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THE APPLICATION OF BARRIER TESTS IN RENEWABLE ENERGY CDM PROJECTS: THE CASE OF BRAZIL

Environmental Sciences Series

Partner University

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PREFACE

Strategies that lead to successful solutions in environmental protection require the co-ordinated implementation of social and technological measures and the integration of ecological, economic and social aspects of sustainability. The interdisciplinary distance learning program Environmental Sciences (infernum) combines these essential competences in environmental science to provide a multidisciplinary approach to acquired knowledge. Organized by the Fraunhofer Academy, the course is jointly offered and supported by the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT in Oberhausen and the FernUniversität in Hagen.

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The application of barrier tests in renewable energy CDM projects: the case of Brazil

Stephan Hild

FRAUNHOFER VERLAG

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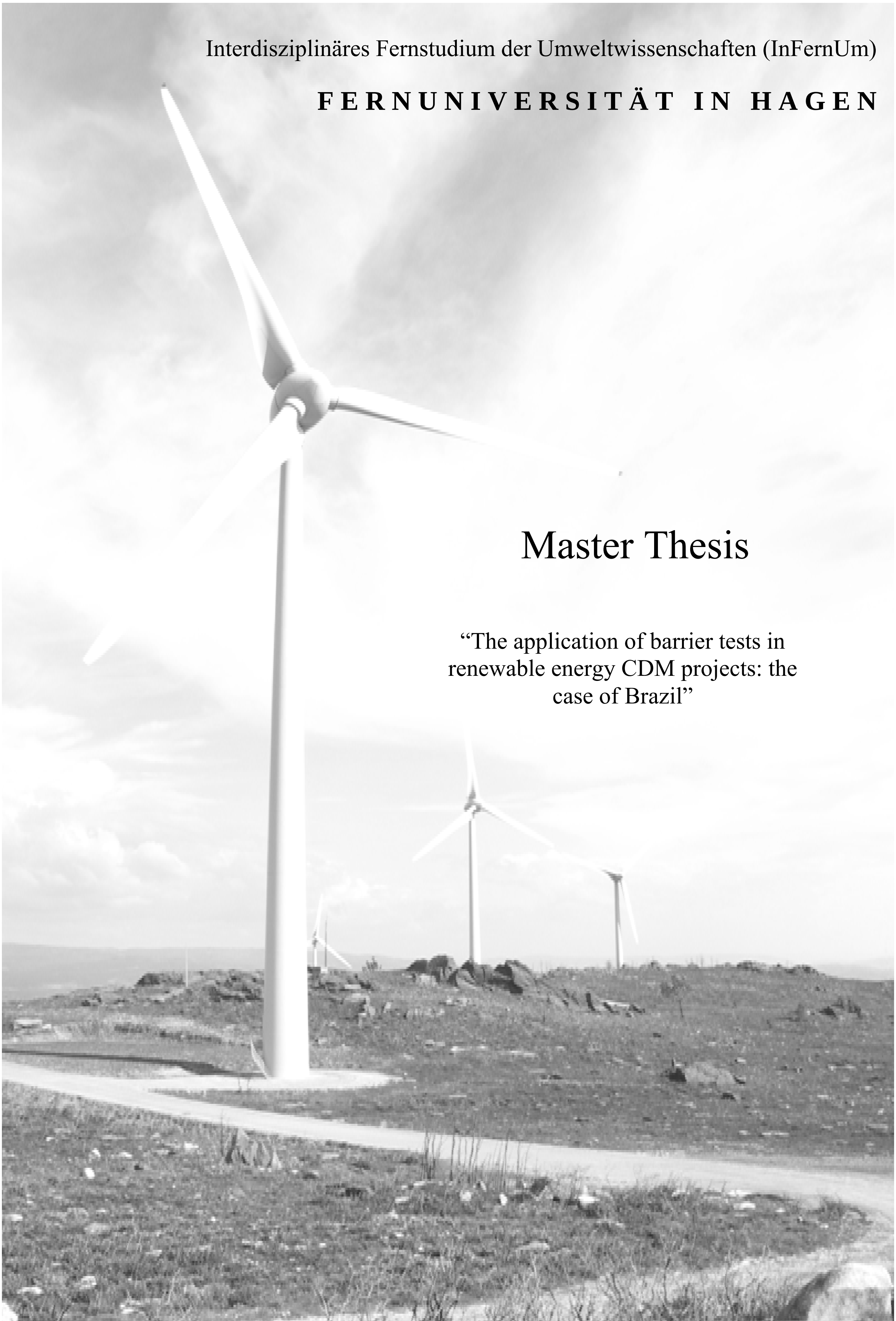
Preface

Dear reader,

The underlying field research for this study ended in November 2007. Two years later, in October 2009, more than 1830 CDM projects have been registered at the UNFCCC, while more than 120 have been rejected, mostly due to lack of proof for additionality.

Trends that became apparent while working on this paper turned manifest in the meantime: Brazil didn’t succeed in keeping up with the dynamic development of the CDM – only 13 further Brazilian renewable energy CDM projects were registered since November 2007. At the same time 5 were either rejected by UNFCCC or withdrawn by the project proponents themselves. As a benchmark: China had over 200 such projects registered in 2009 only! These facts indicate that this paper still is highly relevant. I hope that it contributes to the understanding of climate change projects under Kyoto in general and, in particular, the concept of additionality.

Munich, October 2009



Interdisziplinäres Fernstudium der Umweltwissenschaften (InFernUm)

FERNUNIVERSITÄT IN HAGEN

Master Thesis

"The application of barrier tests in renewable energy CDM projects: the case of Brazil"

Submitted by: Dipl.-Kfm. Stephan Hild

Submitted to: Dr. Axel Michaelowa, Universität Zürich
Dipl.-Ing. Michael Lucht, Fraunhofer UMSICHT

Date of submission: 29 November 2007

The cover photograph was taken by the author and shows
four ENERCON E-70 wind turbines.

This work is dedicated to my beloved family,
Paula, Ursula, Falco and Reinhard.

I feel deeply grateful to my thesis supervisors and examiners Dr. Axel Michaelowa and Dipl.-Ing. Michael Lucht for their valuable guidance, to Dr. Brigitte Biermann and Jenny Tröltzsch of the InFernUm team for the patient support, as well as Prof. Michael Finus for introducing me to the world of environmental economics.

Without my dear Brazilian friend Manuel Augusto Matos da Costa Ramos my research journey to Brazil would not have been possible: obrigado! Very special thanks also to my friend Tarik Al-Koufri for his patient technical support.

I owe a lot to the helpfulness and kindness of Lex de Jonge, Branca Bastos Americano, Karsten Karschunke and Malin Ahlberg, Claudia do Valle Costa and Alexandre D'Avignon, Werner Betzenbichler, Irma Lubrecht, Sandra Greiner and Adriaan Korthuis.

I further feel obliged to the WWF for the support with my interviews and to Ecosecurities for the invitation to the important and marvellous event Rio+15.

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1 Introduction

1.1 Context

The recent publication of the synthesis report (AR4)[1] by the Intergovernmental Panel on Climate Change (IPCC) has made the urgent need for thorough action on climate change ever more apparent. Greenhouse Gas (GHG) emissions have to be brought down substantially over the next decades. However, in the industrialised world, and even more so in the emerging economies of the developing countries, GHG emissions keep on soaring. In the unique challenge of breaking the deadlocked climate diplomacy, in which leading emitters of industrialised countries (e.g. the US) and emerging countries (like China, India or Brazil) confront each other with the pledge for taking the lead, the Kyoto Protocol's Clean Development Mechanism (CDM) is out to play a decisive role.

The CDM belongs to the flexible compliance mechanisms the protocol provides, and is designed to mobilise capital in the industrialised countries for the realisation of emission reducing projects in the developing world. It thus constitutes a part of the transfer of means and technologies from Annex-I to Non-Annex-I[2] countries, as stipulated in the United Nations Framework Convention on Climate Change (UNFCCC). The CDM thereby involves developing countries in the GHG abatement process and contributes to helping them enter a “cleaner“ development path.

At the moment the biggest share of certified emission reductions (CERs) in the CDM accrues from the destruction of industrial gases like HFC or N_2O, as well as Methane capture from landfills and coal mines (Capoor/Ambrosi 2007 and UNEP/RISØ). However, given the predicted growth rates of energy demand in the emerging economies (IEA 2006), a strong focus on the stimulation of renewable energy technologies seems not only appropriate but urgent.

To guarantee the environmental integrity of CDM projects, that is, to make sure that on a global balance GHG emissions do not *rise* due to the CDM, the criterion of additionality was introduced. Analysing the diffusion of renewable energies (RE) by the means of the CDM, its institutional and regulatory elements, such as the operationalisation of the additionality criterion, can be expected to play a decisive role. A central element in the

[1] AR4: fourth assessment report of the IPCC, see http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf .
[2] See footnote 4 of this paper.

assessment of project additionality is the *barrier analysis*, part of the so-called "additionality tool" provided by the CDM executive board.

This paper attempts to assess the impact of the application of this barrier test on the realisation of CDM projects, with special focus on the diffusion of renewable energy technologies in a country that is not only the third largest host country to CDM projects, but also is unique in that it already has one of the cleanest energy matrices in the world: Brazil.

How is the barrier test applied in the Brazilian CDM and how does the actual application influence the development of RE in the country? Is the CDM an appropriate tool for a further diffusion of renewables on a larger scale in Brazil? Is the barrier test a suitable tool to distinguish additional from non-additional projects? And: how additional is the Brazilian CDM portfolio?

1.2 Procedural approach

The paper starts with an introduction to the Clean Development Mechanism, because its theoretical background, its institutional design and its specific presumptions are preliminary for the further argumentation (Chapter 2). One of the CDM's key elements, the additionality criterion and its operationalisation shall be looked at with more depth in the following section (Chapter 3). What is the current state of CDM implementation in Brazil, what country-specific issues exist, what role do renewable energies play in the national CDM portfolio and what are the viewpoints of relevant stakeholders in the Brazilian CDM? In order to set the stage for the empirical analysis, the fourth section tries to provide answers to these questions (Chapter 4). The subsequent empirical section analyses the Brazilian renewable energy CDM projects. Here we look at both, the ones that are already registered, as well as those that are only validated, with respect to the quantitative and qualitative application of the barrier test. The findings will be analysed and preliminary conclusions presented (Chapter 5). In the final conclusion the "pieces" of the findings will be put together in order to provide answers to the above questions. Respective appropriate suggestions will be derived and presented (Chapter 6).

1.3 Methodological approach

The following research is based on the original United Nations documents, as well as on a review of relevant literature. An extensive series of explorative interviews with representatives of all important stakeholder groups[3] was conducted personally by the author in Brazil, the UK, the Netherlands and Germany during September and October 2007. Findings were complemented by e-mail interviews of Brazilian project owners and were used to put the empirical findings into the right context. A brief summary of the interviews, containing the most important areas of consent and dissent that are important for the further argumentation, is presented in section 4.5. For a more comprehensive summary please refer to Appendix G of this paper.

For the empirical section 96 project design documents (PDDs) of Brazilian CDM projects were reviewed and a project database, containing all relevant information, was created. To make the performance of individual projects with respect to the quality of additionality demonstration comparable, a scoring method was created by the author and applied to all 96 CDM projects. Findings are presented and analysed in Chapter 5, a compressed version of the database can be found in Appendix A below.

2 The Clean Development Mechanism

2.1 Foundation in the Kyoto Protocol and the Marrakech Accords

At the 1992 “Earth Summit“ in Rio de Janeiro the United Nations Framework Convention on Climate Change (UNFCCC) was signed, followed by the Kyoto Protocol (KP, see United Nations 1998) in 1997. The protocol was signed by 38 industrialised nations[4] and the European Union, which agreed to reduce their emissions of the six most important greenhouse gases (GHGs) to specific percentages below 1990 baseline levels, throughout the first commitment period, running from 2008 to 2012. It is in vigour since February 16th 2005 and except for the US and Australia, 175 signatory states have ratified the protocol in the meantime[5].

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[3] Project developers, DOEs, DNAs, the EB, NGOs as well as the scientific community.

[4] These countries are called Annex B countries in the Kyoto Protocol. With some exceptions they are the same countries as the Annex I countries of the UN framework convention on climate change. Following the majority of the literature and for the sake of simplification, hereinafter only the terms Annex I (AI) and Non-Annex I (NAI) will be used, also synonymous for industrialised and developing countries.

[5] See: http://unfccc.int/kyoto_protocol/background/status_of_ratification/items/2613.php

The KP contains a range of flexible properties in order to facilitate compliance for the signatory states with binding targets, among them three genuine flexible mechanisms, often referred to as "Kyoto-Mechanisms". These instruments, namely Emissions Trading (IET[6]), Joint Implementation (JI) and the Clean Development Mechanism (CDM) are market-based and have in common that they shift emission reductions to where these can be obtained at lower costs. IET allows Annex-B-countries to trade parts of their emission budget among each other[7], while in JI an emission-reducing project is carried out in an Annex I country[8], directly or at least partly financed by another Annex I country. Both mechanisms are not the focus of this paper and therefore will not be further discussed.

Article 12 of the Kyoto Protocol formally lays the foundation of the CDM, leaving however many crucial questions open to later specification. Only in the so-called Marrakech Accords (MA) from 2001, the CDM was made operational (see below and UNFCCC 2001).

2.2 Theoretical background

The Clean Development Mechanism originated from a Norwegian proposal in the early nineties which materialised in a pilot prototype for CDM and JI - the Activities Implemented Jointly (AIJ). The idea gained momentum through a Brazilian proposal from early 1997 and was then supported during the Kyoto negotiations (in a changed version) by the United States (Oberthür/Ott 1999, Michaelowa 2004).

The idea behind the CDM is that industrialised nations (AI countries) reduce GHG emissions not (only) in their own territories, but get a chance to do so in developing countries (NAI countries). This is possible because the contribution of a particular greenhouse gas to global warming does not depend on the place where it is emitted into the atmosphere. The rationale behind this option is that emission reductions are most likely to be able to be carried out cheaper in developing countries.

[6] Here: International Emissions Trading, as opposed to emissions trading within the European Emissions Trading Scheme (EU ETS).
[7] See: Article 17 Kyoto Protocol
[8] See: Article 6 Kyoto Protocol. Typical host countries of JI-projects are the East-European countries with an economy in transition (CEIT).

An additional characteristic feature of the CDM is its market orientation. It is believed that “The Market“, that is, private enterprises, will do the best job in conceiving, tracing and developing cost-effective projects. Trading the “emission reductions“ at a “carbon market“ will make sure that rational behaviour of the market participants leads to mutual benefits and thereby to the lowest costs. Where offer and demand meet, both partners end up being better off, at least in an ideal world without market distortions.

Therefore, from a theoretical perspective, the overall welfare can be increased by moving emission reductions to where they are cheapest and up to a situation where marginal abatement costs of different countries converge. In reality there are distortions of this idealised scenario, e.g. there are transaction costs, which however, are not the subject of this work (see e.g. Michaelowa et al. 2003).

In order to achieve these benefits, emission-reducing projects in developing countries must be financed by industrialised nations. But how can emission *reductions* be measured and operationalised? This is achieved by comparing the emission situation *after* the realisation of the project with the counterfactual, that is, the situation *without* the project. This reference scenario, i.e. the Business-As-Usual (BAU) emissions path, is called the baseline. Against this baseline, the project emissions are measured and the difference is the emission reduction (see below, section 2.6). If this reduction is measured and divided into units, such as metric tonnes of CO_2-equivalent, these can be handled (e.g. certified, transferred or traded).

