. This is the main explanation for the difference between the prices of these carbon assets. Indeed, the EUA-CER spread has widened in the past year (Appendix 4), responding to the growing concern that the overall import limit of the EU ETS will soon be reached.

The CER/ERU import limit over the period 2008-2020 is around 1.65 billion tCO_2e (Delbosc et al. 2011). However, given that this cumulated import limit is the sum of specific import limits at the installation scale, and that some installations choose not to use offsets, the actual demand is estimated to be around 1.3 billion tCO_2e. Other sources of demand (EU member states, Japanese government and private sector) amount to 0.3 billion tCO_2e between 2008 and 2015 (Bellassen et al. 2012). This demand, however, is much less liquid and faces competition from other carbon assets such as AAUs and RMUs that can also be used by Annex I countries for their Kyoto compliance. In total CDC Climat Research forecasts the medium-term (pre-2015) demand from the EU ETS and secondary sources to be between 1.6 and 1.9 billion tCO_2e – an amount that can be issued by 2013-2014 (Figure 10).

At least three reasons can be proposed as to why the EU decided to stop being a large source of demand for CERs. One is that the EU ETS is already oversupplied with allowances, a problem which is only worsened if offset credits are allowed. The second is the "supplementarity principle": half of the emissions reduced by EU ETS should be reduced within its perimeter. The third is that the CDM became increasingly viewed as a subsidy paid by European industry to its competitors in emerging economies: as it can be seen in the case of HFC projects, earnings from CERs may allow to sell refrigerants at a lower price than warranted by their input costs (see section III.C).

Figure 10 – Issuance and forecast issuance of EU ETS-eligible Kyoto offsets



Source: Bellassen et al. (2012).

In the future the demand for offsets might be expected to become less concentrated. New national cap-and-trade schemes are emerging in Australia, China, South Korea and Mexico, which might provide another source of demand, although it is still unclear to what extent they will accept CERs.

III. Baselines and additionality: the cornerstone of the CDM

Being essentially an offsetting mechanism, the CDM represents an environmental "zero-sum" game, as the emissions reductions generated in developing countries can be used for compliance by developed countries. Therefore, in order to ensure that the overall magnitude of abatement does not decrease, the Kyoto Protocol stipulates that to be certified under the CDM, emissions reductions have to be "real, measurable and additional to any that would occur in the absence of the certified project activity" (Kyoto Protocol 1997). This concept, usually referred to as "additionality", is central to ensuring the environmental integrity of the CDM. This seemingly simple and fair idea proved to be a highly contentious concept, resulting in controversies around numerous projects. In order to understand how this issue is dealt with in practice, the implementation of the rules for additionality and baseline setting are analyzed through two case studies.

A. Additionality assessment

Additionality is assessed at the validation stage of the project cycle (see Figure 3 in section I.B) by the DOE based on the demonstration provided in the PDD by project participants. Unless included in a positive list, a CDM project has to prove that the project scenario is different from what would have happened without the project, which is often referred to as the "baseline scenario". Most demonstrations follow the additionality tool[20] developed by the CDM EB – an algorithm consisting of three or four steps: identification of alternatives to the project activity, investment analysis and/or barrier analysis and, finally, common practice analysis (Figure 11).

- *Barrier analysis,* i.e. the identification of barriers – such as investment, technological or "prevailing practice" (when the project is "first of its kind") etc. – that would impede the implementation of a project without its registration under the CDM. Barrier analysis is widely used in the CDM despite its reliability being often questioned as it involves a large degree of subjectivity. For example, Schneider (2009) found out that 43% of 93 randomly chosen CDM projects do not provide any explanation on how the suggested barriers would actually prevent the project activity. In many cases the identified barriers represent common risks associated with any kind of investment such

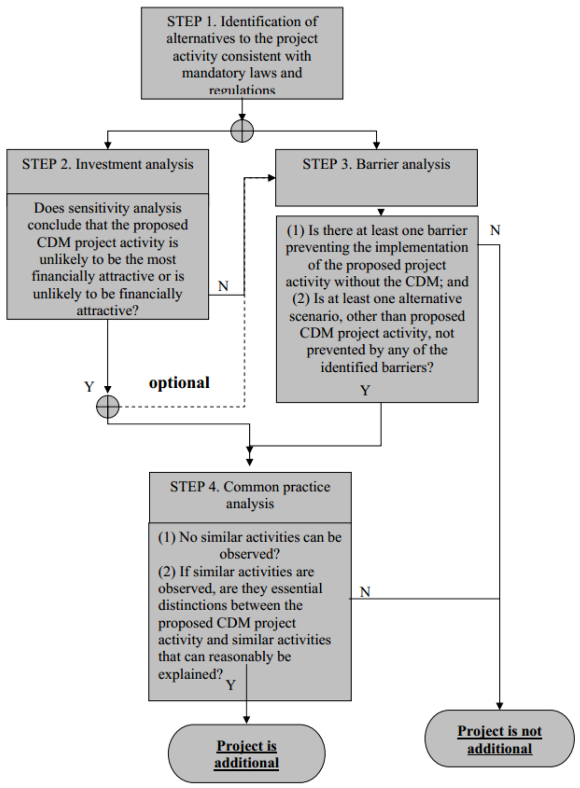
[20] The use of the additionality tool is however not mandatory, unless a project employs a methodology that explicitly refers to the additionality tool.

as exchange rate risks or political risks. Finally, 61% of analyzed large-scale projects quote costs as a barrier, although the additionality tool explicitly excludes this (Schneider 2009).

- *Investment analysis,* i.e. proving that a project is less attractive than alternative investment options. If the CER sale is the only source of revenue for the project – e.g. destruction of industrial gases – a simple cost analysis showing that the project generates additional costs is sufficient. In case a project generates revenues other than from the sale of CERs – e.g. generation of electricity from renewable energy sources or fuel savings due to the improved energy efficiency – investment comparison or a benchmark analysis is warranted. Schneider (2009) showed that transparency of the investment analysis varies greatly with some project developers providing exhaustive information about their financial calculations and underlying assumptions, while others employ a "black-box" approach offering only the results of their calculations and disabling the possibility to verify them. This may not be entirely conclusive as DOEs usually have access to financial information that may not be fully disclosed in public documents. This issue is being addressed through the introduction of default values, such as return on equity by project type and by country.
- *Common practice analysis* mandates an analysis of the whole sector in order to identify whether a proposed project is a "common practice" in the industry. The advantage of this approach is that it is more objective, since it does not include judgments with regards to motivation for launching a project. However, it is very difficult to define what exactly constitutes a "common practice". Some methodologies (e.g. AM0011) consider an activity not a common practice if it occurs in less than 5% of cases, while others (e.g. AM0041) suggest a benchmark as high as 33% (Schneider 2009). Moreover, with opportunities provided by the CDM some project types, e.g. industrial gases, may become common practice in the industry rather quickly. Therefore, common practice analysis is usually used only as a "credibility check" in addition to investment and/or barrier analysis.

It is worth noting that the first two versions of the additionality tool included the fifth step – impact of registration of the proposed project activity as a CDM project activity. This step was revoked at the EB29 in 2007.

Figure 11 – Tool for the demonstration and assessment of additionality



Source: EB65 Report, Annex 21 (UNFCCC 2012)

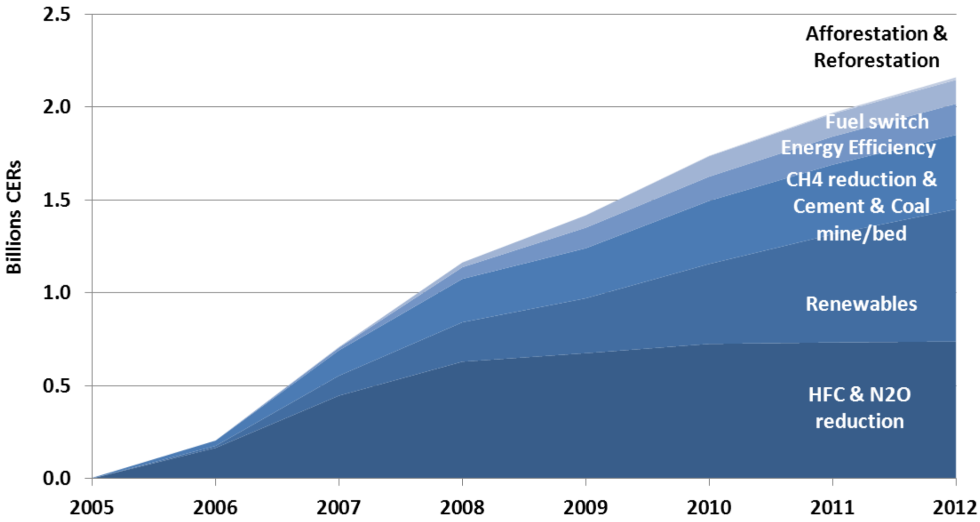
In order to further increase the scrutiny of additionality demonstration, the Executive Board introduced the concept of "prior consideration". This rule requires the project developer to notify the host country's DNA and the UNFCCC secretariat of their intention to register a CDM project within six months from its start. This requirement applies to all projects with the starting date of activity on August 2nd, 2008 and after. It is intended to prevent the application by existing projects, whose developer only became aware of the CDM opportunity years after their implementation. For projects starting before August 2nd, 2008, it is still necessary to demonstrate that the CDM was "seriously considered in the decision to implement the project activity".