In contrast to NAI countries, AI countries face a specific emission-cap, according to their Kyoto obligations[9]. The total amount an AI country is entitled to emit, consists of virtual certificates, each representing the emission of one tonne of CO_2 equivalent[10]. The sum of these Assigned Amount Units (AAUs) is the upper boundary which is what the real, verified emissions may add up to after the first commitment period, if a country chooses to comply. As these caps tend to be lower in most cases than in the 1990 base year, and as countries undergo economic growth in the meantime, reaching this target is a considerable challenge for most AI countries.

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[9] The EU for example is obliged to reduce their emissions by 8%. Having formed a so-called bubble (Art. 4 KP) the EU re-allocated the reduction targets among member states (which is referred to as burden sharing).
[10] Each of the GHG is weighted with its global warming potential (GWP). GWPs express the contribution of greenhouse gases to the radiative forcing (and thereby to the greenhouse effect). They are normatised to CO_2, Methane (CH_4) having a GWP of 21, Nitrous Oxide (N_2O) of 310 etc. Hence 1 tonne of methane equals 21 t CO_2equivalents (CO_2e), see: Rahmstorff/Schellnhuber 2006, or: http://unfccc.int/ghg_emissions_data/items/3825.php .

In this way, the CDM is thought to assist AI countries in meeting their obligations, as each Certified Emission Reduction (CER) carried out (or financed) by an industrialised country in a developing country, will be added to its emission budget.

Before leaving the theoretical overview and turning to the institutional framework it should have become evident that the practical implementation of this mechanism has to be strictly regulated, supervised and enforced in order to avoid free riding, which would result in extra emissions rather than abatement. If fictitious emission reductions were certified and would enter into the system, industrialised countries were entitled to emit more without having reduced elsewhere.

2.3 Goals and regulatory framework of the CDM

Article 12.2 of the Kyoto protocol states the three central goals of the Clean Development Mechanism:

- Assist NAI countries in achieving sustainable development[11];
- Assist NAI in contributing to the ultimate objective of the UN FCCC[12];
- Assist AI countries in achieving compliance with their quantified emission limitation and reduction commitments.

It is obvious that cheap abatement options for industrialised countries are neither the only, nor the first goal of the CDM to be mentioned. Giving developing countries a chance to participate in the global efforts to reduce emissions and promoting sustainable development in these countries are equal targets.

[11] Sustainability originally is a concept of ancient forestry management and means that today's harvest is not to diminish tomorrow's yields. Since the publication of the report "Our Common Future", the so-called Brundtland-Report, in 1987, sustainable development has turned into a popular concept, describing a development path that is balanced between economic, social and environmental welfare and which at the same time, does not narrow the possibilities of future generations. Due to space limitations this important topic cannot be further discussed in this work. See for comprehensive appraisals: Sutter 2003 / Olhoff et al. 2004 / Pearson 2004 / Cosbey et al. 2005 / Burian 2006 / Holm-Olsen 2006 / Sutter & Parreño 2007

[12] The convention is generally accepted as the basis of international climate policy and states the final goal: "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (…) within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (Article 2, UNFCCC). The convention was designed in a spirit of historical responsibility and justice, stipulating that "the developed country Parties should take the lead in combating climate change and the adverse effects thereof" (Article 3.1 UNFCCC).

To achieve these goals, *project activities* that result in Certified Emission Reductions (CERs) may be carried out in NAI countries, while AI countries may use these CERs to comply with their commitment[13]. The certification of emission reductions is bound to three conditions (Art 12.5 KP):

- Voluntary participation of the parties (i.e. countries) involved;
- Real, measurable and long-term contributions to the mitigation of climate change;
- Emission reductions must be ***additional*** to any that would occur in the absence of the project.

The foundation for the strict implementation of an environmentally sound CDM was laid out in this article of the Kyoto Protocol.

Engagement in the CDM is explicitly allowed for private and/or public entities[14] and was designed to commence from the year 2000 onward[15], which is referred to as *prompt start*. CERs that accrue between the project start and the beginning of the first commitment period can be banked and used during the period[16].

The comprehensive regulatory framework of the CDM is laid out in more detail in the sixty-six paragraphs and four appendices of the Annex to Decision (D) 17/CP.7 in the Marrakech Accords (MA) from 2001. Participation in the CDM is restricted to countries that have ratified the Kyoto Protocol[17]. Countries remain responsible for the fulfilment of their Kyoto obligations when they authorise private entities to participate in the CDM and must ensure that these act according to the modalities and procedures of the CDM[18].

It was further decided to establish *simplified modalities and procedures* for small- scale CDM project activities, such as renewable energy projects with an output lower than 15 MW[19]. The simplifications concern the comprehensiveness of the documentation, the baseline methodologies, monitoring and validation/verification requirements as well as the fees (see http://cdm.unfccc.int/Panels/ssc_wg).

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[13] See: Art 12.3 a and b KP
[14] See: Art12.9 KP
[15] See: Art 12.10 KP
[16] See: Annex to decision (D) 17/CP.7 para 13, Marrakech Accords (MA)
[17] See: Annex to D 17/CP.7 para 30 / 31, MA
[18] See: Annex to D 17/CP.7 para 33, MA
[19] See: Annex to D 17/CP.7 para 6c, MA

A new but promising element of the CDM regulatory framework is the Programme of Activities (PoA), mostly referred to as *programmatic CDM*, by which projects "*under a programme of activities can be registered as a single clean development mechanism project activity, (…)*". This means that individual projects that result from a certain local/regional/national policy can be registered as one CDM project, considerably lowering the relative transaction costs
(see: http://cdm.unfccc.int/ProgrammeOfActivities/index.html).

2.4 Institutional architecture of the CDM

The Conference of the Parties (COP) of the UN Framework Convention on Climate Change serves as the Meeting of the Parties of the Kyoto Protocol (MOP), COP/MOP in the insider lingo. The COP/MOP provides both authority and guidance to the Clean Development Mechanism (Art 12.4 KP and Annex to D 17/CP.7 para 2 MA). It also provides guidance to the CDM Executive Board (EB), which supervises the CDM and is fully accountable to the COP/MOP[20]. The EB consists of ten members from the Kyoto parties, who meet several times a year[21]: one member from each of the five world regions (the United Nations regional groups), two members of AI countries, two NAI members and one representative of the small island developing states. EB decisions shall be taken by consensus. If this cannot be reached, a three-fourths majority vote is binding[22]. This provision gives developing countries a clear majority, leaving however the industrialised countries with a blocking minority. The EB can rely on the services of the UNFCCC secretariat in Bonn and has quite an extensive range of duties[23], the most important being the following:

- Reporting to the COP/MOP on the development of the CDM;
- Approving new methodologies;
- Registering (reviewing, rejecting) CDM projects;
- Improving the small scale modalities;
- Running a registry and a repository of rules, methodologies, standards and procedures as well as a database of projects.

[20] See: Annex to D 17/CP.7 paras 3 and 5, MA
[21] 8 times in 2007, 6 times in 2006, 5 times in 2005, see: http://cdm.unfccc.int/EB/index.html
[22] See: Annex to D 17/CP.7 paras 7 and 15, MA
[23] See: Annex to D 17/CP.7 paras 19 and 5 a-p, MA

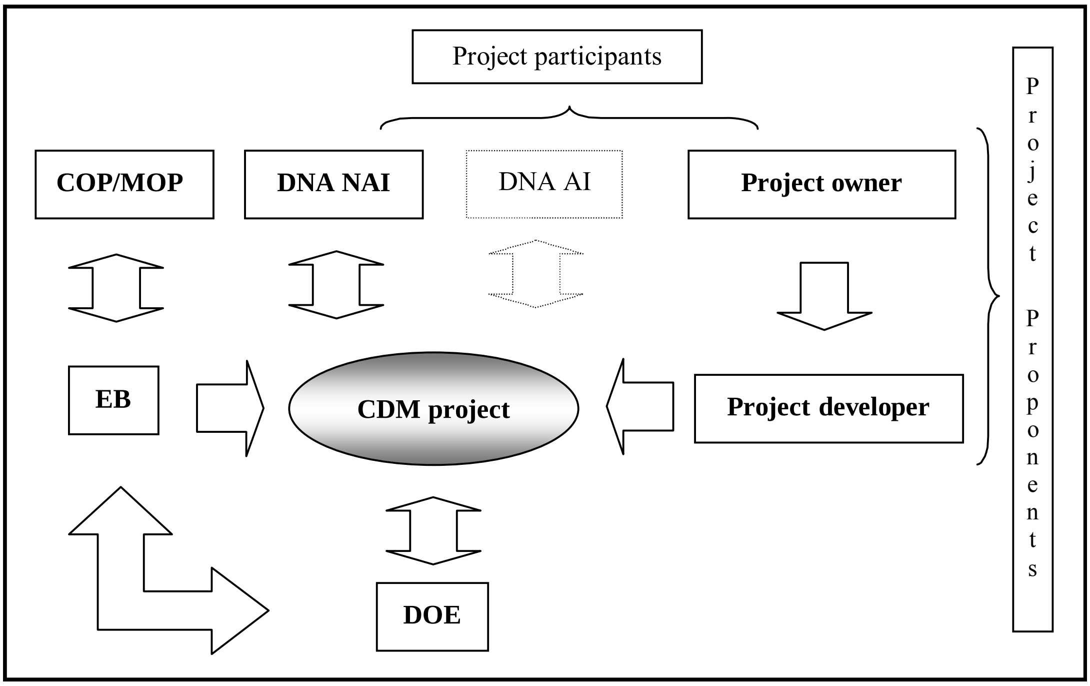
Several sub-panels, such as the Methodologies Panel (Meth Panel) or the Registration and Issuance Team (RIT) support the EB in its tasks [24]
(see: http://cdm.unfccc.int/Panels/index.html).

The EB is also responsible for the accreditation and supervision of the so-called Designated Operational Entities (DOEs) (Art 12.5 KP and Annex to D 17/CP.7 para 20, MA). DOEs are "*legal entities that have the necessary competence to perform validation, verification and certification functions …*" (see: Appendix A to the Annex of D 17/CP.7). They are responsible for the validation of projects and for the verification and certification of emission reductions (see next section, "The project cycle") and are accountable to the COP/MOP[25]. At present (November 2007), there are 18 accredited DOEs (for an overview see http://cdm.unfccc.int/DOE/list/index.html), among them organisations like Det Norske Veritas (DNV), Technischer Überwachungsverein (TÜV-SÜD,-NORD and -RHEINLAND), Bureau Veritas Certification Holding (BV Cert) or SGS United Kingdom Ltd. (SGS). DOEs are accredited for specific sectors, like energy or chemical industries, waste management, agriculture or mining, where they have special expertise at their disposal.

Each country wanting to participate in the CDM has to designate a national authority (DNA) that authorises a project activity on behalf of the respective country[26] (issuance of a letter of approval - LoA). In the case of NAI countries the DNA is also responsible for the sustainability assessment of the respective project proposals. Often these DNAs are located in the ministry of the environment (UK: Defra / NL: VROM) or a national environmental agency (D: UBA [DEHSt]). In Brazil the DNA is an inter-ministerial commission (CIMGC), which is based at the Ministry of Science and Technology (MCT).

[24] See: Annex to D 17/CP.7 para 18, MA
[25] See: Annex to D 17/CP.7 paras 26 and 27, MA
[26] See: Annex to D 17/CP.7 para 29, MA

Figure 1: Institutional setup of the CDM



2.5 The project cycle

The project cycle begins with the idea of an emission reducing project in a NAI country that is eligible to host CDM projects. The idea may come either from the local owner of a certain plant (e.g. a Brazilian sugar mill), from an international or local consultancy, from the supplier of a certain technology or from a state agency. Initial ideas and concepts are usually outlined in the so-called Project Idea Note (PIN) which is however, not yet part of the *official* UN project cycle.

The first official document, which is prepared by the project developer (be it the project owner or a consultancy), is the Project Design Document (PDD), which is specified in Appendix B to the Annex of decision 17/CP.7 (MA). The PDD outlines, in a standardised form, the purpose and technical description of the project. Information on the project participants, the chosen baseline methodology (approved or new) as well as an explanation of why the project can be considered additional has to be provided. Furthermore the project boundary must be defined, the project duration and the chosen crediting period stated and the monitoring method outlined. Finally information on the calculation of the expected emission reductions, the environmental impacts and a report on how local stakeholders have been involved must be provided in the PDD (http://cdm.unfccc.int/Reference/Documents/cdmpdd/English/CDM_PDD.pdf).

The next step in the project cycle is the validation through the DOE[27]. Validation is "*the process of independent evaluation of a project activity by a designated operational entity against the requirements of the CDM*" on the basis of the PDD. The DOE is selected by the project developers on a contractual basis in order to confirm that[28]:

- the involved parties are eligible for the CDM;
- comments of local stakeholders have been invited and taken into account;
- an environmental impact analysis has been carried out;
- the project is additional (see below, chapter 3);
- either an approved baseline methodology has been used or, according to the modalities, a new one has been developed;
- provisions for monitoring and reporting are in line with CDM regulation.

The DOE makes the PDD available for stakeholder and NGO comments during 30 days and takes objections into account. Furthermore, it makes sure that the project proponents have the LoA of the respective DNA, including the confirmation that the project contributes to sustainable development of the host country[29]. If finally considered valid, the DOE composes a validation report and submits the proposed project activity to the CDM EB, requesting registration.

Registration is the formal acceptance by the Executive Board of a validated project as a CDM project activity[30]. Projects can be registered either for 10 years or for seven years with the option of two renewals. Upon submission a project is scrutinised first by the RIT and then by the UNFCCC secretariat, who pass on their recommendations to the EB. It must be registered officially eight weeks after receipt by the EB, unless three board members or a party involved in the activity requests a review[31]. This review is finalised in the second EB meeting after the request has been made. If a project proposal still does not meet the criteria it is finally rejected by the EB.

If a project is registered the project operators must implement the monitoring plan as submitted in their PDD, which is a necessary condition for the later verification and

[27] See: Annex to D 17/CP.7 para 35, MA
[28] See: Annex to D 17/CP.7 para 37, MA
[29] See: Annex to D 17/CP.7 para 40, MA
[30] See: Annex to D 17/CP.7 para 36, MA
[31] See: Annex to D 17/CP.7 para 41, MA

certification[32]. The monitoring plan must be based on a previously approved monitoring methodology [33]and is to provide an overview of the data that are used for the calculation of the project emissions as well as for the baseline determination, considering leakage (see below, section 2.6). It describes the quality assurance and the control procedures of the monitoring process.

Small scale projects may contract the same DOE for verification as for validation, whereas large scale projects require *another* DOE. Verification is "*the periodic independent review and ex-post determination (...) of the monitored reductions in anthropogenic emissions by sources of greenhouse gases that have occurred as a result of a registered CDM project activity during the verification period*"[34]. The DOE checks whether the monitoring is in accordance with the approved monitoring methodology as stated in the PDD and, if appropriate, carries out on-site inspections, conducts interviews with project operators and stakeholders, observes established practices and tests the monitoring equipment. It then calculates the emission reductions and pens the verification report, where it certifies in writing, that, during the specified time period, the project activity achieved the verified amount of emission reductions. This certification report is communicated to the EB and made publicly available[35].

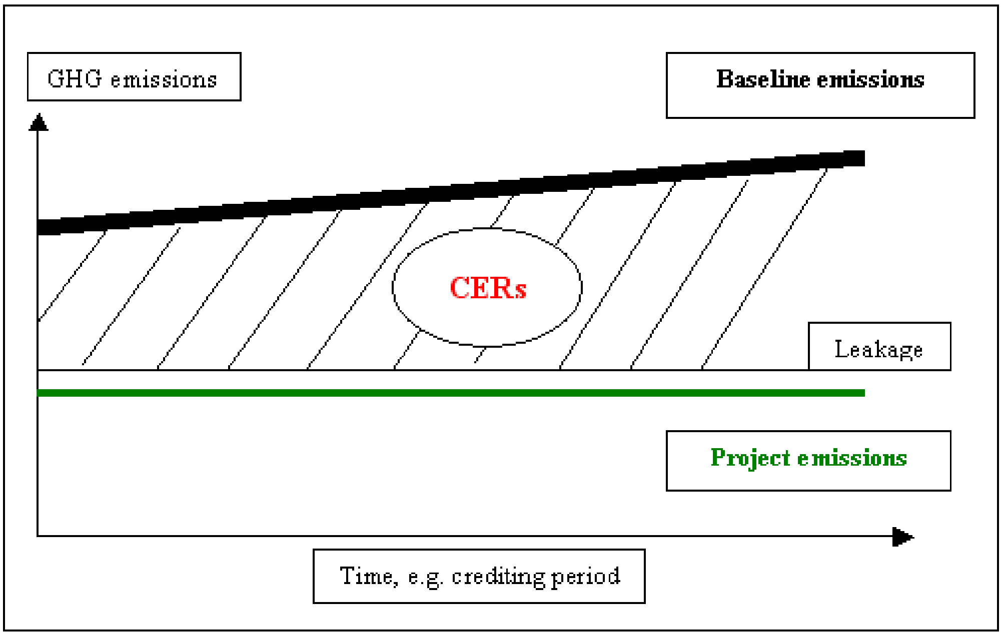
The submission of the certification report constitutes at the same time a *request of issuance* to the EB. The issuance of the credits, the CERs, is the final step of the project cycle. Provided that none of the parties involved or three EB members request a review, two weeks upon receipt of the issuance request, the CDM registry administrator issues the specified quantity of CERs, promptly ceding 2% to the EB for the adaptation fund[36], and forwards the remaining 98% to the account(s) of the project participant(s)[37]. Each CER has a unique serial number, which contains information on the origin of the unit and makes it identifiable and traceable[38]. It shall be held only in one account in one registry at any given time (see Appendix D to the Annex of D 17/CP.7, MA).

[32] See: Annex to D 17/CP.7 paras 56 and 58, MA
[33] See: Annex to D 17/CP.7 para 54, MA
[34] See: Annex to D 17/CP.7 para 61, MA
[35] See: Annex to D 17/CP.7 paras 61-63, MA
[36] A share of the proceeds of the CDM projects shall be set aside for covering the administrative expences and to furnish a fond dedicated to the support of those developing countries that are particularely vulnerable to climate change (Art 12.8 KP).
[37] See: Annex to D 17/CP.7 para 66, MA
[38] All movements of credits are administered by the ITL, the international transaction log.

2.6 Baseline Methodologies

As already mentioned, the central concept of the emission credit approach is the *baseline*, against which any reduction is measured. The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions of greenhouse gases that would occur in the absence of the proposed project activity[39].

Figure 2: Baseline and emission reductions



Methodologies for establishing baselines for different project types are designed by the project developers and are submitted for approval to the EB, where they are scrutinised by the Meth Panel. Once a methodology is approved it can be used by any other project developer, provided that it fits the project type.

Baselines shall be established on a project-specific basis, in a transparent and conservative manner regarding the choice of approaches, assumptions, methodologies, parameters, data sources, key factors and additionality, taking into account uncertainty. This postulation tempts to avoid exaggerated baselines that would cause a credit inflation (on associated problems see below, section 3.1). In drawing up a baseline, project developers have to take into account all relevant information like specific national

[39] See: Annex to D 17/CP.7 para 44, MA

circumstances, the economic situation of the respective sector, fuel availability, power sector expansion plans, policies etc[40].

Note that the investor country as well as the host country (or their respective agents), have an economic incentive to overstate the baseline (Michaelowa 1998a) as it determines their credit yield. The higher the baseline, the higher the emission reductions compared to given project emissions! The only advocate of the environment, in this case the atmosphere, is the UNFCCC regulation of the CDM and its stringent implementation and enforcement.

A prerequisite for the baseline establishment is the definition of the project boundary that encompasses all GHG emissions under the control of the project participants, which are significant and reasonably attributable to the CDM project[41]. Another important parameter in the determination of emission reductions is leakage, which is defined as the net change of GHG emissions that occurs *outside* the project boundaries but is measurable and attributable to the CDM project[42]. Leakage is relevant because it diminishes the emission reductions when comparing the baseline with project emissions.

According to the simplifications with respect to Small Scale (SSC) Projects, there exists a predefined set of baseline methodologies. Project developers simply have to choose the right methodology for their project. Appendix C provides an overview of the most important SSC methodologies. For large scale project types currently 47 approved methodologies and 12 approved consolidated methodologies exist[43].

2.7 Current state of the CDM

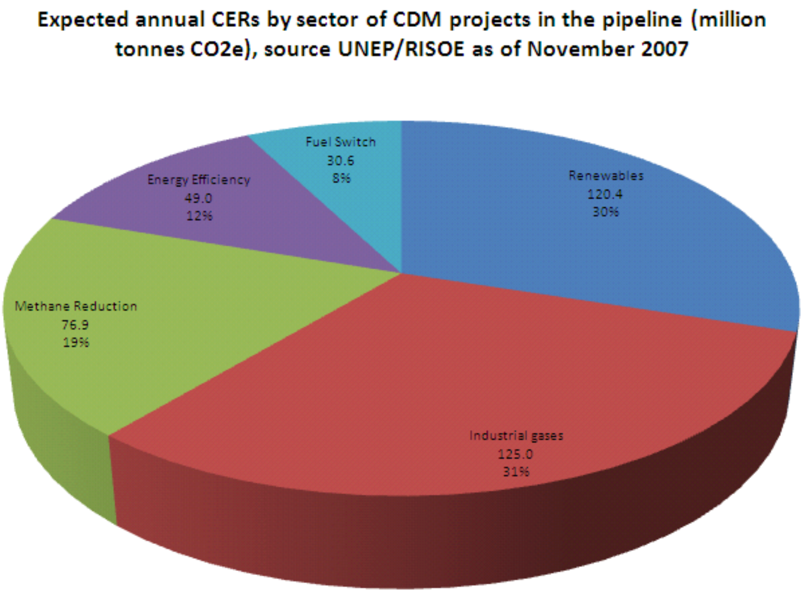
The first CDM project to be registered by the EB was a Brazilian landfill-gas-to-energy project, in November 2004. In November 2007, 848 projects have been registered, 39 will be registered after completing minor corrections, 53 have requested registration, for 50 submitted projects a review has been requested and another 8 are under review. 46 projects have been rejected by the EB so far
(see: http://cdm.unfccc.int/Projects/index.html).

[40] See: Annex to D 17/CP.7 para 45, MA
[41] See: Annex to D 17/CP.7 para 52, MA
[42] See: Annex to D 17/CP.7 para 51, MA
[43] See: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

Close to 2400 projects are in the project pipeline, including those in the validation stage (see for details UNEP/RISØ: http://www.cdmpipeline.org).

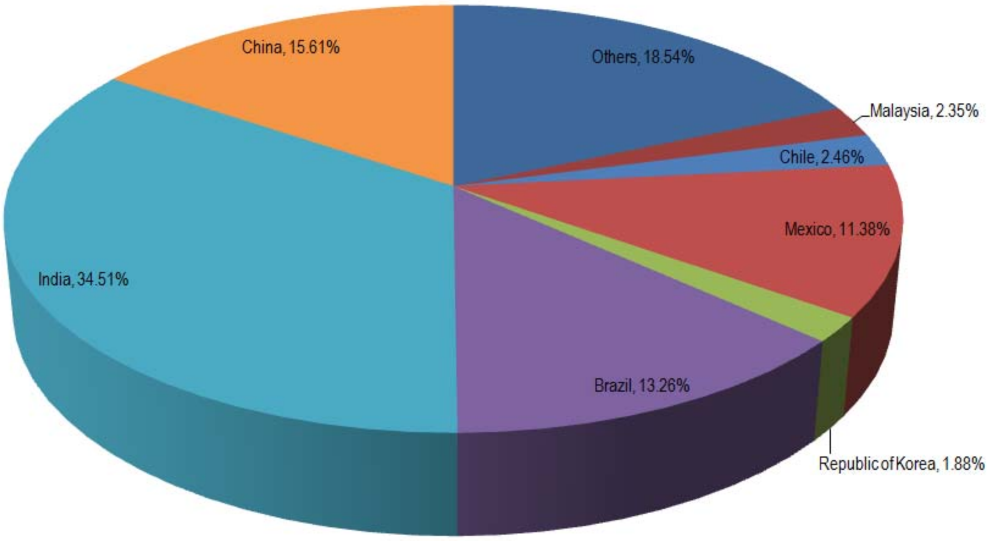
The currently registered CDM projects will generate certified emission reductions to the extent of 174 million tonnes of CO_2-equivalent per year, which will add up to over a billion until the end of the first Kyoto commitment period. CERs from all projects currently in the pipeline will be more than twice as many (see below, Figure 3). Note however that these figures accrue from estimated reductions, as stated in the PDDs. The verified and later certified amounts are often, depending on the project type, considerably lower (e.g. landfill gas projects yield at the moment only some 20%, due to inadequate capture systems, suboptimal operation of the landfill and simple overestimation of gas generation; see Capoor/Ambrosi 2007).

Figure 3: Expected CERs per sector



75 % of all registered projects are located in just four countries (India 34%, China 16%, Brazil 13% and Mexico 11%), while in the whole of Africa there are only 3% (see http://cdm.unfccc.int/Statistics/index.html as of November 2007). There is a clear correlation between the target countries of ordinary foreign direct investment and the countries that successfully attract CDM projects (Ellis et al. 2005). A lack of institutions and capacities seems to be the major barrier for a more equitable distribution (ibid. and: Ellis/Kamel 2007 or BMU/UBA 2007).

Figure 4: Regional distribution of CDM projects



When looking at countries with respect to the amount of emission reductions, the picture is even more dramatic: the four leading countries will receive close to 80% of all generated CERs (China with 45%, India 16%, Brazil 10% and South Korea 8%). This has a lot to do with the prevalent technologies. China has most HFC 23 destruction projects on its territory, which, due to the enormous GWP of this industrial gas, generate huge amounts of CERs. An overview over the existing types of CDM projects and their reduction technologies is presented in Appendix B.

Industrial gases can be abated relatively cheaply (Cames et al. 2007 / Burian 2006) which along with the specific GWP, is the reason for the enormous amounts of credits in these sectors, while for instance in solar energy, the contribution of carbon finance to the overall project finance is minute. There is however evidence that renewables are catching up while the potential of industrial gases will soon be exploited (Capoor / Ambrosi 2007).

Figure 5: Expected CERs per host country

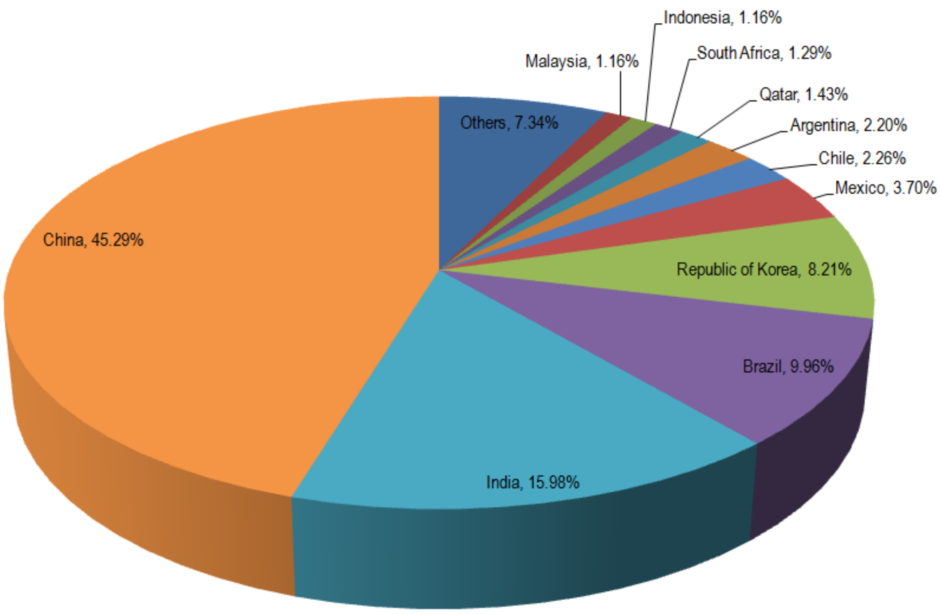
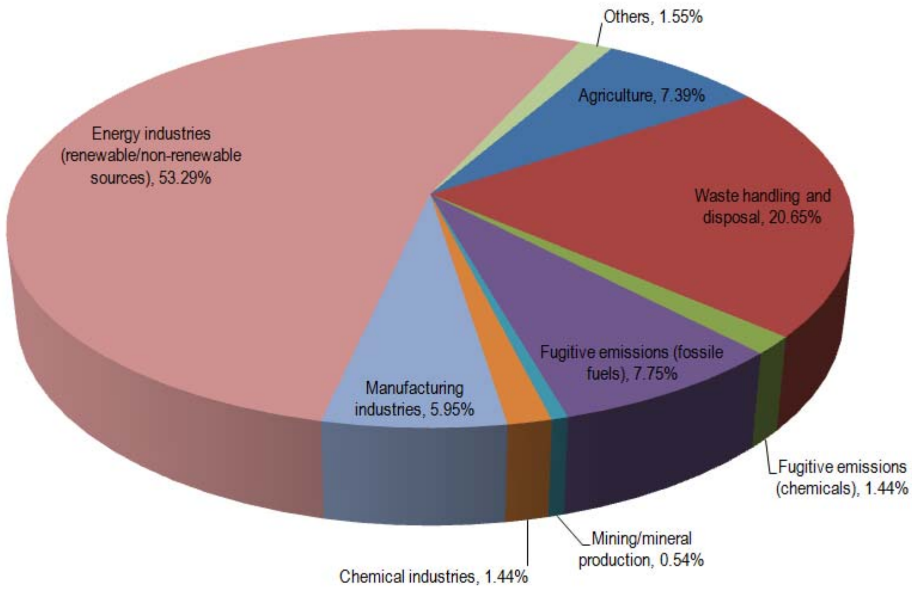


Figure 6: Registered CDM projects per sector



Source: UNFCCC (http://cdm.unfccc.int)

2.8 The value of Certified Emission Reductions: the carbon market

Other than occasional auctioning at exchanges like the Asia Carbon Exchange[44] most of the CER trade takes place bilaterally between buyers and sellers, with the former typically belonging to either AI governments, carbon funds or larger companies and the latter to private or semi-stately entities of host countries or outside investors. As yet there is no spot market for credits.

Apart from helping countries to reach their Kyoto target, CERs can be used for compliance by companies that are subject to the European Emissions Trading Scheme through the EU linking directive (see EU 2003). This is expected to contribute considerably to the demand for these credits during the *second* commitment period of the EU ETS that starts in 2008. The price for CERs is described as being strongly linked to second phase European Union Allowances (EUAs), with a specific discount. Point Carbon in its October and November editions of the CDM & JI Monitor reports CER price ranges of 13 – 15 € for primary and 17.40 – 17.85 € for secondary CERs[45]. The World Bank/IETA report "State and Trends of the Carbon Market 2007" states an average price of 8,40 Euros per CER during 2006 (Capoor/Ambrosi 2007).