The complexity and subjectivity of additionality demonstration is one of the reasons for delays during the registration process (Haya 2009). Together with baseline determination, the demonstration of additionality represents half of the administrative costs involved in the elaboration of a PDD (Guigon et al. 2009). A disagreement between the DOE and the Executive Board on additionality is also the most frequent reason for a review, concerning two thirds of all review cases (Mizuno et al. 2010).

B. Additionality of renewables in China and India

The development of renewable energy sources – such as hydro, wind, solar, biomass, tidal and geothermal – is often seen as one of the crucial elements of the global climate change mitigation action. For example, the "450 scenario"[21] supposes the increase of the share of renewables in the total energy demand from 13% in 2009 to 27% in 2035 against 14% in the "current policy scenario" (IEA 2011). The share of renewables in the CDM pipeline has been growing steadily in the past few years – by April 1st, 2012 there were over 2 600 registered renewable energy projects that were expected to generate 700 million CERs, that is one third of all CERs expected by the end of 2012 when no risk-adjustment is applied (Figure 12). The forecast of the risk-adjusted model by CDC Climat Research is lower – 300 million CERs – or one fourth of all CERs forecasted by April 30th, 2013 by the same model.

Figure 12 – CERs expected by the end of 2012 according to registered PDDs at a given time



Source: UNEP Risoe (2012).

About 67% of these CERs are expected to originate in China and 13% in India – the two largest CDM host countries. Both China and India largely rely on coal-fired power plants for the electricity supply – around 80% and 70% of electricity was produced from coal in 2009 respectively (IEA 2012). This situation leads to the dependence from coal imports – according to the US Energy Information Administration in 2009 China and India were the 2nd and the 4th largest coal importers respectively and the volume of coal imports

[21] "450 scenario" refers to the global course of action that would limit the concentration of the CO_2 in the atmosphere at the level of 450 parts per million (ppm) as recommended by the Intergovernmental Panel on Climate Change (2007).

has been growing rapidly (EIA 2012). Coal-fired power plants also create problems with local pollution and public health. In order to diversify their energy supply, governments of both countries have put in place ambitious plans for the roll-out of renewable energy. In 2007 for example, China set a target to increase the share of renewables in the primary energy consumption to 10% by 2010 and to 16% by 2020. This target is supported by various domestic policies such as subsidies, tax breaks and feed-in tariffs (Peidong et al. 2009). Moreover, the government plays a central role in developing renewable energy as the sector is dominated by large state companies (Shen 2011). It can therefore be argued that most of these projects are a part of the long-term energy strategy and would have happened with or without the CDM.

Wara and Victor (2008) showed that almost all new hydro, wind (and also gas) power plants in China applied for registration under the CDM. This implies that should these projects be truly additional, there would be no new hydro, wind and gas power plants built in China without the CDM, which is an implausible scenario given the political support to the power sector diversification. A more recent study (Haya and Parekh 2011) yielded similar conclusions regarding large hydro projects, also arguing that since hydro already accounts for 16% of global installed electricity generation capacity, it should be considered a common practice.

Although this is strong evidence that not all renewable energy projects in China are additional, this loophole may have been willingly created by the EB through the E+/E- rules. The question of inclusion of new national policies in the assessment of additionality and the establishment of baselines is indeed regulated under the guidelines on the treatment of national and sectoral policies established at the EB22 in 2005. The rules distinguish between two types of policies:

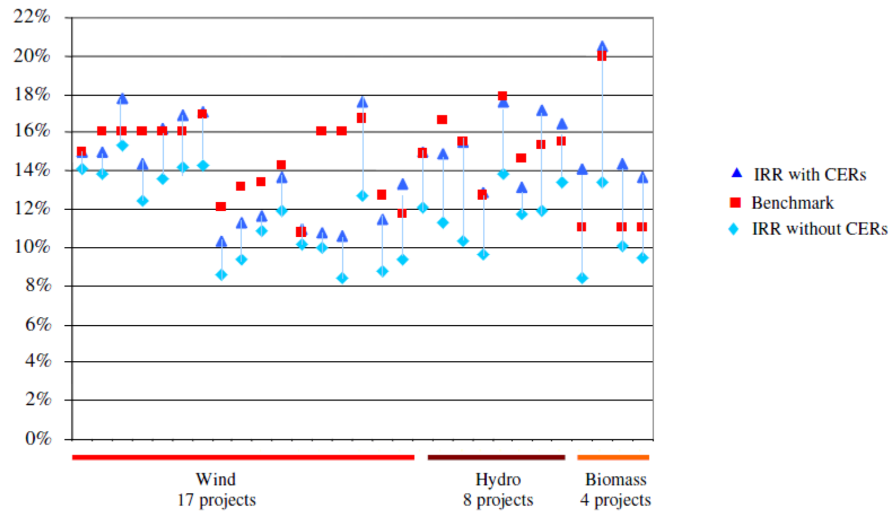
- Policies that provide a comparative advantage to more emission-intensive technologies (E+) can be taken into account only if they were in place prior to the adoption of the Kyoto Protocol on December 11th, 1997. The rationale behind this rule is to prevent countries from artificially affecting the baselines.
- Policies that provide a comparative advantage to less emission-intensive technologies (E-) can be taken into account only if they were in place prior to the adoption of Marrakech Accords on November 11th, 2001. The rationale behind this rule is to prevent a perverse incentive for countries not to implement climate change mitigation policies.

Hence, the E+/E- rules help avoid perverse incentives for host countries' governments, but this is necessarily achieved at the expense of the stringency of the definition of additionality, as it might have happened in the case of renewable energy projects in China. The CDM EB saw this contradiction and at its 55th meeting in 2010, it examined a draft set of guidelines aimed at reconciling additionality demonstration and E+/E- rules. Its decision to discontinue "the consideration of the treatment of national and sectoral policies in the demonstration and assessment of additionality" and yet to assess the "possible impact of national and sectoral policies in the demonstration and assessment of additionality […] on a case by case basis" is like running with the hare and hunting with the hounds: it did not clarify whether strict additionality or E+/E- rules would prevail.

In her study of renewable energy projects in India, Haya (2009) demonstrated more specifically that the investment analysis that was used to prove additionality was a subject to strategic behavior. Indeed, since the effect of the CER revenues on the internal rate of return (IRR) in renewable energy projects is only a few percentage points, there is a very small interval where the project is financially additional with CERs and non-additional without. As benchmark IRR vary from 10 to 20% for renewable energy projects in India (Figure 13) and they are consistently higher when the IRR is higher, the author concludes that the benchmarks were likely adjusted by project developers to match the additionality interval.

Since the inputs for the investment analysis include lots of uncertainties and assumptions with regards to future costs and revenues, there is some wriggle room for project developers to bend the figures to their advantage. As it was mentioned earlier, this issue is being addressed through the introduction of default values.

Figure 13 – Benchmark investment analysis of selected Indian CDM projects



Source: Haya (2009)

Moreover, in many cases the IRR with CERs is still below the benchmark, yet all these projects were built, which confirms that either the investment analysis is inaccurate or that the benchmark is irrelevant to the project developer. Note an irrelevant benchmark is not necessarily problematic: the benchmark is intended to represent the IRR expected by a standard investor in the region. But CDM guidelines do not require a project to be profitable or more profitable than a given benchmark: a benevolent project developer is allowed to lose less money though the CDM than otherwise. Haya's study was also complemented by interviews with relevant stakeholders that confirmed that in most cases the CDM part of the project was just an "icing on the cake" and not a key factor in the investment decision-making, confirming that the projects would have taken place anyway (Haya 2009).

The case of renewable energy CDM projects in China and India shows that the existing system of additionality assessment may not be able to prevent non-additional projects from being registered. Since additionality depends on the reliability of a hypothetical scenario, it is virtually impossible to precisely quantify the amount of emissions reductions. Moreover, as seen with the E+/E- policies, non-additional projects may willingly be accepted in order to avoid sending perverse incentives for national policies on subsidies or feed-in tariffs. Schneider (2007) suggests that up to 40% of CDM projects responsible for 20% of expected emissions reductions might be non-additional or questionable.

More generally the problem of the additionality evaluation is that it requires the assessment of alternative hypothetical scenarios, which will never materialize if the project is implemented. This means that additionality can never be established with a 100% certainty. In this light, the additionality issue becomes a question of finding the right balance between the amount of non-additional projects that manage to get registered – so-called "false positives" representing windfall CER profits for projects that would have happened anyway – and the amount of additional projects that do not manage to pass the additionality test or that are frightened away by the cost and risk of the demonstration – "false negatives" – that represent lost opportunities (Trexler, Broekhoff, and Kosloff 2006).

C. Baseline setting and rent capture

In order to calculate the amount of carbon crediting, a CDM project needs to set a baseline, i.e. a reference scenario representing the most probable amount of GHG emissions that would have occurred in the absence of a project. The basis for baseline calculation is laid out in the methodology used by the project. In order to streamline baseline selection and additionality demonstration processes the Executive Board developed a "combined tool" (Appendix 2), which is a slightly modified tool for demonstrating additionality. As stipulated by the Marrakech Accords, project participants shall select the baseline methodology based on the most appropriate of three possible approaches (UNFCCC 2002):

- existing actual or historical emissions, as applicable;
- emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
- average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20% of their category.