3 The criterion of additionality

3.1 Theoretical background

In the very foundation of the Clean Development Mechanism, in article 12 of the Kyoto Protocol, additionality is defined as a key eligibility criterion for CDM projects: reductions in emissions must be additional to any that would occur in the absence of the project activity, in order to be certified (see art 12.5 c KP). The stipulation fails however to constitute a functional or more specifically, an accurately manageable criterion. Moreover, the respective paragraph in the Marrakech Accords is vague: ***a CDM project is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity*** (see Annex to decision 17/CP.7 para 43). What exactly does this mean and how can an additional project be distinguished from one that isn't? It is not

[44] ACX, see: http://www.asiacarbon.com/news.htm
[45] see: www.pointcarbon.com

surprising that an academic debate about the operationalisation began shortly after the 1997 COP in Kyoto (Michaelowa 1998a / Philibert 1998 / Rentz 1998 / Baumert 1999).

Simply speaking, there are two different possible interpretations of the concept at the two extreme ends of the scale. Additionality can either mean that a project is additional if emissions are lower than in a situation without the CDM, that is, if no CDM registration would be possible *or* it can mean that a project is additional if less GHGs are emitted after a certain project has been implemented in comparison to the situation before. The consequences of both readings differ fundamentally: while the first interpretation suggests that a project is additional if it is not business as usual, that is, if it hadn't come about *anyway*, the other interpretation is similar to the definition of a baseline, and basically makes *any* project eligible that supplies the same output with lower emissions. The first view is clearly aimed at projects that, for whatever reason, wouldn't come into existence if it wasn't for CDM registration and the respective support.

While on the one hand a cursory appreciation of the above mentioned wording of the UN documents supports the second understanding, advocates of the first perception have a deeper level of logic on their side: if a project would have come into existence anyway, i.e. if it was business as usual, it would not render emission *reductions* in the first place. It is however vain mental acrobatics to philosophise about the true spirit of the authors of article 12.5 c. Let us instead take a look at the possible implications and consequences of the two extremes, and at who has a natural interest to be biased to either perception.

One can argue that clean and environmentally friendly technology is good and worth supporting *per se*, and there are probably only few who would challenge this. What could be better than stimulating a broad diffusion of green technology throughout the whole of the developing world? When reading the additionality criterion corresponding to the second interpretation, it is understood that the CDM is seen as a support tool for just that: for any project or activity with higher emission efficiency. This would however, lead to extensive *free riding* (Greiner/Michaelowa 2003 or Müller-Pelzer 2004) or more specifically, an avalanche of financial support, even for highly profitable projects that any reasonable decision maker would or should have carried out anyway. Was the CDM really made for this, would this make sense at all?

Projects which can be realised only with the extra support of the CDM are, on the other hand, *marginal* projects, at the margin of becoming self-supporting. In an ideal world these projects would not be worth realising, as the benefit is obviously lower or just as high as the costs. The real world however is full of externalities[46] and often neither the damages that are caused by obsolete technologies, nor the benefits that come along with new technologies are reflected in the cost-benefit balance. Additionally, traditional large scale technologies such as the fossil fuel industry, can look back upon a century of learning effects and economies of scale. Hence, it comes as no great surprise that new clean technologies often face a systematic disadvantage compared with traditional ones, although they offer a vast yet untapped potential of environmental benefits. Here CDM can play the role of a catalyst, helping these marginal projects over the threshold, and thereby expanding the range of feasible mitigation options (Michaelowa 2005a). The higher the additional environmental benefit, the more CERs a project will generate and the stronger is the extra support. This is efficient, which becomes clear when we imagine a potential project that is very expensive and does not render a large amount of emission reductions. Such a project would not become feasible, even with the CDM. In this way the average price of certified emission reductions would give a hint at the *marginal cost of emission abatement* on a global level.

So what would be the problem with the second interpretation, the one that would lead to a “watering-can“ support? Firstly, there exists a polit-economical problem. It is either state governments that buy CERs for Kyoto compliance or private entities that are subject to the EU ETS. Either way it is the citizens of AI countries that pay for these transfers, be it through taxes, energy- or commodity-prices. Financial means are always scarce. Not being able to build kindergardens or hospitals, in order to increase the earnings of an already highly profitable industrial enterprise in another continent might be hard to justify. It is not the purpose of the CDM to identify any low-emitting activities and reward them with monetary payment, thereby subsidising commercially viable businesses (Michaelowa 2005a or Greiner/Michaelowa 2003)[47].

However there is another problem of even deeper concern. The CDM was not set up as a mere financial transfer system to promote technological change. It is a baseline-and-credit system, where every reduced tonne of CO_2-equivalent turns into a certificate (CER) entitling the buyer (an AI government) to emit one extra tonne domestically. We must not forget that this is the underlying incentive: the one and only reason for

[46] External effects are impacts of an activity on a third party that are not brought about by a market transaction. The activity thus results in costs or benefits to someone else, which are not taken into account by the initiator (Endres 2000). Especially in the field of environmental issues external costs, i.e. external effects that are attributed a monetary value, play a major role (IPCC 2001).
[47] The fact that these deliberations are not at all trivial became apparent in the heated debate in Canada last year, as was reported by a Canadian speaker at Carbon Expo 2007 in Cologne.

industrialised countries (and their private companies respectively) to put money into these credits is that they are cheaper than the reduction of the same tonne at home. The CDM, as it was set up, is emission neutral (Müller-Pelzer 2004) and only supposed to increase the where-flexibility (Boehringer/Finus 2005). But this only works if the extra tonne that is emitted is balanced by a ***real reduction*** somewhere else! If non-additional projects, i.e. projects that would have been carried out anyway, generate CERs, the extra emission allowance for an industrialised country is *not based on a real reduction* ("fake" reductions, Greiner/Michaelowa 2003: 1007 or "meaningless, unearned tradable credits that displace real reductions in AI countries", Michaelowa 2005a). At the end of the day world-wide emissions would rise rather than fall[48]!

Another undesirable side effect of this is that due to the inflation of generated credits, any price information on the marginal abatement cost is lost, therefore crowding out ultimately real additional and valuable projects. In addition, this would jeopardise one of the sub-goals of the CDM, namely the transfer of advanced environmental technology, because it is exactly this technology that is typically more expensive and less likely to be profitable under BAU circumstances.

There is also another strategic issue: if on a larger scale, non-additional bilateral[49] projects are included in the CDM, developing countries are deprived of their own, low-cost (or better: profitable) abatement options, which otherwise would have been an asset for future climate negotiations about possible binding targets for NAI countries (see Michaelowa 2005a).

Therefore, if the disadvantages of non-additional projects are that obvious, why hasn't the vague formulation of the additionality criterion long been eradicated from the official documents? We must not forget that the CDM regulation, just as climate policy as a whole, is the outcome of political negotiations, which are highly influenced by partisan interests. Also, in the case of tightening the additionality interpretation, the incentive structure is not all that biased towards an environmental position: host country A (AI) wants lots of cheap credits, host country B (NAI) wants to maximise its credit generation (Michaelowa 1998). Furthermore, (potential) project owners, technology suppliers, consultancies and all participants in the "carbon market" would rather see restrictions

[48] Sometimes referred to as "tropical air" in analogy to "hot air" of the economies in transition (see: Dutschke/Michaelowa 1998)

[49] Bilateral CDM projects are set up in the way that was described above. It is however also possible for a NAI country to set up a CDM project without the participation of a AI country and later commercialise the CERs on it's own, a frequently used option that is called *unilateral*.

reduce than increase. It is mainly an alliance of academia[50] and environmental NGOs that support the UNFCCC personnel in defending the environmental integrity of the CDM[51].

In the literature the interpretations mentioned above have been discussed as investment- (Greiner/Michaelowa 2003), and/or financial[52] additionality (Baumert 1999), versus environmental additionality. For an overview over these and other concepts see Müller-Pelzer 2004; see also UNIDO 2003b, who developed their own tool for additionality determination, or PROBASE 2003).

3.2 History of additionality determination

In the years between Kyoto and Marrakech, the concept of additionality was merely a subject of theoretical analysis. The actual implementation of the CDM was still far away and the Kyoto Protocol far from being ratified, let alone in force, and "*people have tried to make sense of the concept and operationalise it*" (PROBASE 2003). After COP 7, 2001, in Marrakech, it was clear however, that "things were getting serious". The CDM executive board was formed and assigned with extensive tasks, amongst others to develop general guidance on additionality determination (see Appendix C (a)(v) of the Annex to decision 17/CP.7, MA).

Yet at its fifth meeting (EB05) in August 2002, the EB told the Meth Panel that no further work was needed on the additionality issue, based on the grounds that the stipulation of para 43, in accordance with the baseline definition of para 44, was sufficiently clear. When looking back, this is a truly questionable perception. At EB07 in January 2003 the board published a "glossary of terms" in which the term 'additionality' isn't even mentioned (see EB07, Annex 4, http://cdm.unfccc.int/EB/007/eb7ra04.pdf).

Nevertheless, it was decided at the same time, that for *small scale activities,* "project participants **shall** provide an explanation to show, **that the project activity would not**

[50] And not even to a 100%, see for example Cosbey 2005 or Garcia 2007 who suggest automatic registration for specific project types, irrespective of their additionality.
[51] An example of an understanding of the first of the above interpretations is provided by the NGO South South North, demanding that CDM projects "*would not have happened in the ordinary course of business, but for the CDM*" (see: http://www.cdmguide.org/glossary/index.jsp).
[52] Michaelowa et al. refer to financial additionality with respect to the requirement that the CDM must not be financed through ODA funds (see: MA D 17/CP.7 preamble)

have occurred anyway due to at least one of the following barriers (see Attachment A to Appendix B of Annex 6 to the report of EB07):

(a) Investment barrier: a financially more viable alternative (...) would have led to higher emissions;
(b) Technological barrier: a less technologically advanced alternative (...) involves lower risks due to performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
(d) Other barriers: without the project activity, for another specific reason (...), such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher."

At EB08, in March 2003, the clarification on issues relating to baseline methodologies stipulated that for large scale projects too, new baseline methodologies *must* state how the methodology demonstrates, that a project activity is additional and therefore not the baseline scenario (see Annex 1, EB08). At the following meeting (EB09) the Meth Panel was commissioned to prepare recommendations on additionality demonstration. In July 2003 the panel analysed the fluctuating additionality interpretations, as they had been used in the submitted methodologies (many of which had been rejected by the EB). They condensed the diverging arguments into two positions, similar to the interpretations already referred to (see previous chapter):

(1) Without the ability to register under the CDM, the proposed project activity would be (...) unlikely to occur.
(2) If the proposed CDM project activity is not implemented, a less GHG friendly activity would have been initiated or be continued instead.

The panel states that the second interpretation does not question whether or not the proposed activity would have gone ahead anyway, and recommends that **the first interpretation should be the only one used.** It then goes on to provide examples for a procedural approach for additionality demonstration. At the subsequent EB10 in July 2003, explicit clarifications were provided for the first time on how it may be demonstrated through the methodology, that a project is additional and therefore not the baseline scenario (see EB10, Annex 1, http://cdm.unfccc.int/EB/010/eb10repan1.pdf). For this purpose, examples of "tools" were listed, including:

- a qualitative or quantitative assessment of different potential options and an indication of why the non-project option is more likely; and/or
- a qualitative or quantitative assessment of one or more barriers facing the proposed project; and/or
- an indication that the project type is not common practice and not required by legislation.

Here, for the first time in black and white the *first* understanding of additionality is gleaming through, but it would take another year until "draft consolidated tools for the determination of additionality" for large scale projects were drawn up, at EB15 in September 2004 (see the following section).

Although during informal meetings, the EB had been in contact with stakeholder associations and accredited NGOs, a storm of criticism broke out subsequent to the publication of the draft additionality tool (Michaelowa et al. 2005b). According to the International Emissions Trading Association IETA the apparent interpretation of additionality would go "*beyond what is referred in the MA*" (IETA 2004). Projects were posed to a "*highly subjective assessment*" and questioned "*to death*" (IETA 2005).

Until today the EB is working on further improvement of the operationalisation of the additionality concept. In 2007 it called for input and submissions on best practice examples for further improvement of the additionality tool.

3.3 The consolidated additionality tool for large scale projects

The above mentioned draft version of the Additionality Tool (AT), as it was put forth at EB15, shall not be further considered here. It is however noteworthy that until the publication of the first official version of the AT at EB16 in October 2004, the wording became stricter rather than looser. To give one example: in the draft version the barrier analysis shall "*determine whether the proposed project activity faces barriers that prevent a **wide spread** implementation of this activity*..." (see EB15, Annex 3, emphasis by the author). In a much clearer phrasing of the final version, the word "*wide spread*" is left out (see EB16, Annex 1), emphasising the prohibitive nature of the barrier.

The AT provides a step-wise approach to demonstrate and assess additionality. Its latest version (3) from January 2007 can be found at http://cdm.unfccc.int/EB/029/eb29_repan05.pdf. In this paper only the first and the latest version will be considered, outlining the differences, i.e. the development. The utilisation of the AT is voluntary; project participants may also propose other tools to the EB.

The procedure starts with Step 0, which is a preliminary screening of the project start. This step has become obsolete in the meantime, and is not part of the current version (3). Because the Marrakech Accords allow project participants to kick off their projects (and the crediting periods respectively) even before official registration (*prompt start*, see above[53]), they shall provide evidence that the project started between 1 January 2000 and the registration date (provided that the PDD had been submitted until 31 December 2005) and that the incentive of the CDM had been *seriously considered* in the decision to proceed with the project. Respective documentation shall be included.

Step 1 covers the identification of alternatives to the project that can be part of the baseline. These alternative scenarios shall be realistic, credible and in line with existing laws and regulations. They must be available to the project proponent (PP), provide comparable outputs and services and are to include:

- the proposed project activity not undertaken as a CDM project;
- all other plausible alternatives that deliver outputs (like electricity, heat or cement) and services of comparable quality, properties and application areas; or
- the continuation of the current situation (no project).

In the case of the PP wanting to include an alternative which does not comply with laws or regulations, he must provide evidence that these are systematically not enforced and that non-compliance is wide-spread. Should the proposed project be the only one consistent with the laws and regulations, it is not additional. PPs now have the choice to proceed to either Step 2 or Step 3.

[53] See also decision 18/CP.9

Step 2 is the investment analysis, a sub-tool designed to assess investment additionality (in line with the concept of Greiner/Michaelowa 2003). Its purpose is to determine whether the proposed project is economically or financially less attractive than the alternatives. First, an appropriate analysis method is to be selected. PPs may choose between a simple cost analysis (option I), investment comparison analysis (option II) or a benchmark analysis (option III). Option I is only applicable to cases where the project produces *only costs* while the benefits would *only* accrue from the CER income. HFC23 destruction or Methane flaring without energy generation are examples of this constellation.

When applying option II or III, the appropriate financial indicator must first be identified. PPs can use the Internal Rate on Return (IRR), the Net Present Value (NPV), the cost benefit ratio or the unit cost of service, depending on suitability in the decision-making context. In the next step the chosen indicator has to be calculated for the proposed CDM project.

In option II the corresponding indicator of all the other alternatives of Step 1 has to be calculated. Applying option III the respective benchmark has to be identified, which is to represent standard returns in the market but *not* the subjective profitability expectations of particular investors. Benchmarks may be derived from government bond rates, commercial lending rates or well documented company internal benchmarks. The benchmarks must be comparable to the project indicator also with respect to the risk structure.

Once the financial indicators of the alternatives are calculated (option II) or the benchmark is determined (option III) *in a transparent and reproducible manner*, these values are compared with the financial indicator of the proposed project. If the latter is less favourable, the proposed project cannot be considered financially attractive. The robustness of these findings must be substantiated through a sensitivity analysis of the critical parameters. PPs may either proceed directly to Step 4 or back up their results with Step 3, the barrier analysis.

Step 3, the barrier analysis, examines whether the proposed project faces barriers that *prevent* its implementation, whilst not preventing at least one of the alternatives. In a first substep (3a), barriers that would prevent the project from being carried out if it *wasn't* registered as a CDM project have to be identified. Examples are given in the tool, such as investment barriers, technological barriers or barriers due to prevailing practice (for more details see below, section 3.4 and 5.2.2). Alleged barriers are to be substantiated by transparent and documented evidence, like laws and regulations, government or international statistical data, academic studies etc. PPs then have to show how the barriers do not prevent the implementation of at least one of the alternatives. If Step 3 is satisfied they may move on to Step 4.

Step 4 is the common practice analysis, designed to complement and reinforce the investment and barrier analysis (the “generic“ additionality tests) and is meant as a credibility check. It looks at the extent to which a certain technology has already penetrated a market (sector or region). PPs must analyse other activities *similar* to the project, implemented previously or currently underway, disregarding other CDM projects. Should any similar activities exist, it must be demonstrated why these do not face or haven’t faced the same barriers (had there been any subsidies or had circumstances changed etc).

In the final Step 5, PPs are to explain how the CDM registration alleviates the financial hurdles (Step 2) or removes the barriers (Step 3) so that the project can be undertaken. Examples are given, amongst these are the CER revenues, reduction of exchange rate risks and the attraction of new players. Like Step 0, Step 5 is not part of the current version of the AT, because the argumentation is considered to be sufficiently included in the steps above.

Apart from the omission of Step 0 and 5, some supplemental elements (and examples) are included in the current version of the AT. DOEs are explicitly requested to carefully assess and verify the reliability and credibility of all data, assumptions, rationales and documentation during the process of validation. In Step 3, a stronger emphasis is put on the fact, that if the CDM does not alleviate the identified barriers which prevent the proposed project, the project activity is not additional. It is stressed that barriers must be realistic and credible. Detailed specifications are added to the barrier examples. For a Flow Chart visualising the additionality tool, please see Appendix D below.

3.4 Theory and actual application of the barrier test

Any imaginable project faces barriers to its realisation. If this wasn't so, everybody would run around starting projects every day (Michaelowa 2005a). Barriers have to be taken into account and overcome in order to realise a defined goal; this is considered normal. If the barrier test is to separate additional from non-additional projects, it must be able to shed light on barriers which:

- by their size or nature would prevent possible PPs to go ahead with the project, and at the same time;
- would be alleviated through CDM-related benefits to a degree that makes the realisation attractive enough to proceed.

This discrimination is like a razor's edge, or as Michael Lazarus said (Michelowa et al. 2005b), artificially binary: either a barrier is prohibitive or it isn't. Where to draw this *thin red line*, may be considered highly subjective. And keeping in mind the incentive constellation, as outlined above, a systematic overstating of barriers, a juggling of parameters, can be expected in order to make the project look less attractive than it really is (Michaelowa 2007).

Let us take a more detailed look at these barriers for large scale projects. The barrier types mentioned are only *examples* and allow the PPs to argue their case in any *other* improperly defined manner (Michaelowa 2007).

Investment barriers, which have to be distinguished from the investment analysis pursuant to Step 2, may consist of the fact that *similar activities*[54] undertaken by private entities have only been implemented with grants or other non-commercial financing terms. Or the fact, that no capital is available from domestic or international capital markets, due to real or perceived risks. Both investment barrier types could and should be substantiated by credible documentation, such as government documents, studies of respectable research institutions, or in the latter case, through refusal statements of the very banks.

[54] The term "*similar*" is defined in the AT.

Technological barriers may be based on the following facts:

- Adequately trained staff is not available, leading to a high risk of equipment disrepair or underperformance;
- Lack of infrastructure to implement and maintain the technology;
- A high risk of technological failure under the local circumstances;
- The unavailability of a certain technology in a particular region.

The way these barriers are specified in the AT doesn't allow for a demonstration of their prohibitive nature (Michaelowa 2007). With decent wages and conditions, labour can be found or trained under basically all circumstances and lacking infrastructure can be set up. In the end, it all comes down to finance: removing or alleviating these barriers costs money, which then has an impact on the financial parameters and can be further dealt with in the investment analysis of Step 2. Additionally, lacking infrastructure or high risk of operational failure under the particular circumstances should be backed up by credible confirmation (ibid.).

Prevailing practice of other, more polluting technologies, as suggested as a further example in the AT, might be an *indicator* for a substantial barrier, but definitely not sufficient proof. Technology vintages have to be taken into account (Michaelowa 2007), as sometimes obsolete technologies prevail *even though* no prohibitive barriers prevent the breakthrough of a technological innovation – technological history is full of examples.

In addition to the barriers suggested in the tool, PPs use a variety of further argumentations and associate them with terms like cultural, economical, infrastructural barriers etc, in an arbitrary and inconsistent way. Already a cursory review of project design documents, when arbitrarily chosen, reveals that in many cases PPs fail to show how exactly the barrier *prevents* the implementation of a project and in which way the CDM helps to remove the barriers. They just claim on a very general basis that there are barriers, which makes the CDM registration necessary. Below, in sections 6.2 and 6.4 we will investigate in detail how the barrier test is actually applied in renewable energy CDM projects, based on Brazilian examples.

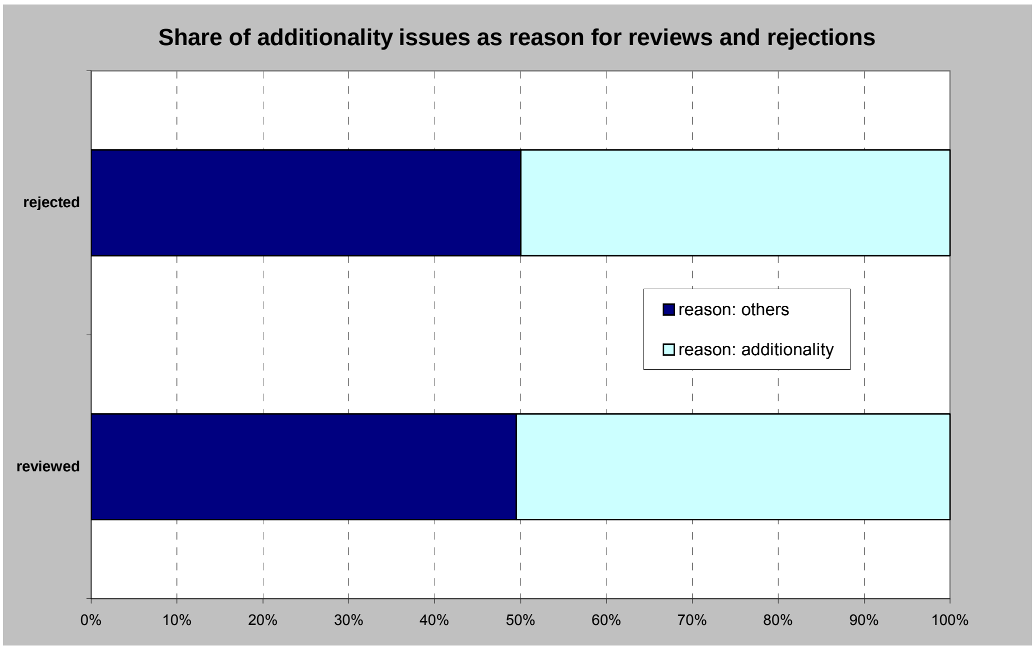
3.5 Impacts of the changing interpretation of the barrier test on the submission and the registration of RE CDM projects

On a global scale the application of the barrier test is mirrored in the reviews and rejections of submitted projects by the CDM executive board (see above, the project cycle).

3.5.1 Quantitative appraisal

The following appraisal has been compiled from the review scopes of all the EB meetings and the project database of the UNFCCC website. In the three years between registration of the first project activity in late 2004 and the end of 2007, 103 submitted projects caught a review and 46 (45%) of them were ultimately rejected. Of the 103, 52 (50%) had not satisfactorily demonstrated additionality (other reasons being formal errors, wrong baseline methodologies etc) and of these 52, 23 (44%) were rejected in the end. This means that at half of the rejected projects, additionality concerns were the reason.

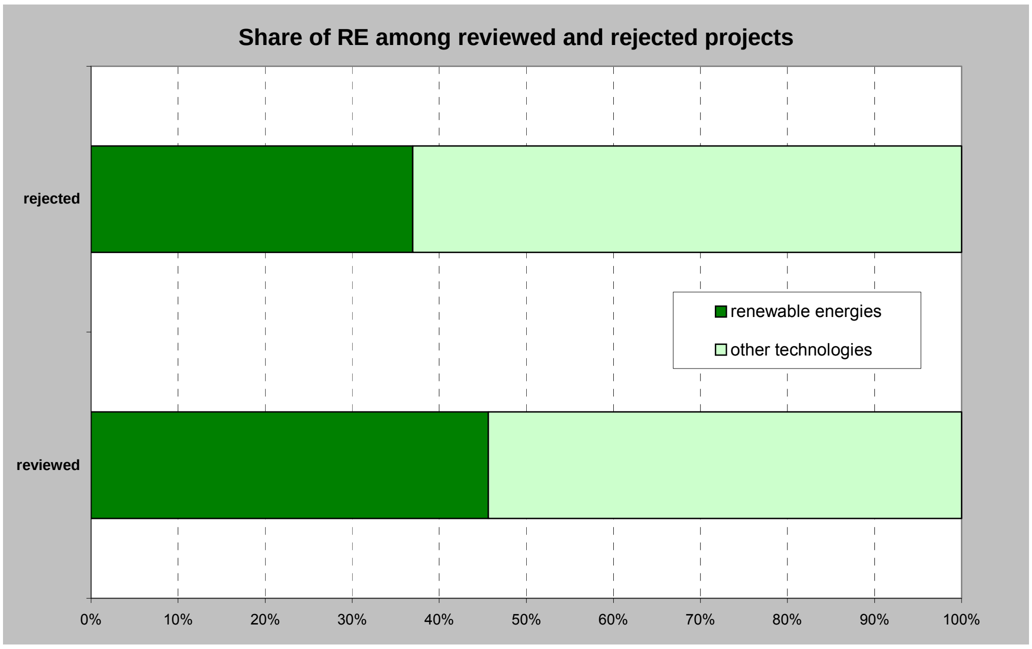
Figure 7: Proportion of additionality issues in reviews and rejections



47 of the 103 projects reviewed were renewable energy projects (46%), of which only 17 (36%) were ultimately rejected, which is a better than average proportion (45% - see above). 37% of all rejected projects were renewable energy projects. Considering that 53% of all registered CDM projects belong to the sectoral scope of energy industries

(consisting mostly of renewables) 37% could be interpreted as a comparatively good performance of renewables.

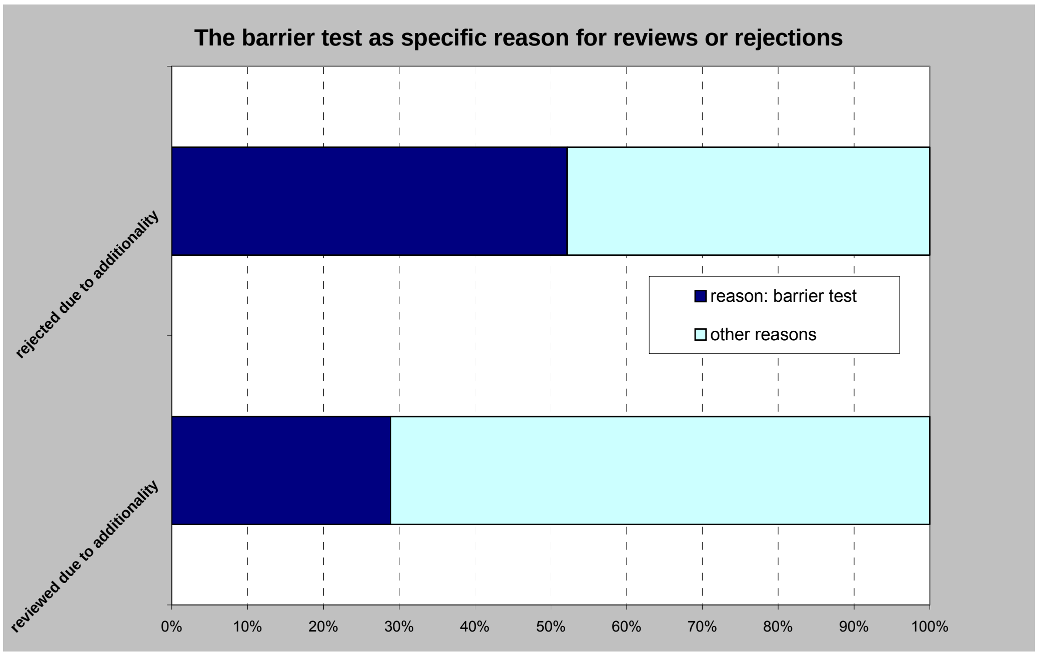
Figure 8: Proportion of renewables in reviews and rejections



In some cases, the EB in its review scope simply questioned the credibility of the additionality demonstration in general, but often it is the actual barrier analysis that was found to be unconvincing or unfounded. In 15 of the 52 cases (29%), where additionality was the reason for the review, it was explicitly the barrier test which was considered to be insufficiently substantiated. Among the 23 projects that were rejected due to insufficient additionality, were 12 where explicitly the barrier test application was considered inadequate. At 52%, this share is significantly higher than the sample of the mere review. Obviously the PPs were much less able to back up their barrier argumentation after the review request than in those cases where other reasons, like the investment analysis, had been the cause for critique.

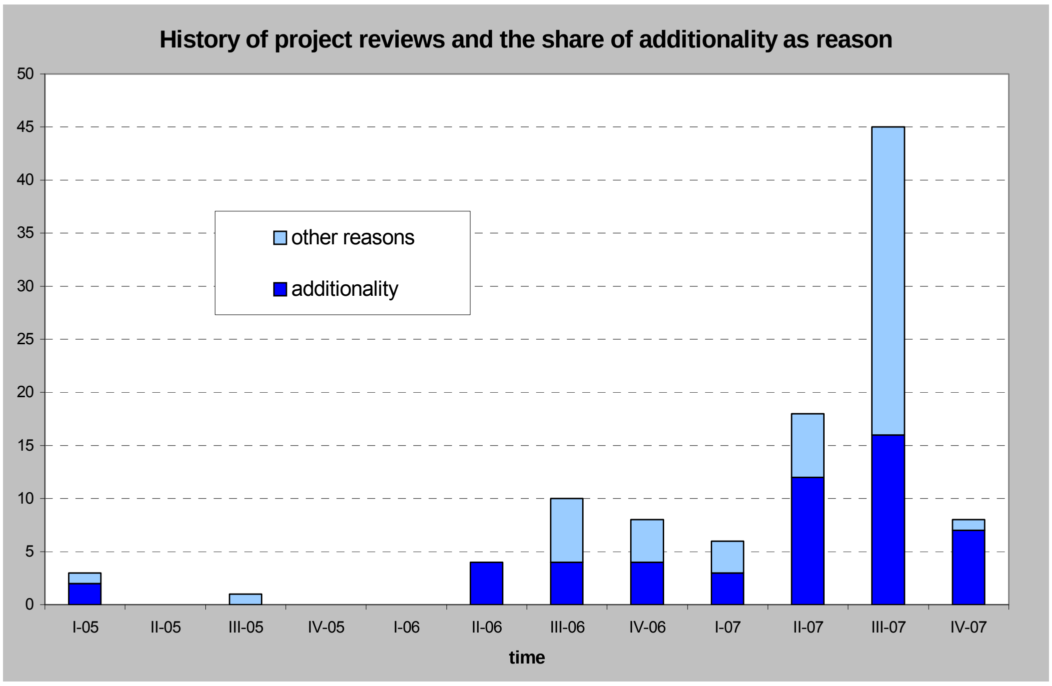
There are however certain limitations to this consideration as the reasons given for the reviews and rejections are first of all extremely brief, and secondly very general. Sometimes simply "unconvincing additionality" is claimed without any indication of what exactly is considered insufficient.