Thus, similarly to the additionality test, a potential problem with setting the exact emissions reduction baseline stems from the fact that one of the three alternatives requires assuming a hypothetical scenario that could never be verified in the real world. The baselines are set on a project-by-project basis, further aggravating inconsistencies. The Executive Board has already implemented some measures to address this issue, for example by developing a tool to determine GHG intensity of the electricity grid across methodologies (Ruthner et al. 2011). This is especially important for transparent calculation of emissions reductions for greenfield renewable energy projects.

Moreover, the development of country-wide standardized baselines has been discussed since COP11 in Montreal. COP16 in Cancun provided for a possibility for host countries' DNAs to submit standardized baselines concerning all or part of the country for consideration by the Executive Board (UNFCCC 2011b). In its report the COP referred to the fact that standardization was already applied in some approved methodologies. Indeed, several methodologies applied performance benchmarks – the third approach – that defined the baseline as the average of the top X% of installations in a given sector. This approach is employed by several methodologies such as refrigerating appliances (AM0070), super-critical coal (AM0013) and cement (ACM0005 and NM0302) (Füssler 2012), with a benchmark value that varies between the methodologies. Thus, it can be concluded that this element of the CDM reform was spurred bottom-up.

Following the decisions of COP16, the Executive Board adopted the Guidelines for the Establishment of Sector Specific Standardized Baselines (EB62), streamlining the procedure for submitting and using standardized baselines. Practical aspects of this procedure were further elaborated in the Guidelines for Quality Assurance and Quality Control of Data Used in the Establishment of Standardized Baselines at the EB66 in February 2012. The effectiveness of this initiative on the actual use of standardized baselines cannot yet be assessed.

Rent capture in industrial gas projects

The difference between a project's emissions and the baseline defines the amount of emissions reductions that can be credited with CERs. The case of HFC-23 destruction projects shows that baseline setting requires special attention in the CDM.

HFC-23, or trifluoromethane, is a highly potent GHG with a warming potential 11 700 times higher than CO_2. It gets emitted during the production of HCFC-22, another gas that is in turn used in refrigerants and as a chemical feedstock for manufacturing synthetic polymers (Wara and Victor 2008). The Montreal Protocol[22] mandates the gradual phasing-out of HCFC-22 use for refrigerants by 2040, whereas the production for feedstock purposes is not regulated. 84% of global HCFC-22 production in 2010 took place in China and India (UNEP 2012), explaining the large HFC-23 emissions reduction potential in these countries and the concentration of such projects in these two countries.

The HFC-23 destruction projects quickly became one of the largest project types under the CDM in terms of emissions reductions (Figure 12). The abatement cost in this type of projects is very low and the revenues generated from the sale of CERs might easily exceed those from the sale of HCFC-22 itself (Schneider 2011). This situation creates a risk of strategic behavior, i.e. artificially increasing the

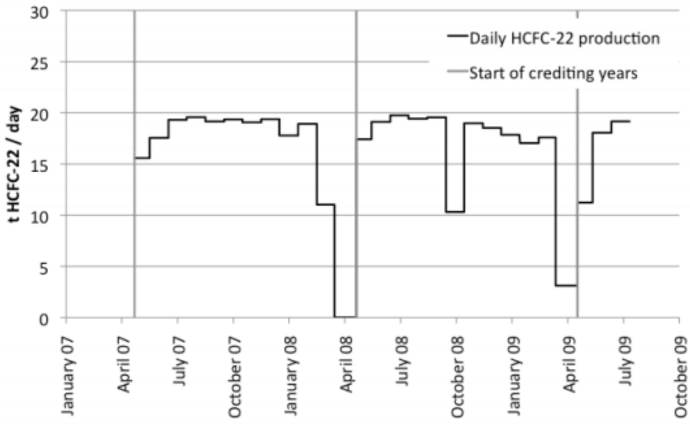
[22] The Montreal Protocol (1987) regulates substances that deplete the ozone layer.

production of HCFC-22 or even artificially increasing the HFC-23/HCFC-22 ratio[23]. As it became aware of it, the CDM EB addressed this risk in the methodology through three limitations:

- the HFC-23/HCFC-22 ratio is capped by the minimum of the lowest historical annual ratio in 2000-2004 and 3%. If no historical data is available, a default ratio of 1.5% shall be used;
- the amount of HCFC-22 production eligible for CER crediting is limited to the maximum historical level in 2000-2004;
- only existing HCFC-22 production facilities are eligible under the CDM.[24]

These measures, however, did not to live up to their expectations: around half of the projects seem to be behaving strategically by producing the exact amount of HCFC-22 eligible for crediting (Schneider 2011) – not more and not less. The production data also shows that some installations produced the maximum amount of HCFC-22 eligible for crediting, while considerably reducing or even halting production when the limit was reached and then restarting it right at the beginning of the following crediting year (Figure 14). This means that the production volumes were probably driven by the incentive to monetize CERs rather than the demand for the main product. This is an indication that a perverse incentive to produce more HCFC-22 than necessary, simply in order to destroy the by-product and claim carbon credits, could not be prevented by the methodology.

Figure 14 – Daily HCFC-22 production (project 767)



Source: Schneider (2011).

The same pattern can be observed, for example, in the project 1194. The installation was shut down for one month just before the end of the crediting year in September as the exact amount of HCFC-22 eligible for crediting in that period was produced. The fact that installations stopped the production just before the end of the crediting year (e.g. April and August in the case of projects 767 and 1194 respectively) disqualifies the seasonal explanation to this phenomenon.

Schneider (2011) also analyzed 163 monitoring reports and found that in 2 cases no CERs were issued for the whole monitoring period since the maximum amount of HCFC-22 eligible for crediting had been reached. In both cases (projects 1105 and 151) the HFC-23/HCFC-22 ratio was considerably decreased during these period while returning to the level above the crediting threshold just after the beginning of the following crediting year. This is another indication that the strategic behavior likely occurred and that the CDM methodology was unable to prevent some installations to operate under a higher HFC-23/HCFC-22 ratio than in the absence of the project.

The Executive Board responded by further tightening the baseline methodology. The cap on the amount of HCFC-22 production eligible for crediting was decreased from the historical maximum to the historical average while the maximum HFC-23/HCFC-22 ratio was decreased from 3% to 1% thus considerably

[23] The amount the HFC-23 produced depends on many factors including temperature, pressure, feed rates, catalyst concentration and catalyst deactivation as well as the optimization of the production process (Irving and Branscombe 2002).

[24] In order to be eligible for the CDM an installation should have been operating for at least 3 years between 2000 and 2004 and should have been operating since 2005 to the start of the project activity.

reducing the amount of emissions reductions eligible for crediting. As of March 2012 all requests for issuance undergo review, since the methodology clarification requires DOEs to check that the equipment was not changed to alter the HFC-23/HCFC-22 ratio (GIZ 2012).

Besides providing perverse incentives, HFC-23 destruction projects are an example of overpayment for GHG abatement. Wara and Victor (2008) have estimated that the payments in the form of carbon credits will total 4.7 billion euros for these projects while the costs of abatement are probably below 100 million euros. Market prices provide further evidence to this overpayment: the market price for HCFC-22 in China dropped considerably since the launch of the CDM to its historical low in 2008 while the prices for raw materials – chloroform and hydrogen fluoride – increased. Under this combination of input vs. output prices, some plants reported that the production would not be profitable on the sole basis of HCFC-22 sales (Schneider 2011).

Another measure to reduce windfall profits along with tightening the baselines was undertaken by the Chinese government that applied a 65% tax on revenues from the sale of CERs from this type of projects. It can be noted that this move does not seem to have deterred project developers, and that it introduces the government as one of the beneficiaries of the project, similarly to “rent sharing” in JI (Shishlov et al. 2012).

An alternative method to curb HFC-23 emissions could be for example the use of a special fund under the Montreal Protocol or direct sectoral/policy crediting. One must be reminded however that these alternative methods would probably not have emerged in the absence of the CDM, as few people anticipated the abatement potential in this sector back in 2001.

Hence, the case of HFC-23 destruction projects is an example of the “search engine” function of the CDM – that is identifying low cost abatement opportunities. It also demonstrates that the baseline stringency is an important tool to ensure the economic efficiency and, in this specific case, even the environmental integrity of the CDM. In general, more ambitious baselines can be used as an “insurance” against non-additional projects as well as a means to reduce windfall profits.

D. *Moving beyond pure offsetting*

As it was shown on the example of HFC-23 destruction projects, too lenient a baseline might result in non-additional emissions reductions being credited with CERs. Conversely, an overly-stringent baseline, i.e. a baseline considerably lower than the actual business-as-usual (BAU) emissions, might result in additional emissions reductions without carbon crediting. It was already demonstrated on the example of JI projects in the fertilizer industry that depending on the baseline stringency, the abatement “rent” can be shared between the project developer and the government (Shishlov et al. 2012): emissions reductions below business-as-usual and above the baseline make up the rent of the government while emissions reduction below the baseline constitute the rent of the project developer. In the case of the CDM however, host countries do not have quantified emissions reduction targets under the Kyoto Protocol, therefore the baseline stringency defines how the abatement “rent” is shared between the project developer and the environment: non-credited emissions reductions below business-as-usual and above a stringent baseline make up a rent for the environment.