Figure 9: Barrier test issues in reviews and rejections



When looking at who validated the 23 projects rejected due to insufficient additionality, a significant imbalance can be found: 13 times DNV was the validating DOE, followed by BV Cert with 4 cases, the rest was distributed among other validators.

Figure 10: Chronological development of project reviews



3.5.2 Chronological development of reviews and rejections

It is interesting to see that from the end of 2004 onwards (registration of the first CDM project) through all of 2005 until May 2006, *only 4* were projects reviewed out of well over 160 registered projects, none of which were later rejected. From May 2006 onwards, the review practice became much tougher and in July 2006 the first 4 projects were rejected; all due to non-additionality.

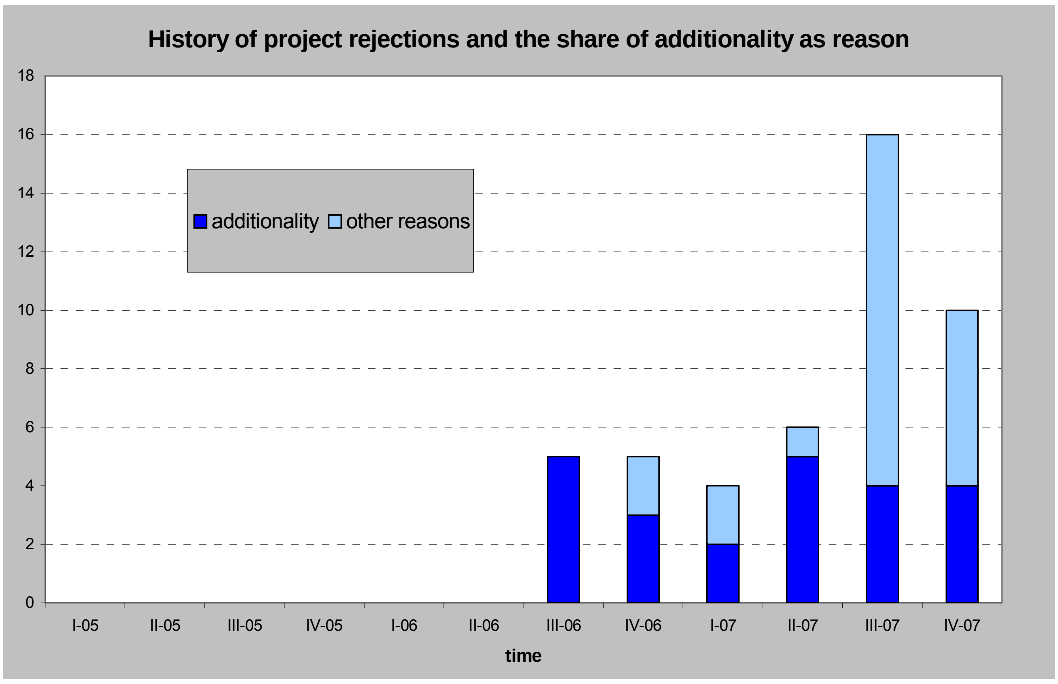


Figure 11: Chronological development of project rejections

Looking at the temporal development of project reviews and rejections one can clearly see the impact of the creation of the RIT in 2006 and the additional project scrutiny by the UNFCCC secretariat in 2007. This "crack-down" on non-additional projects, their proponents and the involved DOEs by the EB did however not lead to a consistently strict application of the additionality check from that time on (see for example Michaelowa/Purohit 2007). There is ample consent among interviewed CDM stakeholders that out of nearly identical projects some were registered and others rejected (see below, section 4.5 and Appendix G). Figure 12 and 13 and show the respective development for the renewable energy sector only.

Figure 12: Chronological development of RE projects reviews

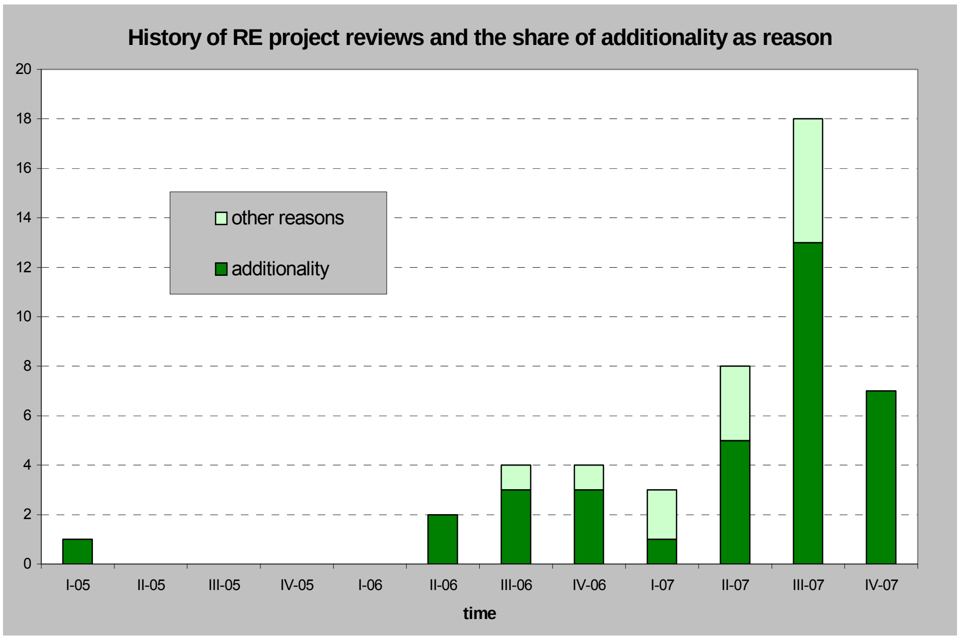


Figure 13: Chronological development of RE project rejections

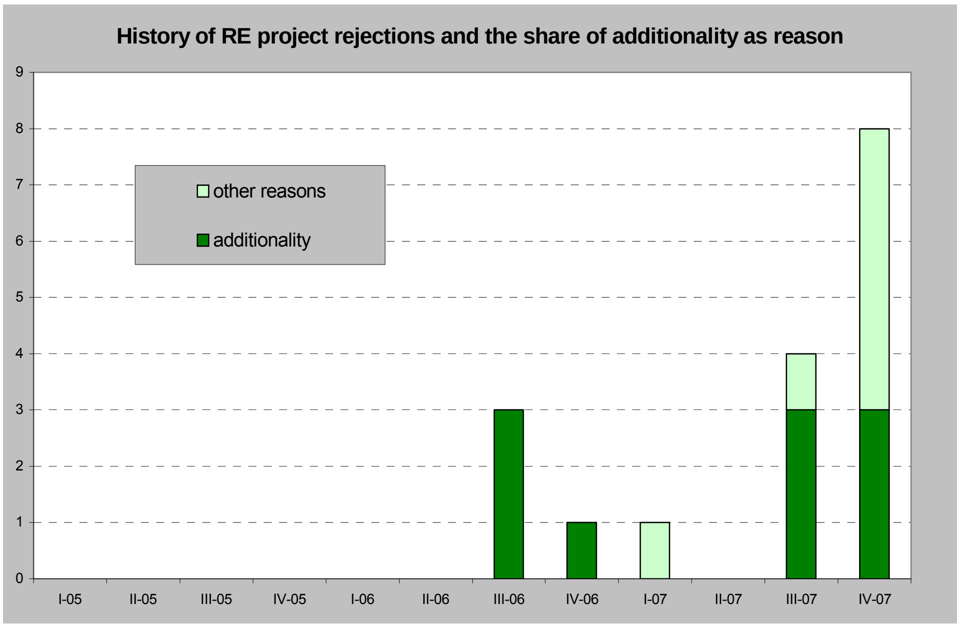


Figure 14: Development of RE project reviews and registrations

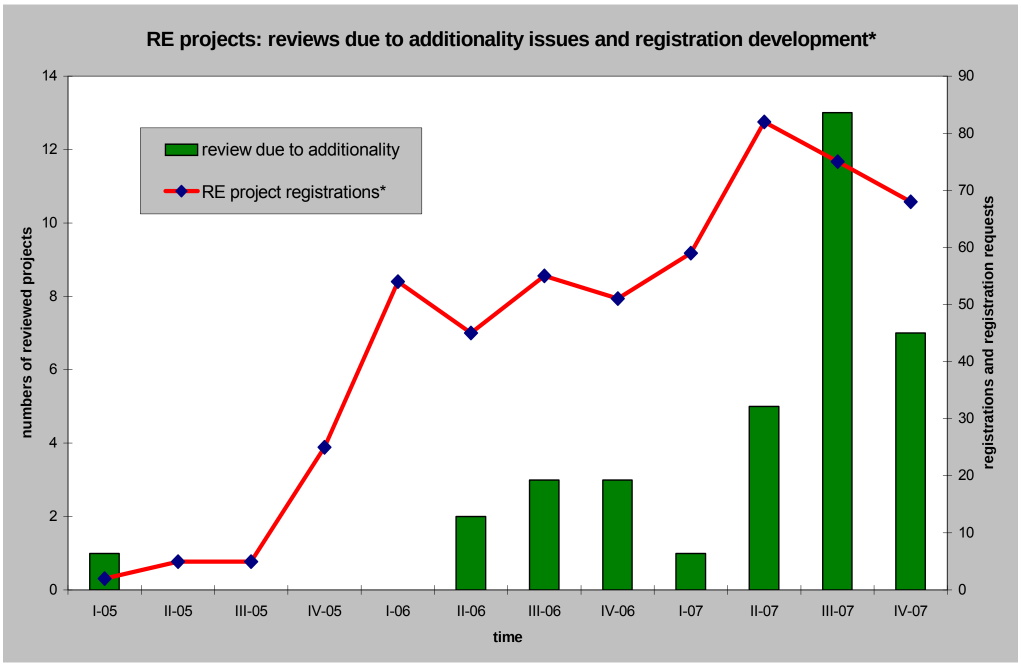


Figure 14 shows that on a global scale the quantitative development of renewable energy CDM project registrations *might* have been affected negatively by an assumed stricter interpretation of additionality on the part of the EB. Note however, that at the time of writing data for the quarter IV-07 was not fully available yet. On the other hand this constraint should not be over-estimated because it is true for *both*, the review- *and* the registration development.

The next section takes a look at possible qualitative impacts of the recent review and rejection practice.

3.5.3 Case study highlighting the impact of the current interpretation of the barrier test on the submission and registration of a RE CDM project

The Brazilian small scale rice-husk based biomass-to-energy project "GEEA Biomass 5 MW Power Plant Project" (1089) had been validated by DNV in early 2007, and subsequently requested CDM registration, currently holding the status "corrections requested, following a review request". Note that this stage is not a review yet but gives the project developer and the DOE a chance to clarify respective doubts.

The PDD valid at project submission, was developed by Mitsubishi and uses the simplified method for additionality demonstration according to Attachment A to Annex B (see above, section 3.2). Three barriers are presented to demonstrate that the project would "*not be carried out in the regular course of business*" (see PDD as of March 2007, p. 15[55]). In the "Barrier due to prevailing practice" it is pointed out that the continuation of the current situation (no project) would not face any barriers, whereas the use of rice residues as fuel for electricity generation does not represent "*a standard waste management practice in Brazil*". The implementation of such kind of project would be "*highly unlikely to be the natural choice*". The argumentation is "backed" by the "*indication that the biomass power generation is not attractive without the revenues from CERs.*" No further elaboration or documentation is provided. Next there is a Technological barrier, explaining that the application of rice husks implies a higher performance risk due to higher shares of inorganic compounds and lower calorific values compared to other fuels, which would require CER income as risk compensation. Lastly, an Investment barrier is presented, stating that "*financial/economic barriers due to the fact that the capital costs related to biomass units are very high*". High upfront investment costs, as well the fact that it had taken two years to obtain a loan from the development bank, is claimed. The arguments however, remain absolutely generalised and unsubstantiated. The reader gets no information on fuel and maintenance costs, on electricity tariffs etc and on how profitable the project would be in the end and more importantly, whether it would have been anyhow worthwhile to implement.

The review request from July 2007 states that "*Further evidence supporting the identified barriers should be presented in the PDD and validated by the DOE to confirm the additionality of the project activity*". The request, as well as the project developer's and the validator's responses can be found on the UNFCCC website[56]. A revised version of the PDD is presented, where the investment barrier and the barrier due to prevailing practice have been substantiated considerably. The details of the problems encountered in obtaining the project loan are outlined now with respect to the actual project rather than in general. To back up the economical barrier, the IRR calculation is presented, of which the underlying assumptions are laid open and backed by a sensitivity analysis. It is shown in a transparent manner that the inclusion of anticipated CERs income streams moves the project much closer to the financial reference benchmark, the SELIC rate (see for a detailed discussion of the SELIC rate and the IRR below, in section 5.2.2.2). The

[55] See: http://cdm.unfccc.int/Projects/DB/DNV-CUK1176960362.6/view
[56] Please see: http://cdm.unfccc.int/Projects/DB/DNV-CUK1176960362.6/history

findings are summarised in a well structured table. Also the prevailing practice barrier is substantiated by statistical data from the Brazilian ministry of mines and energy.

Although the project was not yet registered in November 2007, the fact that the project hasn't been put under official review (which should have happened during EB34 in September 2007), indicates that it will be registered soon. The current interpretation of the barrier concept expressed in the review request of the EB definitely had a significant impact on the quality of the barrier test of the analysed project. According to the author's opinion, the additionality claim has significantly improved. Given that both project developers and DOEs, are in most cases multinational companies, a single case like this is likely to have a positive impact on the quality of the barrier tests for future projects.

4 The state of CDM implementation in Brazil

4.1 Brazil: a brief introduction

4.1.1 Country information

Brazil is a country of continental dimensions: with 8.5 million km^2 it covers roughly 50 % of the South American land mass. It has a population of well over 180 million and with respect to both area and population constitutes the fifth largest country in the world (see IBGE 2007). Since the 1940s the overall population has more than quadrupled while in the same period, the population in urban areas increased by more than eleven times (LaRovere/do Valle Costa 2005). 83% of the inhabitants today live in urban areas (do Valle Costa 2006), which are mainly located along the coasts.

The republic of Brazil has a federal structure, consisting of 26 states plus a federal district containing the capital city of Brasilia. The states vary substantially in size, the state of São Paulo having close to 40 million inhabitants, followed by Minas Gerais with 20 million, while the states Acre, Roraima and Amapá only have roughly half a million. For statistical reasons Brazil is divided into five areas: the North, North-East, Center-West, South-East and the South.