This concept, sometimes referred to as “super additionality” (Bento et al. 2012) is presented on Figure 15. If an installation’s BAU emissions are below the baseline (too lenient a baseline), a project might continue operating without change while claiming non-additional credits or mitigate emissions and claim both additional and non-additional emissions reductions. In both cases the global emissions will increase, since non-additional credits will be used to offset emissions elsewhere. Conversely, if the BAU emissions are above the baseline, the installations that decide to mitigate their emissions will produce a number of net emissions reductions thus moving beyond pure offsetting.

Figure 15 – Project's decision making and its consequences for mitigation

	Baseline>BAU emissions	Baseline=BAU emissions	Baseline<BAU emissions
Emissions reductions	Non-additional and additional	Additional	Additional and super-additional
GHG in the atmosphere	Increase	Stable	Decrease

Source: adapted from Bento et al.(2012).

It is worth noting that due to the hypothetical nature of additionality, the case when BAU emissions equal the baseline is rather unlikely to occur. Thus setting the emissions reductions baseline is not a question of finding 100% precise values, but rather a question of finding the right balance between non-additional and net emissions reductions. Standardized baselines that rely on performance benchmarks are one of the means to achieve such a balance and spur net emissions reductions in the case of underperforming installations. The performance benchmarking approach is already used to calculate the free allocation of allowances in Phase III (2013-2020) of the EU ETS and it is also being incorporated in the CDM, as explained earlier.

IV. Contribution of the CDM to sustainable development

A. *Sustainable development and the sovereignty principle*

The goal of the CDM is threefold: 1) to assist Annex I countries in achieving compliance with their emissions reduction targets, 2) to reduce the cost of compliance and 3) to assist non-Annex I parties in achieving sustainable development (Kyoto Protocol 1997).

On the one hand, developing countries are currently producing more than half of the global GHG emissions and their share is constantly growing (IPCC 2007). Therefore, their participation in tackling climate change on a global level is crucial. On the other hand, non-Annex I parties face primary development challenges: securing food and water supply, alleviating poverty, putting in place infrastructure etc. Therefore, involving these countries in GHG abatement requires integration of the development dimension into the CDM. The reality, however, proved to be more complicated, as the questions with regards to sustainable development definition, judgment and measurement arose.

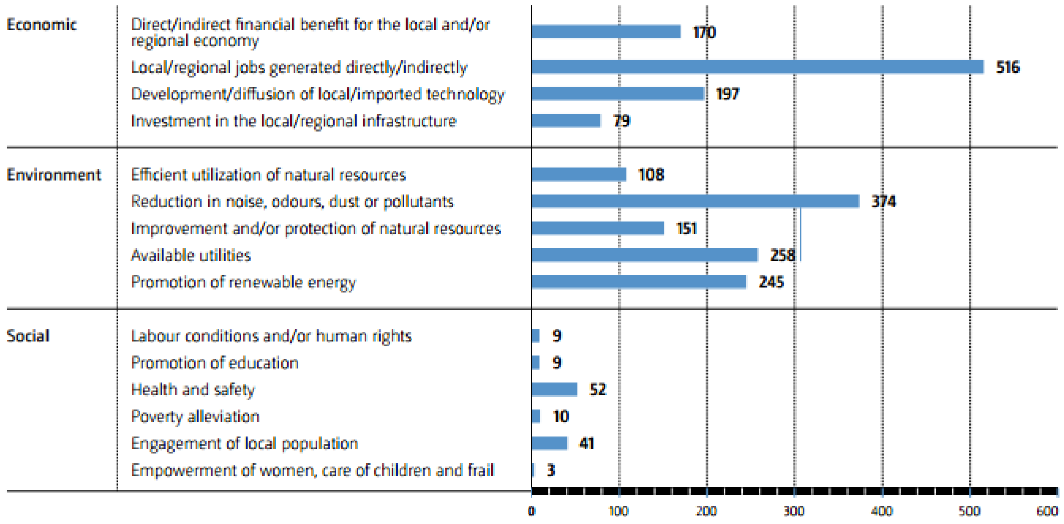
The most common definition of sustainable development appeared in the Brundtland Report in 1987: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland 1987). Sustainable development incorporates three key dimensions:

- *Economic* – a project contributes to the economic development, provides technology transfer, improves the balance of payments etc.
- *Environmental* – a project reduces GHG emissions and local pollution, decreases pressures on local environment, contributes to biodiversity preservation etc.
- *Social* – a project contributes to poverty alleviation, improving health conditions, protection of human rights etc.

The assessment of sustainability criteria under the CDM is a responsibility of a host country's DNA that has to include a confirmation that a project contributes to sustainable development in its letter of approval. This reflects the sovereignty principle thereby host countries should be independent in prioritizing their own development needs.

UNFCCC (2011a) empirically derives 15 main indicators of sustainable development. In its analysis of 2 250 registered CDM projects, the authors attempted to quantify the contribution to sustainable development according to each of these indicators (Figure 16). Each project claiming sustainable development benefits was attributed with up to four indicators.

Figure 16 – Number of sustainable development claims



Source: UNFCCC (2011a).

The results of this exercise highlight that the social dimension of sustainable development has remained underrepresented in the CDM. One has to note, however, that such an evaluation largely depends on the way the indicators are categorized. For example, Olsen and Fenhann (2008) included the job creation – the most often claimed benefit – into the social category, which rebalances the distribution of impacts across the three dimensions.

In general the evaluations of sustainability performance of the CDM are mixed. For example, the UNFCCC concluded that "there is evidence to suggest that CDM projects are indeed making a contribution to sustainable development over and above the mitigation of GHG emissions in the host country" (UNFCCC 2011a). The World Bank (2010) presents similarly positive conclusions particularly underlying the CDM's contribution to technology transfer. At the same time some other studies concluded that "the CDM in its current form has not realized sustainable development benefits envisaged in its creation" (Boyd et al. 2009) and that it "does not significantly contribute to sustainable development" (Olsen and Fenhann 2008). It is acknowledged that most CDM projects are able to claim at least some side-benefits of their GHG mitigation activities, but the lack of common sustainability criteria and monitoring requirements makes it difficult to do an ex-post evaluation of their performance. For example, a study of 44 projects of the Dutch CDM portfolio (Gupta et al. 2008) concluded that those benefits that are directly related to the GHG emissions reduction (e.g. technology transfer) are usually achieved. At the same time indirect benefits, such as retrofitting a nearby park under a landfill gas project, are generally not monitored properly and non-fulfillment of such contributions does not affect a project as long as emissions reductions are achieved according to the plan.

B. Technology transfer in the CDM largely depends on the country and the sector

Technology transfer is often quoted as one of the key side benefits of the CDM. Indeed, some countries explicitly require technology transfer as one of the prerequisites of a CDM project approval (UNFCCC 2011a). Although the PDD specifically requires the project developer to describe how a project will contribute to technology transfer, there is no clear definition of this term.

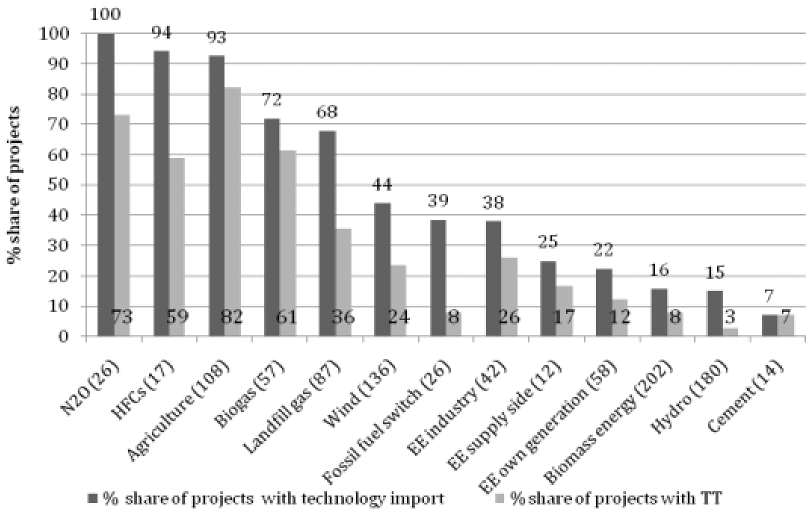
Das (2011) attempted to provide a definition for technology transfer based on capacity building concept and to distinguish between technology transfer and simple technology import. Technology transfer is deemed to take place if one of the three cases:

- a technology is developed specifically for a CDM project by a host country in collaboration with a foreign partner;
- a technology import is followed by adapting or improving this technology according to local conditions by a host country;

- a technology import is accompanied by trainings on operation and maintenance of the equipment.

The study of 1 000 CDM projects found out that technology transfer largely depends on the type of a project (Figure 17).

Figure 17 – Technology import and technology transfer by project type



Source: Das (2011).

Similar results were obtained in UNFCCC (2011a), which found that the highest rates of technology transfer are demonstrated by industrial gas (over 90%) and methane avoidance (about 85%) projects, while renewable energy projects demonstrate the lowest rate (around 20%).

Both studies also identified considerable variations in the rate of technology transfer depending on the country. More advanced developing economies such as China, India and Brazil require foreign technologies to a lesser extent than less developed countries. Besides, countries like China host an increasing number of unilateral projects – projects without any foreign participants (except the credit buyer) – which are *de facto* unlikely to involve technology transfer. Indeed, Das (2011) identified that the larger the role played by foreign participants, the more likely technology transfer is to occur: only 14% of unilateral projects involved technology transfer, while in bilateral and multilateral projects it appeared in 37% of cases (Appendix 6). This fits with the finding that technology transfer decreased overtime as the countries built their own capacities (UNFCCC 2011a), while the number of unilateral projects grew.

C. The CDM in LDCs: few emissions reductions, large development potential

There is an ongoing discussion regarding the lack of participation of LDCs to the CDM with several possible solutions being put forward such as preferential treatment, import quotas, country eligibility screening and CER discounting (Bakker et al. 2011). CER discounting is thought to be useful in pushing more advanced developing countries to move to a more ambitious abatement action, although not really helping improve the attractiveness of LDCs for the investors (Castro and Michaelowa 2010). Some argue that the CDM is inherently not suitable for the LDCs, and that these countries have to resort to other instruments such as for example the Global Environment Facility (Flues 2010).

Three important reforms aiming at increased participation of the LDCs in the CDM were introduced:

- *Programme of Activity* (PoA), introduced in 2009, is a framework that allows implementing an unlimited number of CDM programme activities (CPAs) under one registered PoA. This modality enables the use of small-scale methodologies that are not available in the regular CDM. Small-scale replicable projects (often with scattered emissions) under PoA also benefit from reduced transaction costs, which makes them more attractive for investors. PoAs are meant to cater for small and diffuse sources of emissions, and are therefore often seen as a means to enhance the involvement of LDCs in the CDM and promote sustainable development. As of September 1st, 2012, there were 30 registered PoAs, mainly focused on household energy efficiency and small-scale renewables (UNEP Risoe 2012). A typical example of a PoA is the distribution of more efficient cookstoves in African countries. Although limited in terms of GHG emissions reductions – the average registered PoA produces around 180 ktCO_2e of emissions reductions annually – such PoAs have far-reaching social impacts on the local communities such as improving health conditions, contributing to education by reducing the amount of child labor or slowing down deforestation rates. Unlike individual CDM projects with a fixed perimeter, PoAs may have wider reach allowing them to tap into emissions reductions of whole sectors, even dispersed ones. A good example of a large-scale PoA is the Sichuan Rural Poor-Household Biogas Development PoA in China that was registered in June 2012. This PoA is focused on deploying efficient biogas digesters in up to one million farm households in the least-developed rural areas. The emissions reduction potential of this PoA is 20 million tCO_2e over the lifetime of 28 years.

- *Suppressed demand* guidelines allow incorporating a scenario of increasing emissions in the baseline. Addressing such situations is especially important for LDCs, where the demand for GHG emitting services, e.g. energy, is not met. Suppressed demand guidelines provide for a possibility to incorporate the “minimum service level” in the baseline scenario, i.e. a baseline when the minimum human needs, such as energy for lighting, cooking and water supply, are satisfied. The project then provides a low emitting technology which “reduces” the emissions that would have occurred in a world where the “minimum service level” would have been provided through classical GHG emitting technology.
- *Interest-free loan scheme* that was announced at the Carbon Forum in Ethiopia in April 2012. The scheme is managed jointly by the UNFCCC, the United Nations Environment Programme (UNEP) Risoe Centre and the United Nations Office for Project Services (UNOPS) and provides loans to finance the early stages of project development in LDCs and countries with less than 10 CDM projects registered.

On the demand side the EU is also tackling the issue of the LDCs’ underrepresentation, having banned the use of CERs originating from CDM projects registered after 2012 in countries other than LDCs. Note that this decision is unlikely to have an effect as the import limit will be reached soon after 2012 (Bellassen, Stephan, and Leguet 2012).

D. Adverse impacts to local communities in hydro projects

One of the most controversial project types under the CDM is large hydro. Besides the criticism regarding the additionality of these projects that was discussed earlier, many large hydro projects were reported to negatively affect local communities and even sometimes violate human rights.

One of the most striking examples is the Barro Blanco Hydroelectric Power Plant Project (3237) in Panama. This project is a new version of the project Tabasara I, which was proposed several times in different versions since 1980s and always triggered protests amongst local communities (Sogandares 2011). The water reservoir of the Barro Blanco dam will directly affect several towns and livelihoods of 5 000 indigenous Ngöbe and Buglé people (CDM Watch 2012). The project developer failed to consult local indigenous population during the site visits, while the comments submitted by Ngöbe Buglé community were neither published on the UNFCCC website nor taken into account by the DOE during the validation of the project (Amicucci et al. 2011). Despite the fact that the project is heavily contested by NGOs such as CDM Watch, International Rivers as well as local environmental groups and indigenous communities, it was registered under the CDM after a review by the Executive Board in 2011. This led to a wave of protests that culminated in violent clashes with the police that left three people dead in early 2012 (Helmore 2012). In its film about Barro Blanco project, Al Jazeera interviewed a top official in the government of Panama, who underlined the importance of hydroelectric energy for Panama’s booming economy and stated that nothing could stop the project (Elis 2012).

The case of Barro Blanco illustrates a disfunctionning stakeholder consultation, which is mandatory for CDM projects. However, even if the consultation had been held correctly, the current system of sustainability assessment by the DNAs of host countries is not designed to guarantee the protection of the rights of indigenous people. Although very few cases of human rights violations have been reported, hydro projects with adverse impacts for local communities may not be exceptional. For example, Haya and Parekh (2011) identified 6 hydro projects with considerable adverse impacts that were registered under the CDM. Although it does not provide enough evidence for generalization about all hydro projects in the CDM, these examples raise concerns over the human rights protection. Lack of proper stakeholder consultation and potential conflicts of interest in the project approval process are the main issues that require further investigation.

It is worth noting that the EU takes measures to address this problem on the demand side: the European countries can issue LoAs only to those large hydro projects (over 20 MW of installed capacity) that comply with international environmental and social regulations under the World Commission on Dams (WCD).

In general, the transparency of the mechanism strongly increases the reputation risk borne by investors in CDM projects compared to other types of investments. For example, after a case of human rights violation was reported by CDM Watch in the Aguan biogas project in Honduras, EDF Trading, the main investor, backed out of the project within a few days.

E. A potential trade-off between GHG abatement and sustainable development

A study on the integrity of the CDM (Ruthner et al. 2011) confirms that the existing system of sustainable development assessment is perfectible as the DNA's approval does not always rely upon rigorous evaluation. Three main reasons for this can be identified:

- *lack of guidelines for sustainability assessment*. There are no clear procedures outlining how exactly the assessment should be conducted by a DNA. As a result there is no proof that the assessment takes place at all prior to the issuance of the LoA. According to one study no projects have been rejected due to sustainable development criteria (Ruthner et al. 2011).
- *lack of monitoring and enforcement*. There are no international procedures at the level of the CDM Executive Board for ex-ante and ex-post monitoring of sustainability criteria, as determination whether a CDM project contributes to sustainable development in a host country is the prerogative of the host country itself. Therefore there are no enforcement mechanisms under the CDM Executive Board that ensure that no environmental or social damage is done after a project is registered.
- *trade-off between national development and local impacts*. Governments of the host countries might prioritize national development over the well-being of local communities.

These issues are a consequence of the sovereignty principle of sustainability assessment: when green development interferes with the well-being of local communities, countries are and wish to keep being sovereign in the balance they strike.

The lack of sustainable development criteria triggered the emergence of labeling initiatives, such as the Gold Standard that apply additional "screening" for sustainability. Besides that, the Gold Standard requires a periodic monitoring of the fulfillment of sustainability contributions claimed in the PDD (UNFCCC 2011a). Ex-post comparison of selected Gold Standard projects to a "representative portfolio" of non-Gold Standard CDM projects confirmed that labeled projects are associated with higher local benefits. However, the comparison of projects of similar types remains inconclusive (Drupp 2011). This proves that certain project types, such as for example landfill gas capture, naturally provide more local benefits than others. Hence, similarly to technology transfer, the contribution of a given project to broader sustainable development goals largely depends on its type.

Different alternatives with regards to sustainable development in the post-2012 CDM framework have been proposed:

- *Minimal global standards for sustainability*. This approach is already being practiced by carbon offset labels such as the Gold Standard. Minimal requirements could be ensured at the international level and might include among others local employment generation, improving infrastructure or local tax revenues. The Gold Standard also provides an example of a more robust procedure for stakeholder consultation that could be implemented under the CDM.