The country's nominal GDP is 1,067 billion USD[57], making it the second biggest economy in the Americas after the US. The GDP per capita is of 5,717 USD (Banco Central do Brasil, http://www.bcb.gov.br/?INDECO). Brazil's economy is export oriented, agricultural goods (sugar, soy, coffee, meat etc) and industrial goods (airplanes, cars etc), contributing strongly to a positive trade balance. The current decade is characterised by growth rates in the range of 2 – 5 %, with an inflation rate of around 6% (DEG/bfai 2006). It hasn't always been this way, especially in the 1990's when there were periods of high inflation. Income and wealth are distributed extremely unevenly in Brazil, the country having one of the highest GINI-coefficients (58) worldwide. While the richest 10% receive 46% of the income, the poorest 10% do not even receive 1%[58]. Although large parts of society have living standards comparable to those in any industrialised country, on the scale of the Human Development Index Brazil ranks only 69[59]. About 22%[60] of the population is confronted with landlessness and extreme poverty, leading to dramatic social unrest, violence and crime.

The rapid growth of population and economic activity has also left its traces on an environmental level. Rainforest deforestation is a problem of global significance and dimension, with dramatic effects on biodiversity, as well as contributing to the bulk of Brazil's greenhouse gas emissions[61]. Export oriented large-scale agro-industry is based on huge mono-cultures, being partly responsible for deforestation and land degradation[62].

4.1.2 The Brazilian energy sector

On the other hand, Brazil has one of the cleanest energy matrices of the world. As a reaction to the 1973 oil crisis, the transport fleet switched to a large extent to the use of ethanol from sugarcane and by the 1980s 85% of all cars were fuelled by alcohol (La Rovere/do Valle Costa 2005). Currently a massive bio-diesel program is being launched. Electricity production is dominated by CO_2-free hydro power. CO_2 emissions from electricity production for the entire country amounted to only 12.2 million tonnes in 2006 (do Valle Costa 2006) which, compared for instance to Germany with 80 million

[57] The alternative approach of purchasing power parity will not be discussed here.
[58] See: http://hdr.undp.org/hdr2006/statistics/countries/data_sheets/cty_ds_BRA.html
[59] See: http://hdr.undp.org/hdr2006/statistics/countries/data_sheets/cty_ds_BRA.html
[60] See: http://hdr.undp.org/hdr2006/statistics/countries/data_sheets/cty_ds_BRA.html
[61] According to the National Communication of 2004, in 1994 236 million t CO2-eq./a from energy consumption face 776 mt/a from deforestation!
[62] Brazil grows 18% of the world's total in soy beans and owns the second largest bovine herd in the world. Methane emissions in 1994 amounted 10 million tonnes (see: La Rovere 2005).

inhabitants and 380 million tonnes[63], is relatively modest. The characteristics of the Brazilian electricity sector are one of the key factors determining the development of CDM projects in the renewable energy sector, as we will see further down.

4.1.2.1 Regulatory developments

The electricity sector has undergone a period of constant changes throughout the past one and a half decades. In the early 1990s the Brazilian government decided to privatise and decartelise the sector in order to create an environment suitable for attracting enough private investment to finance the necessary growth (do Valle Costa 2006). In the mid-nineties the Brazilian Electricity Regulatory Agency ANEEL (Agência Nacional de Energia Elétrica) was created in order to ensure competition in the market. At the same time "independent energy producers" and "free customers" were established. Independent power producers obtained the right to operate and were guaranteed free access to the interconnected grid and the network of the local distributors, subject to regulated fees. Today they can sell their electricity either to the regulated market (see below for the current auctioning system), to free customers (that have a certain minimum load), to communities etc (GTZ/BMZ 2007).

Finally, towards the end of the decade the operator of the national interconnected grid ONS (Operador Nacional do Sistema Elétrico) was privatised and a wholesale electricity market was created (do Valle Costa 2006). State-owned holding Eletrobrás still owns the Brazilian part of the bi-national hydro project Itaipú[64], the two nuclear reactors, three energy companies as subsidiaries and about 70% of the transmission lines of the interconnected grid (GTZ/BMZ 2007).

Due to politically and economically induced market uncertainties at the end of the decade, energy investment remained far behind growing demand, which together with unfavourable precipitation in 2001, led to the great blackout (apagão) in that year. The consequence was a rationing of electricity which was to have considerable impact on consumption in the subsequent years (private consumption for example fell from 84 to 73 TWh/a and did not recover until 2005, see: GTZ/BMZ 2007). When in 2003 the political landscape changed (election of the government Lula da Silva), the second major remodelling of the sector began - "the reform of the reform" (do Valle Costa 2006). This "New Model" of the electric sector was introduced in 2004 and focuses on supply

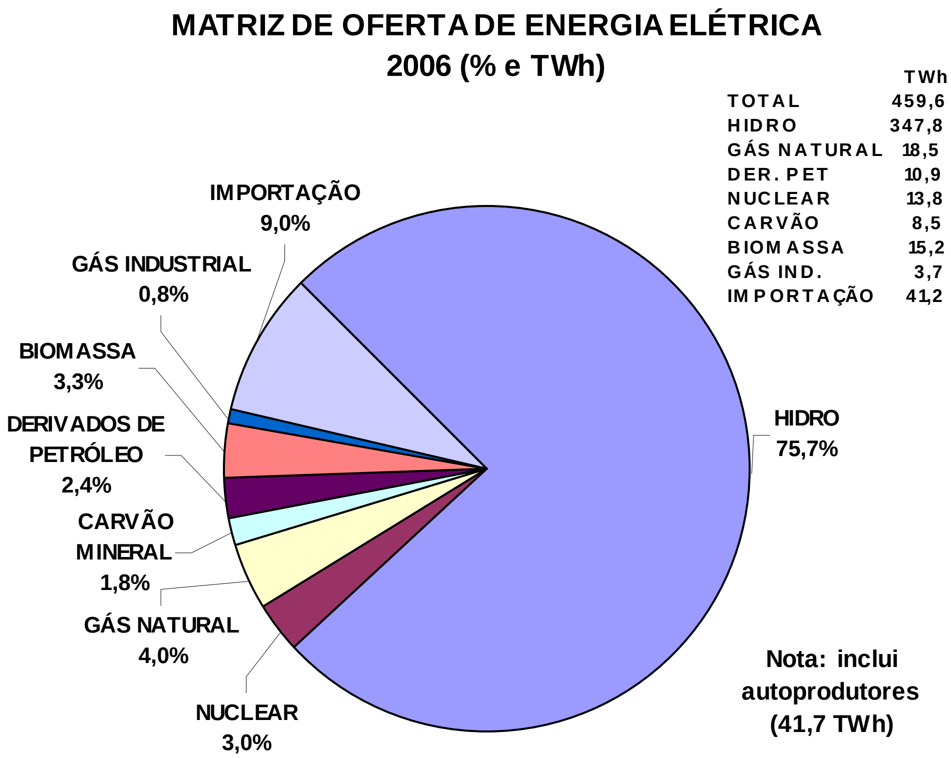
[63] CO_2-emissions from energy generation in 2004, see: BMU 2006 NAP II, p. 16
[64] The biggest hydro project in the world, a joint venture with Paraguai.

security, low tariffs and regulatory stability. To guarantee moderate pricing, an auction system (Portuguese: leilão) was introduced, in which electricity distributors have to bid for their long term contracts by criterion of the lowest price. Distributors have to estimate their demand and cover 100% of this electricity by contracts with power producers. These auctions are held at regular intervals and are split between existing facilities and "new energy" as well as between generation sources. In May 2007 the first auction took place solely for small hydro, wind energy and biomass and for 2008 an exclusive auction for wind energy is envisaged.

4.1.2.2 Current status and extension plans

Great parts of the rural interior of the North and North-East of Brazil are supplied by isolated grids. However, the Brazilian interconnected grid consists of more than 82,000 km of high and medium voltage transmission lines. According to transmission constraints, the SIN (Sistema Interligado Nacional) is divided into four subsystems: the South, the South-East/Middle-West, the North and the North-East.

Figure 15: Electricity generation matrix of Brazil



Source: MME – Ministerio de Minas e Energia

Figure 15 demonstrates the generated electricity in 2005, while Table 1 below shows the capacities installed by sources.

Table 1: Installed generation capacity in Brazil

Empreendimentos em Operação							
Tipo		**Capacidade Instalada**		**%**	**Total**		**%**
		N.° de Usinas	**(kW)**		**N.° de Usinas**	**(kW)**	
Hidro		662	76.820.393	70,85	662	76.820.393	70,85
Gás	Natural	78	10.193.502	9,40	108	11.344.480	10,46
	Processo	30	1.150.978	1,06			
Petróleo	Óleo Diesel	575	2.916.686	2,69	597	4.386.580	4,05
	Óleo Residual	22	1.469.894	1,36			
Biomassa	Bagaço de Cana	237	2.986.641	2,75	281	4.044.615	3,73
	Licor Negro	13	794.817	0,73			
	Madeira	26	224.207	0,21			
	Biogás	2	20.030	0,02			
	Casca de Arroz	3	18.920	0,02			
Nuclear		2	2.007.000	1,85	2	2.007.000	1,85
Carvão Mineral	Carvão Mineral	7	1.415.000	1,30	7	1.415.000	1,30
Eólica		15	236.850	0,22	15	236.850	0,22
Importação	Paraguai		5.650.000	5,46		8.170.000	7,54
	Argentina		2.250.000	2,17			
	Venezuela		200.000	0,19			
	Uruguai		70.000	0,07			
Total		**1.672**	**108.424.918**	**100**	**1.672**	**108.424.918**	**100**

Source: ANEEL, see: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp

The "New Model" reverted to more state regulation and brought a stronger focus on fossil sources as an answer to the hydrological risks of precipitation variability. Between 2001 and 2005 the installed capacity of thermoelectric power plants had already doubled from 11.7 GW to 20.3 GW (GTZ/BMZ 2007). According to the current extension plan, about 40 GW of installed capacity is to be added to the system between 2005 and 2015; 30 GW stemming from hydro power and another 10 GW from thermoelectric sources (do Valle Costa 2006). This scenario will significantly increase the share of both fossil based generation and CO_2 emissions.

4.2 Policies for the support of renewable energies in Brazil

The following overview concentrates on the electricity sector, and therefore does not consider biofuels (ethanol and biodiesel), nor solar thermal water heating. Furthermore, although being renewable, traditional large scale hydro power shall be excluded from further analysis because it constitutes a well-introduced and highly cost-effective mainstream electricity generation method in Brazil. On the contrary: the resulting low electricity price can be considered as a main obstacle to other generation methods like biomass, small hydro, wind energy or photovoltaics.

Promotion programmes in the past have supported renewable energy technologies rather indirectly, more as a side effect of extending electricity access (La Rovere/do Valle Costa 2005). In Brazil, 5% of the households (roughly 11 million people) still do not have access to electricity. In the rural areas of the North and North-East this share goes up to 56% and 32% (do Valle Costa 2006). The ambitious programme “Luz para todos” (electricity for all) consequently concentrates on these regions. It is handled by Eletrobrás however, and has no particular inclination towards renewable sources.

An important pillar for the promotion of photovoltaics was the introduction of the “State and Municipalities Energy Development Programme” (PRODEEM – Programa de Desenvolvimento Energético dos Estados e Municípios) in 1994. About 900.000 people in isolated municipalities benefited from the electrification of schools, health centres and water pumps, based on 5.8 MWp of installed solar power. The program is currently under evaluation, as there were severe problems with the maintenance of these systems (do Valle Costa 2006).

There is a subsidy scheme (CCC, Conta Consumo de Combustível), created to lower the cost of electricity generation by diesel or other fossil fuels in isolated rural locations. The CCC is fed by contributions of all consumers of the interconnected grid. Act 9648/98 opened up this arrangement for renewable energy sources[65] too (La Rovere/do Valle Costa 2005).

The backbone of the renewable energy promotion in Brazil however, is the “Incentive Programme for Alternative Sources of Electric Energy” (PROINFA – Programa de

[65] This subsidy scheme does interact with the CDM in a few cases, where projects are set up in isolated regions, like the Saldanha hydro project in the state of Rondônia.

Incentivo às Fontes Alternativas de Energia Elétrica) which was first introduced in 2002 (acts 10.438/2002 and 10.762/2003), and was finally kicked off in 2004, according to decree 5025/04. The initial aim of PROINFA was to add 3,300 MW of installed capacity to the interconnected grid until the end of 2006, equally distributed between biomass to energy, small hydro power and wind energy, each accounting for 1,100 MW. After some difficulties[66] in the beginning, the capacity goals were re-allocated (1423 MW for wind, 1191 MW for small hydro and 685 MW for biomass) and the time frame was extended to 2008. There were 144 installations contracted altogether, of which 63 were small hydro, 54 wind and 27 were biomass projects.

The key features of PROINFA are summarised below (do Valle Costa 2006, La Rovere/do Valle Costa 2005, GTZ/BMZ 2007):

- public call for project selection (selection criterion is the date of the environmental license).
- 20-year power purchase agreements (PPAs) between the independent power producers and Eletrobrás.
- Fixed premium prices are guaranteed and adjusted on a monthly basis by the general market price index (IGP-M). The tariffs differ, corresponding to technology, and ranged from 105 RS/MWh for bagasse based generation to 230 RS/MWh for wind energy in 2006.
- 50% discount for grid access and transmission fees.
- Financing of 80% of the investment through the national development bank BNDES (Banco Nacional de Desenvolvimento Econômico e Social).
- 60% of goods and/or services have to be of national origin.
- Additional costs are, as in the case of the CCC (see above), distributed among the consumers of the interconnected grid, of which small consumers are exempt.
- There are contraction limits per state and technology: max. 20% for wind and biomass and 15% for small hydro.

Not all of the 144 projects that were contracted are likely to be completed by 2008, some may not be completed at all, which would be then be subject to contractual penalties.

[66] Biomass project proponents claimed insufficient tariffs and all participants complained about excessive requirements in order to obtain the BNDES funding.

PROINFA was conceived as a two-phase programme but it seems that PROINFA 2 will not come into existence and that instead specialised auctions are going to channel the extension of renewable sources[67].

An extremely critical and controversial feature of the PROINFA is the provision that, for projects that are at the same time CDM projects and part of the PROINFA, the income of carbon credits is confiscated by Eletrobrás and will be included in the PROINFA account (see decree 5025/04, art. 16[68]). The rationale behind this is the wish of the government to keep the costs of promoting renewable energies as low as possible for the end consumer. By subtracting the CER income from the additional expenses for the premium tariffs, the burden for the final customer is thought to be lowered. The flipside of the coin however, is that by taking the income of carbon credits away from project participants, *ex post* they are ousted of anticipated cash flows, and *ex ante* they have no incentive to conceive, develop and register further CDM projects. Who then would go ahead with the cumbersome and expensive development, validation and registration process? These tasks could of course be undertaken by Eletrobrás itself. It remains to be seen, how this conflict will be resolved – at the moment there are law suits pending over this matter. Another somewhat unclear and confusing situation exists regarding PROINFA and additionality (see for a detailed discussion below, section 5.3.4).