- *A global flexible checklist*. This method is rather similar to minimal global standards with the exception that countries would be free to add/waive certain requirements based on their local context.
- *CER discounting/multiplication*. This approach, discussed by several authors (Boyd et al. 2009; Castro and Michaelowa 2010; Bakker et al. 2011) is attractive because it adds a strong economic incentive to apply higher sustainable development standards. Nevertheless, this might result in severe market distortions and some abatement opportunities might be lost thus hampering the primary goal of the CDM.
- *Global point system*. A standardized assessment system would create an objective way to compare projects based on their sustainable development impact. A certain threshold can be established to ensure the fulfillment of minimal requirements. This method is also attractive from the economic perspective as it allows markets to “price” sustainability in a transparent way. To a certain extent, it already works in practice, as the price for premium voluntary credits sometimes exceeds the price for usual CERs (Boyd et al. 2009).

In principle, pursuing two different goals simultaneously – GHG mitigation at the least possible cost and contribution to the other aspects of sustainable development – supposes that a balance between the two should be stroke. It is impossible to attain both objectives at the same time across the whole CDM pipeline, since the nature of the projects varies greatly. For instance, industrial gas destruction projects provide for a large potential for additional emissions reductions (provided that strategic behavior is averted as discussed earlier), but yield little sustainable development benefits. Conversely, projects focused on rural development in Sub-Saharan Africa, e.g. efficient cook stoves distribution, contribute considerably to local development including employment, health, education and local environment, but their mitigation effect is marginal on a global scale.

Alexeew et al. (2010) demonstrated that there is also a potential trade-off between additionality and sustainability contribution in the CDM. In their study of 40 registered CDM projects in India the authors concluded that such projects as wind, hydro and biomass energy produce considerable sustainable development benefits, but their additionality is questionable. At the same time projects focused on the industrial gas destruction are clearly additional, while their contribution to sustainable development is very limited (Alexeew et al. 2010). In this light, imposing similar sustainability requirements to all sectors might distort the GHG abatement contribution of the CDM.

CONCLUSION: 10 KEY LESSONS

COP16 in Cancun established principles for the new market mechanisms. These principles include inter alia: stimulation of emissions reductions across broad segments of the economy, safeguarding environmental integrity and ensuring a net decrease and/or avoidance of global GHG emissions (UNFCCC 2011b). Being the first and the largest carbon offsetting instrument in the world, the CDM provides valuable insights into implementation of these principles in practice.

This Climate Report derives 10 key lessons from 10 years of experience with the CDM:

- The transparency of the framework has allowed identifying loopholes and spur reforms that have been ongoing since the inception of the CDM. The present reforms are leaning towards the standardization of additionality demonstration and baseline setting as well as streamlining the procedures and giving more opportunities to underrepresented countries and sectors.
- In practice, it is virtually impossible to ensure additionality in 100% of the cases. The natural contradiction between strict additionality and not impeding new environmental policies at the national level partly explains this. The higher transaction costs which come together with a stringent case-by-case scrutiny are another explanation.
- More stringent baselines and performance benchmarks can help ensure net emissions reductions that could compensate for non-additional projects that manage to slip through validation.
- Some project types offer extremely high returns on investment which may encourage strategic behavior and rent seeking. This can be addressed through scrutinizing production technologies and introducing stringent benchmarks and/or crediting limits.
- The examples of renewable energy and industrial gas projects illustrate the “search function” of the CDM: its “bottom-up”, project-based features are well suited to identify new abatement options, but less adapted to scale-up to economy-wide changes.
- The development of PoAs as well as new sectoral crediting mechanisms that avoid project by project additionality demonstration may help achieve wider coverage. Positive lists and standardized baselines which are already being implemented within the CDM provide a good basis for further standardization, and hence scaling-up of the mechanism. Standardization also contributes to limiting the “judgment element” in project assessment.
- Both supply and demand for CERs are largely privatized. The ability of the CDM to attract billions of euros of private capital on an annual basis is an unprecedented and non-anticipated feat. In emerging economies like China, this private investment is increasingly domestic through unilateral projects.
- This privatization was largely achieved thanks to the EU ETS which provided a large and reliable source of demand for CERs. This source of demand is fading due to at least three main issues: oversupply of the EU ETS, “supplementarity principle” and the competitiveness issue raised by the fact that CER revenues partly go to exporting industries in emerging nations.
- Both supply and demand for CERs are largely concentrated. It is a natural outcome of the framework and the structure of the economies and was forecast ex-ante. With the quantitative restrictions in the EU ETS, the demand for CDM offsets from projects registered after 2012 will likely dwindle to a few public buyers, dwarfed by the size of supply.
- The existing system of sustainability assessment places the principle of national sovereignty on top, as the CDM is part of the development strategy of host countries. Therefore, there are no standardized criteria and monitoring methods. In some cases there may be a trade-off between the GHG emissions reduction and contribution to sustainable development in the CDM.

BIBLIOGRAPHY

Alexeew, J., L. Bergset, K. Meyer, J. Petersen, L. Schneider, and C. Unger. 2010. “An Analysis of the Relationship Between the Additionality of CDM Projects and Their Contribution to Sustainable Development.” International Environmental Agreements: Politics, Law and Economics 10 (3): 233–248.

Amicucci, C., D. Stoyanova, I. Apostol, and T. Maisano. 2011. EIB Investments in Panama and Their Impacts on Indigenous Communities Workers and the Environment. Counter Balance.

Bakker, S., C. Haug, H. Van Asselt, J. Gupta, and R. Saidi. 2011. “The Future of the CDM: Same Same, but Differentiated?” Climate Policy 11 (1): 752–767.

Bellassen, V., N. Stephan, and B. Leguet. 2012. Will There Still Be a Market Price for CERs and ERUs in Two Years Time? Climate Brief #13. CDC Climat.

Bento, A., R. Kanbur, and B. Leard. 2012. Super-Additionality: A Neglected Force in Markets for Carbon Offsets. Discussion Paper. CEPR.

Boyd, E., N. Hultman, J. Timmons Roberts, E. Corbera, J. Cole, A. Bozmoski, J. Ebeling, et al. 2009. “Reforming the CDM for Sustainable Development: Lessons Learned and Policy Futures.” Environmental Science & Policy 12 (7): 820–831.

Brundtland, G. H. 1987. Our Common Future. World Commission on Environment and Development.

Castro, P. 2012. “Does the CDM Discourage Emission Reduction Targets in Advanced Developing Countries?” Climate Policy 12 (2) (February): 198–218.

Castro, P., and A. Michaelowa. 2010. “The Impact of Discounting Emission Credits on the Competitiveness of Different CDM Host Countries.” Ecological Economics 70 (1) (November): 34–42.

CDM Watch. 2012. UN’s Offsetting Project Barro Blanco Hampers Panama Peace-talks. Press Release.

Cormier, A., and V. Bellassen. 2012. The Risks of CDM Projects: How Did Only 30% of Expected Credits Come Through. Working paper, CDC Climat Research.

Das, K. 2011. Technology Transfer Under the Clean Development Mechanism: An Empirical Study of 1000 CDM Projects. University of East Anglia.

Delbosc, A., N. Stephan, V. Bellassen, A. Cormier, and B. Leguet. 2011. Assessment of Supply-demand Balance for Kyoto Offsets (CERs and ERUs) up to 2020. Working Paper. CDC Climat.

Dinar, A., S.M. Rahman, D. Larson, and P. Ambrosi. 2008. Factors Affecting Levels of International Cooperation in Carbon Abatement Projects. Policy Research Working Paper. World Bank.

Drupp, M. A. 2011. “Does the Gold Standard Label Hold Its Promise in Delivering Higher Sustainable Development Benefits? A Multi-criteria Comparison of CDM Projects.” Energy Policy.

EIA. 2012. “International Energy Statistics.” U.S. Energy Information Administration. http://www.eia.gov/

Elis, G. 2012. Panama: Village of the Damned. Al Jazeera.

Flues, F. 2010. Who Hosts the Clean Development Mechanism?: Determinants of CDM Project Distribution. Working Paper. Center for Comparative and International Studies (ETH Zurich and Univ. of Zurich).

Foucherot, C., and V. Bellassen. 2011. Carbon Offset Projects in the Agricultural Sector. Climate Report, CDC Climat Research.

Füssler, J. 2012. CDM Baseline Approaches for PoA Upscaling and New Market Mechanisms (NMM). KFW BANKENGRUPPE.

GIZ. 2012. “CDM Highlights Newsletter.” Deutsche Gesellschaft Für Internationale Zusammenarbeit (GIZ).

Guigon, P., V. Bellassen, and P. Ambrosi. 2009. Voluntary Carbon Markets: What the Standards Say... Working Paper, Mission Climat. Caisse des Depots.

Gupta, J., P. van Beukering, H. van Asselt, W.P. van der Gaast, and F. de Jong. 2008. Clean and Sustainable? An Evaluation of the Contribution of the Clean Development Mechanism to Sustainable Development in Host Countries. IOB Evaluations.

Haya, B. 2009. Measuring Emissions Against an Alternative Future: Fundamental Flaws in the Structure of the Kyoto Protocol’s Clean Development Mechanism. Working Paper. University of California, Berkeley.

Haya, B., and P. Parekh. 2011. Hydropower in the CDM: Examining Additionality and Criteria for Sustainability. Working Paper, the Energy and Resources Group. University of California, Berkeley.

Helmore, E. 2012. “Panama’s Village Leader Silvia Carrera Defies a President.” The Guardian, February 19, sec. World news. http://www.guardian.co.uk/world/2012/feb/19/panama-protest-silvia-carrera.

IEA. 2011. World Energy Outlook. International Energy Agency.

———. 2012. International Energy Agency Statistics. http://www.iea.org/stats/index.asp.

IPCC. 1995. Climate Change 1995. 2nd Assessment Report.

———. 2007. Climate Change 2007. 4th Assessment Report.

Irving, W. N., and M. Branscombe. 2002. “HFC-23 Emissions from HCFC-22 Production.” In Background Papers–IPCC Expert Meetings on Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 271–283.

Jung, M. 2006. “Host Country Attractiveness for CDM Non-sink Projects.” Energy Policy 34 (15): 2173–2184.

Kyoto Protocol. 1997. “United Nations Framework Convention on Climate Change.”

Lancaster, R. 2012. “Wither the CDM?” Carbon Trading Magazine 1 (4) (May): 10–13.

Lütken, S. 2012. Penny Wise, Pound Foolish? Is the Original Intention of Cost Efficient Emissions Reduction Through the CDM Being Fulfilled? Working Paper. UNEP Risoe.

Mansanet-Bataller, M., J. Chevallier, M. Hervé-Mignucci, and E. Alberola. 2010. The EUA-sCER Spread: Compliance Strategies and Arbitrage in the European Carbon Market. Working Paper. CDC Climat.

Mizuno, Y., K. Koakutsu, K. Iyadomi, N. Okubo, C. Urayama, and K. Takahashi. 2010. Towards CDM Reform. IGES. http://enviroscope.iges.or.jp/modules/envirolib/upload/2798/attach/towards_cdm_reform.pdf.

Morel, R., V. Bellassen, M. Deheza, A. Delbosc, and B. Leguet. 2011. Durban: One Small Promising Step for Climate… by 2020. Climate Brief #10. CDC Climat.

Morel, R., and C. Bordier. 2012. Financing the Transition to a Green Economy: Their Word Is Their (green) Bond? Climate Brief #14. CDC Climat.

Olsen, K. H, and J. Fenhann. 2008. “Sustainable Development Benefits of Clean Development Mechanism Projects: A New Methodology for Sustainability Assessment Based on Text Analysis of the Project Design Documents Submitted for Validation.” Energy Policy 36 (8): 2819–2830.

Peidong, Z., Y. Yanli, Z. Yonghong, W. Lisheng, L. Xinrong, and others. 2009. “Opportunities and Challenges for Renewable Energy Policy in China.” Renewable and Sustainable Energy Reviews 13 (2): 439–449.

Platonova-Oquab, A., and F. Spors. 2012. CDM Reform: Improving the Efficiency and Outreach of the Clean Development Mechanism Through Standardization. World Bank.

Ruthner, L., M. Johnson, B. Chatterjee, M. Lazarus, N. Fujiwara, C. Egenhofer, T. du Monceau, and A. Brohe. 2011. Study on the Integrity of the Clean Development Mechanism (CDM). European Commission.

Schneider, L. 2007. “Is the CDM Fulfilling Its Environmental and Sustainable Development Objectives? An Evaluation of the CDM and Options for Improvement.” Report Prepared for the World Wildlife Foundation. Berlin: Öko-Institut. November.

———. 2009. “Assessing the Additionality of CDM Projects: Practical Experiences and Lessons Learned.” Climate Policy 9 (3) (May 1): 242–254. doi:10.3763/cpol.2008.0533.

———. 2011. “Perverse Incentives Under the CDM: An Evaluation of HFC-23 Destruction Projects.” Climate Policy 11 (2): 851–864.

Shen, W. 2011. Understanding the Dominance of Unilateral CDMs in China: Its Origins and Implications for Governing Carbon Market. Working Paper. Tyndall Centre for Climate Change Research.

Shishlov, I, V. Bellassen, and B. Leguet. 2012. Joint Implementation: a Frontier Mechanism Within the Borders of an Emissions Cap. Climate Report. CDC Climat.

Sogandares, O. 2011. “Massive Protests Against Barro Blanco Hydropower Project in Panama.” CDM Watch.

Sterk, W. 2008. From Clean Development Mechanism to Sectoral Crediting Approaches – Way Forward or Wrong Turn? Policy Paper. Wuppertal Institute for Climate, Environment and Energy.

Trexler, M. C, D. J Broekhoff, and L. H Kosloff. 2006. “A Statistically-driven Approach to Offset-based GHG Additionality Determinations: What Can We Learn?” Sustainable Development Law & Policy 6 (2): 8.

Trotignon, R. 2010. Combining Cap-and-trade with Offsets: Lessons from CER Use in the EU ETS in 2008 and 2009. Climate Economics Chair of Paris-Dauphine University.

UNEP. 2012. “Ozone Depleting Substances Database”. UNEP Ozone Secretariat. http://ozone.unep.org/Data_Reporting/Data_Access/.

UNEP Risoe. 2012. “CDM Pipeline Database.” http://www.cdmpipeline.org/

UNFCCC. 2002. Report of the Conference of the Parties on Its Seventh Session, Held at Marrakesh from 29 October to 10 November 2001. UNFCCC.

———. 2006. Report of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol on Its First Session, Held at Montreal from 28 November to 10 December 2005. UNFCCC.

———. 2011a. Benefits of the Clean Development Mechanism. UNFCCC.

———. 2011b. Report of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol on Its Sixth Session, Held in Cancun from 29 November to 10 December 2010. UNFCCC.

———. 2012. “Official CDM Website.” https://cdm.unfccc.int/

Wang, H., and J. Firestone. 2010. “The Analysis of Country-to-country CDM Permit Trading Using the Gravity Model in International Trade.” Energy for Sustainable Development 14 (1): 6–13.

Wara, M.W., and D.G. Victor. 2008. A Realistic Policy on International Carbon Offsets. Working Paper. PESD.

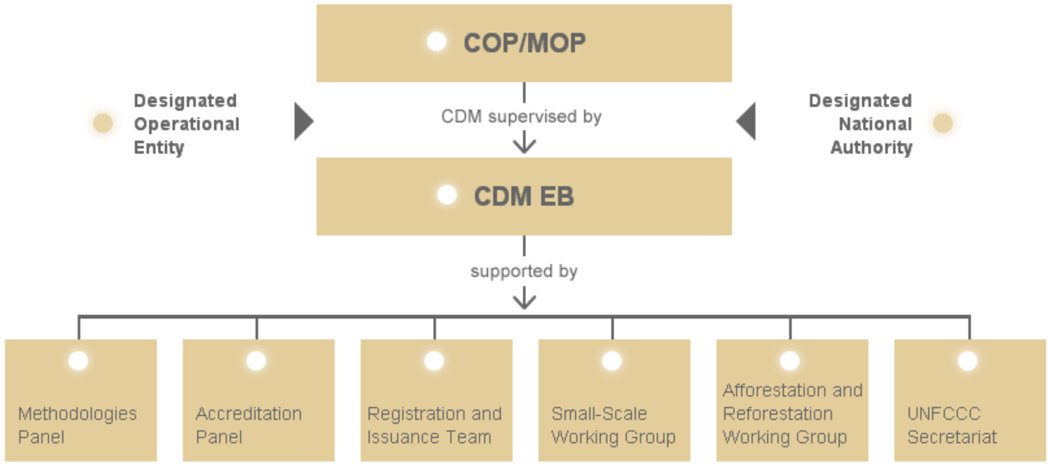
Winkelman, A.G., and M.R. Moore. 2011. “Explaining the Differential Distribution of Clean Development Mechanism Projects Across Host Countries.” Energy Policy 39 (3): 1132–1143.

World Bank. 2010. 10 Years of Experience in Carbon Finance. Report. World Bank.

———. 2012. State and Trends of the Carbon Market. Report. Washington: World Bank.

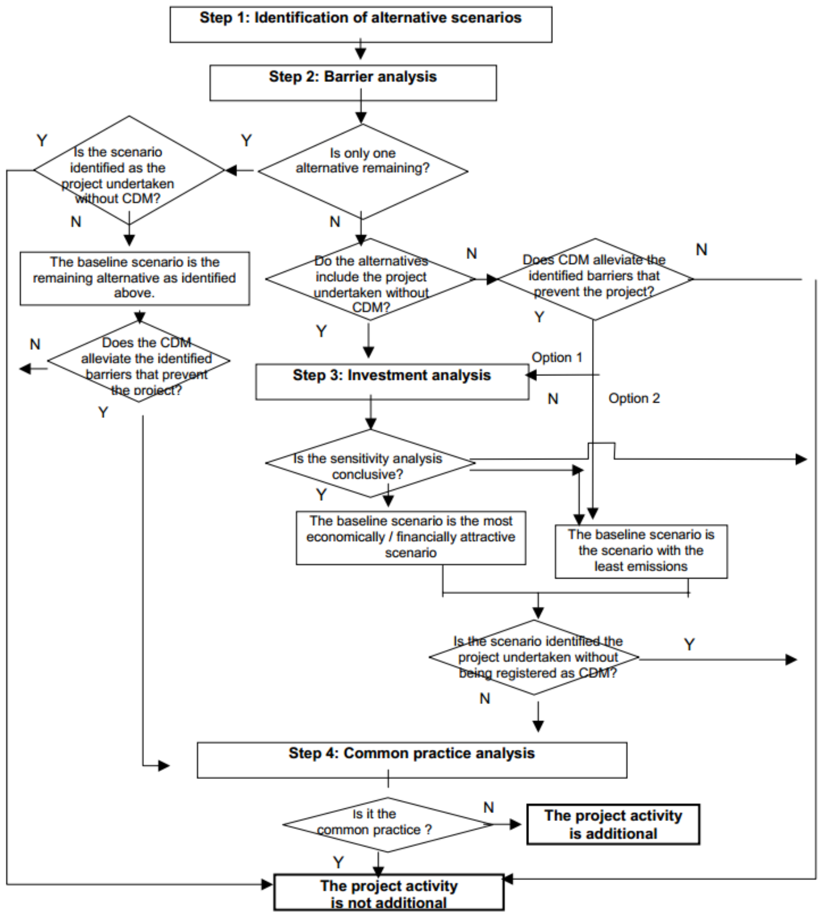
APPENDICES

Appendix 1 – CDM governance structure



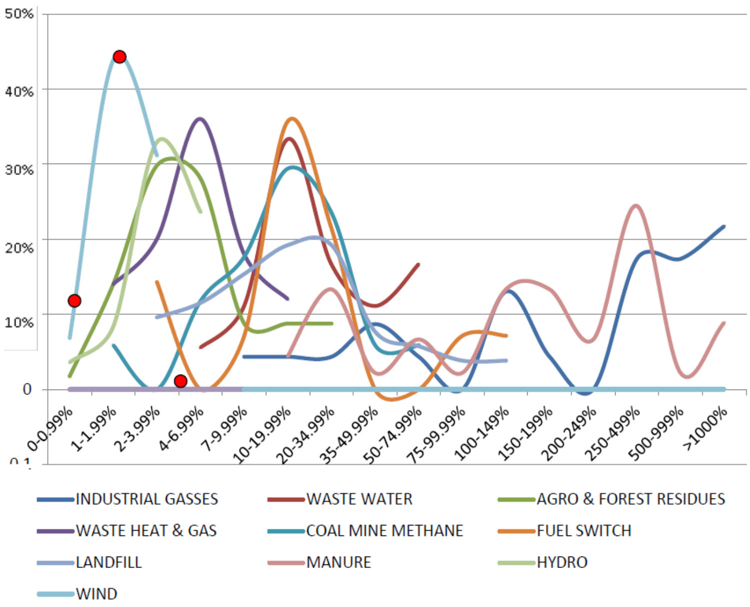
Source: UNFCCC website (2012).

Appendix 2 – Combined baseline selection and additionality demonstration tool



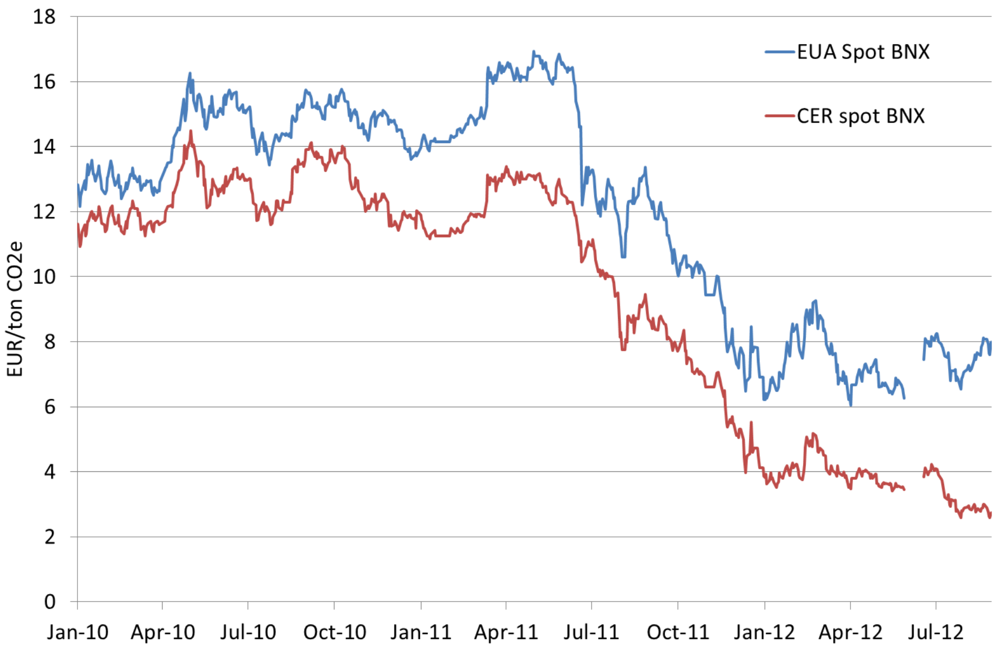
Source: CDM EB 28 Report, Annex 14, UNFCCC website (2012).

Appendix 3 – Annual carbon returns on investments



Source: Lütken (2012).

Appendix 4 – Carbon credits spot price evolution



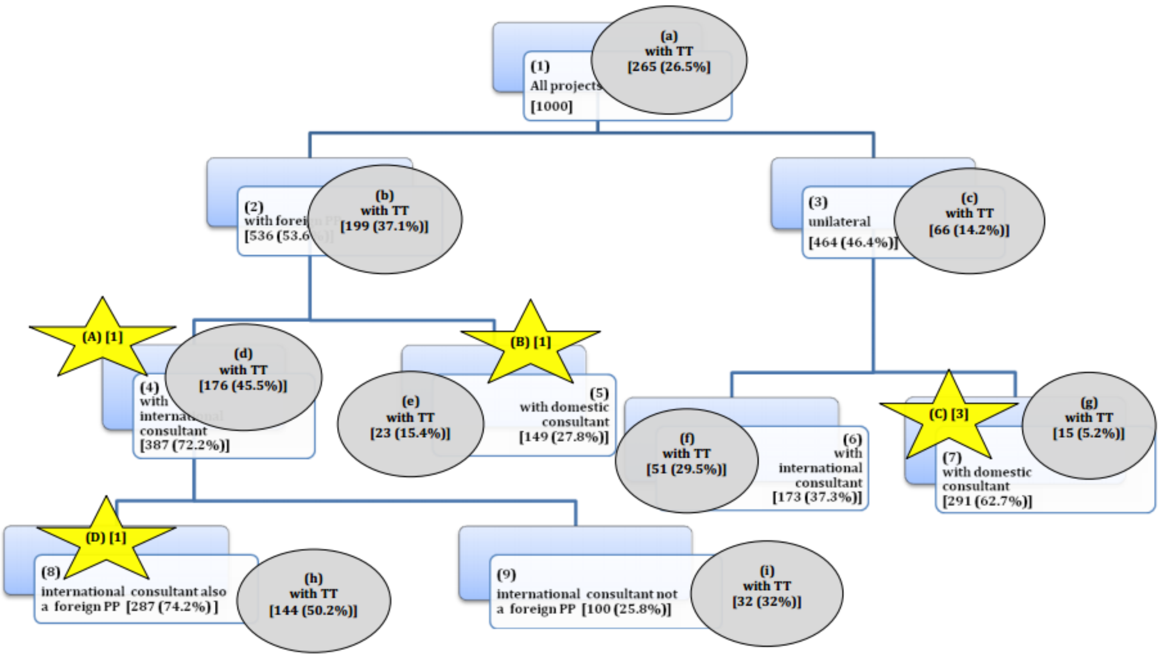
Source: BlueNext (2012).

Appendix 5 – CER/ERU limits in the EU National Allocation Plans in Phase II

Country	Limit for the use of Kyoto credits % of allocation	Annual import limit Mt/yr	Phase 2 import limit Mt
Austria	10,0%	3,1	15,4
Belgium	12,0%	7,0	35,1
Bulgaria	12,6%	5,3	26,6
Cyprus	10,0%	0,6	2,8
Czech Republic	10,0%	8,7	43,4
Denmark	17,0%	4,2	20,8
Estonia	0,0%	0,0	0,0
EU 30	13,5%	284	1420
Finland	10,0%	3,8	18,8
France	13,5%	17,9	89,6
Germany	20,0%	90,4	451,9
Greece	9,0%	6,2	31,1
Hungary	10,0%	2,7	13,5
Iceland			
Ireland	10,0%	2,2	11,2
Italy	15,0%	30,2	151,2
Latvia	10,0%	0,3	1,7
Liechtenstein	8,0%	0,0	0,0
Lithuania	20,0%	1,8	8,8
Luxembourg	10,0%	0,3	1,3
Malta			
Netherlands	10,0%	8,6	42,9
Norway	20,0%	3,0	15,0
Poland	10,0%	20,9	104,3
Portugal	10,0%	3,5	17,4
Romania	10,0%	7,6	38,0
Slovakia	7,0%	2,3	11,4
Slovenia	15,8%	1,3	6,6
Spain	20,0%	30,5	152,3
Sweden	10,0%	2,3	11,4
United Kingdom	8,0%	19,6	98,2
EU 30	**13,5%**	**284**	**1 420**

Source: Trotignon (2010).

Appendix 6 – Technology transfer in CDM projects



Source: Das (2011).

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