4.3 CDM in Brazil: specific situation and current state

4.3.1 Regulation

In 1999, Brazil established an Interministerial Commission on Global Climate Change (CIMGC-Comissão Interministerial de Mudança Global do Clima) which is based at the Ministry of Science and Technology. The commission consists of representatives of eleven ministries, amongst these are mines and energy, agriculture, transport, environment, development etc, and it serves as the designated national authority (DNA) for the CDM[69]. In its resolution 1 of September 2003[70], the regulatory framework of the national CDM implementation was laid out. In order to obtain the LoA of Brazil as a host country, project developers are required to submit to the DNA the project design document (PDD) in English and Portuguese, a description of how the project contributes

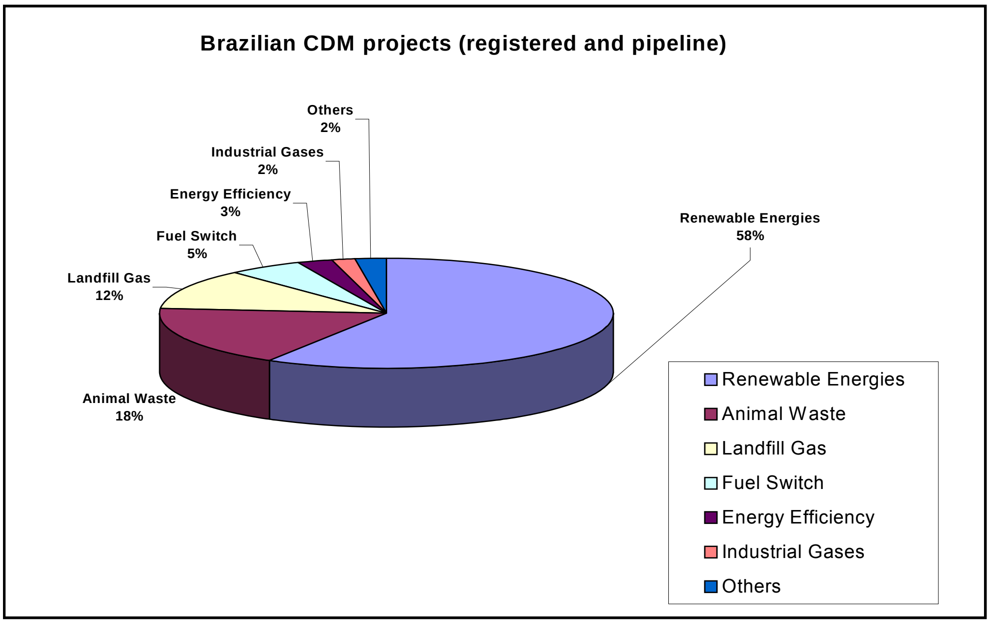
[67] As reported by various interviewed market participants in Brazil.
[68] See: http://www.eletrobras.gov.br/elb/portal/data/Pages/LUMISABB61D26PTBRNN.htm
[69] See: http://www.mct.gov.br/index.php/content/view/14666.html
[70] See: http://www.mct.gov.br/index.php/content/view/16167.html

to sustainable development[71], copies of the invitations for comments to stakeholders (such as municipal bodies), environmental agencies and the Brazilian Forum of NGOs and Social Movements for the environment and development (FBOMS[72]) and the validation report of the DOE in English and Portuguese. The resolution further stipulates that the DOE must be fully established on Brazilian territory. Note that in contrast to the typical project cycle in most other CDM host countries, in Brazil only projects that are already validated may be submitted to the DNA. The projects are then evaluated by the commission and either approved, approved with reservations or not approved, within sixty days upon the first of the bi-monthly meetings after receipt of the submission.

4.3.2 Facts and figures

The Brazilian CDM landscape[73] is largely dominated by four technologies: biomass to energy (81), small hydro power (50), animal waste and other biogas flaring (42) and landfill gas capture (28). The remaining 33 projects consist of fossil fuel switch (12), wind energy (6), energy efficiency (6), industrial gases (4), fugitive emissions (2), electricity distribution (2) and cement (1).

Figure 16: Portfolio of Brazilian CDM projects



Above figure: own illustration, based on the CDM pipeline (UNEP/RISØ) as of November 2007

[71] See: annex III to resolution 1
[72] See: www.fboms.org
[73] Considering the registered projects and the ones in the pipeline (www.cdmpipeline.org - 10.07)

Comparing the number of projects that are already registered (plus the ones requesting registration or under review) with the number still in the pipeline, only biomass to energy and small hydro follow an upward trend (39 to 42 and 23 to 27 respectively).

Figure 17: Sectoral development

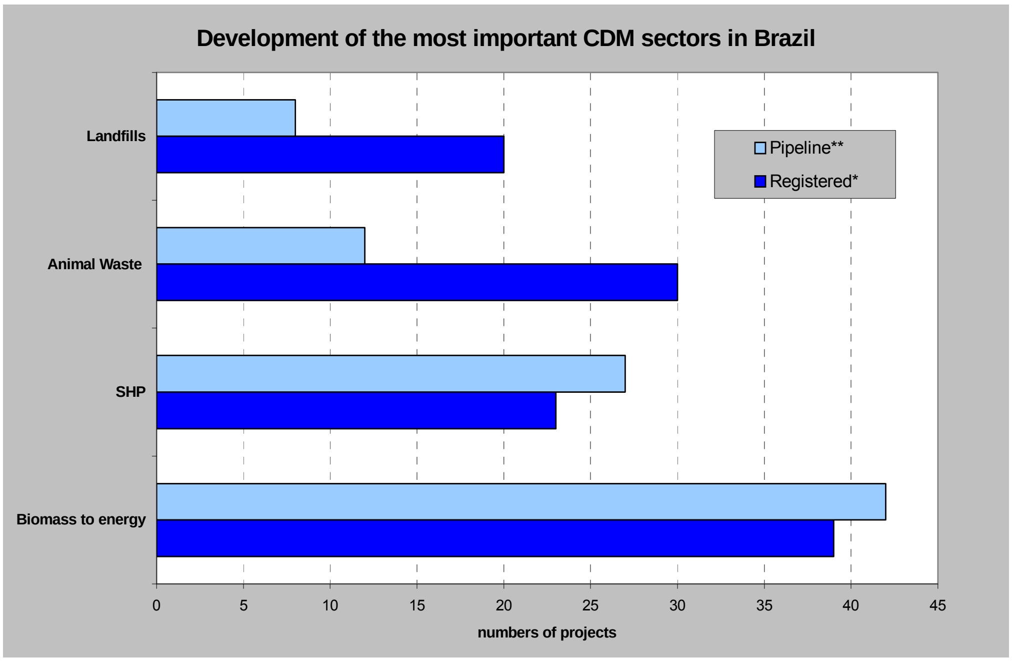
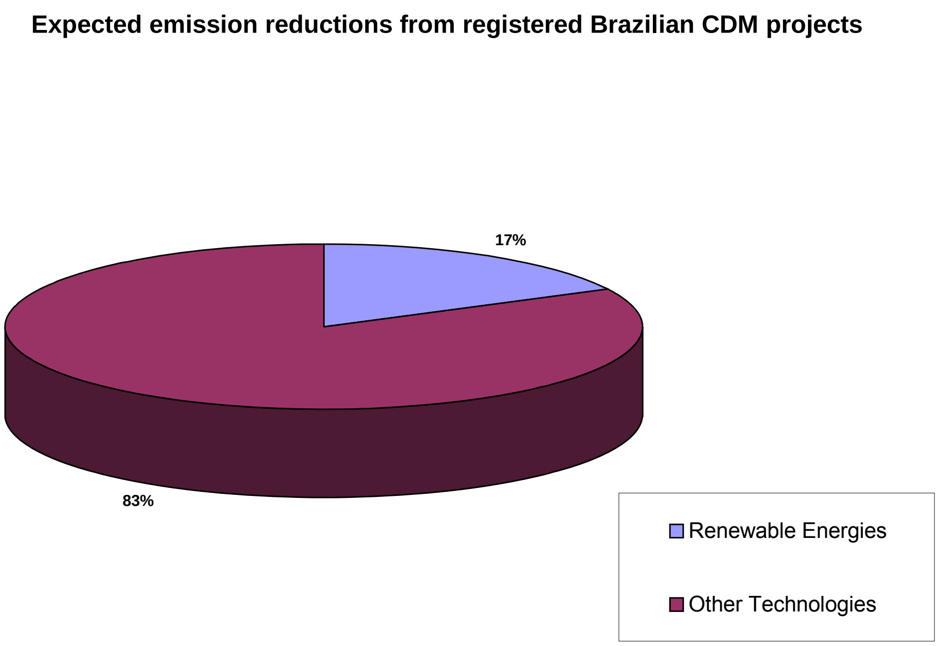


Figure 18: Emission reductions of RE versus other technologies



Own illustration, based on the CDM pipeline (UNEP/RISØ) as of November 2007

The projects that have been registered to date are estimated to render 16.7 million tonnes CO_2-equivalent of emission reductions annually, with approx. 6 million stemming from one single N_2O-abatement project. Projects that are currently requesting registration will deliver another 800 kt and those in the pipeline amount to 6340 kt, or 6.4 million tonnes, of CO_2-equivalent per year.

Four multinational consultancies (Agcert, Ecoinvest, Econergy and Ecosecurities) dominate the Brazilian CDM market for project development. Considering the numbers of projects that are already registered and those in the pipeline (UNEP RISØ), Econergy leads the market with 42 projects, followed by Ecosecurities (37), Agcert (35) and Ecoinvest with 34 projects. All other project developers together account for 84 projects. Comparing the numbers of projects that are registered (plus the ones requesting registration, having corrections requested or that are under review) with the numbers of projects that are still in the pipeline, Ecosecurities (13 to 14) and the “others” (27 to 57) have upward tendencies, while Agcert (28 to 7), Ecoinvest (30 to 17) and Econergy (31 to 11) have less projects in preparation than they had already led to registration. This indicates that there will be a much more diversified landscape among the active project developers, among them PriceWaterhouseCoopers, Mitsubishi, MGM, PTZ Bioenergy and Perspectives but it also sheds a first light – or rather – casts a shadow on the slowing-down of Brazilian CDM implementation, as 120 existing projects face 106 in the pipeline.

The four large developers have a clear inclination towards specific technologies: Agcert concentrating on animal waste management systems, Econergy being behind the bulk of bagasse based biomass to energy projects and wind energy, Ecoinvest specialising to equal extent on small hydro and biomass projects, while Ecosecurities has a diversified portfolio of landfill gas, biomass and hydro projects[74].

Three DOEs are dominating the validation/certification segment. Looking at who validated the projects, again including the ones in the pipeline (being “under validation”), DNV is leading the market with 92 projects, followed by TÜV SÜD (73) and SGS (56). BV Cert (9) and TÜV Nord (6) have played only minor roles so far. While DNV and TÜV SÜD are loosing shares, comparing registered projects with the pipeline, SGS is catching up.

[74] This appreciation is based on the portfolio of projects registered up to now.

A considerable proportion of Brazilian CDM projects are unilateral projects, that is, they do not involve an AI host country. Among the latter, the United Kingdom, the Netherlands, Japan, Sweden and Germany are the most prominent ones. There is however a certain trend towards unilateral projects in Brazil.

The project owners are extremely diversified, only a few companies own more than one project, like for instance Usina Coruripe, Brascan Energética, Rialma, Koblitz or the Brennand Family.

4.4 Renewable energies in the Brazilian CDM portfolio

4.4.1 General issues

As shown above, the Brazilian portfolio of CDM projects is dominated by renewable energies. The following analysis will concentrate on biomass, small hydro and wind energy projects and is based on a database accumulated by the author containing the basic data of all registered projects plus the ones that are only validated (see Appendix A). Although some of the landfill gas projects actually do generate electricity too, this is not the case in all respective projects, and shall not be further considered here, neither are animal waste projects. If not otherwise indicated, information was assembled from the PDDs.

At the time of writing (October 2007) 36 biomass projects, 22 hydro and 3 wind energy projects are registered. There are no solar or geothermal projects, not even in the pipeline. Brazil lacks the geological conditions for geothermal energy generation (GTZ/BMZ 2007), while photovoltaics (PV) are simply considered too expensive despite excellent conditions (Borges da Cunha et al. 2007, or UNIDO 2003a). The contribution of carbon to project finance would be so minute that the CDM is not considered an appropriate tool for the promotion of PV, not just in Brazil but worldwide. Solar thermal, due to its decentralised nature, might become feasible in the future under the programmatic CDM, as a “Programme of Activities”[75].

Together, the 64[76] registered projects are estimated to create annual emission reductions of roughly 3 million tonnes of CO_2-equivalents. Compared with the 16.7

[75] See above, section 2.3.
[76] 61 registered projects, plus 2 with review requested and 1 undergoing minor corrections.

million tonnes of all registered projects in Brazil, the contribution of renewable energy technologies for GHG abatement seems rather small, with N_2O-abatement, animal waste and landfill methane flaring, fossil fuel switch etc accounting for the difference. This is due to the high GWP of other GHG, renewable energy technologies typically reducing only CO_2, although some of the biomass projects do avoid CH_4 emissions too.

The installed electricity generation capacity of all CDM-registered renewable energy projects is close to 2 GW, which is not much compared to the existing 96 GW (GTZ/BMZ 2007). Compared with the extension plans that envisage an increase of 40 GW until 2015 the recently installed CDM projects at least constitute a 5 % share of the capacity growth target.

There is an extreme concentration of projects in the south of the country. The state of São Paulo alone hosts 19 projects which is roughly one third of the total of 61 projects, followed by Minas Gerais (8) and Rio Grande do Sul with 7 projects. Altogether 55 projects (90%) belong to the South/South-West/Centre-West regions, whereas only 4 projects are located in the North-East and 2 in the North.

4.4.2 Baseline and baseline methodologies

4.4.2.1 Overview

The most important baseline methodology with respect to renewable energy projects in Brazil is the Approved Consolidated Methodology (ACM) 0002 for grid-connected electricity generation from renewable sources. Although all of the registered projects until October 2006 had either used AM0015 ("*Bagasse-based cogeneration connected to an electricity grid*", a methodology that was later included into ACM0006 "*generation from biomass residues*") or AMS-I.D. ("*Grid-connected renewable electricity generation for small scale projects*"), ACM0002 provides the essential rules for baseline determination in renewable electricity generation. This is due to the fact that both, ACM0006 in its section on the emission reduction through displacement of grid electricity, and, from the ninth version onwards also the small-scale methodology AMS-I.D., refer to ACM0002 and its guidance to establish the emission factor through the "combined margin" (CM – see below). The sections of the mentioned baseline methodologies dealing with other emission reductions, such as avoided methane emissions from biomass decay, will not be further considered here[77].

[77] All baseline methodologies can be found at: http://cdm.unfccc.int/methodologies/index.html

4.4.2.2 Approved Consolidated baseline Methodology ACM0002

ACM0002 sets the rules for grid-connected electricity generation from renewable sources. It is based on elements of various new methodologies (NM), project developers like Econergy, Ecosecurities or the Prototype Carbon Fund had submitted. The methodology applies to electricity capacity additions from hydro, wind, geothermal, solar, wave or tidal sources. In combination with ACM0001 it is also applicable to electricity generation from landfill methane and as mentioned above, the key concept of this methodology is also relevant for electricity generation from biomass.

In the case of electricity generation through the above mentioned renewable sources the baseline determination is relatively straightforward: grid electricity *is* the baseline, while the generated renewable electricity displaces the otherwise generated power. Hence the emission reduction can be described as

ERy = BEy – PEy – Ly (1)

ER denoting emission reductions, BE baseline emissions, PE project emissions, L leakage and y indicating a certain year. The baseline emissions are the product of the emission factor (EFy, in tonnes of CO_2/MWh) and the electricity supplied by the project to the grid (EGy, energy generated in MWh)[78].

BEy = EGy x EFy (2)

For most renewable energy projects PEy = 0. In geothermal projects, fugitive emissions and operating emissions shall be considered. New hydro projects with reservoirs have to calculate their emissions that are due to flooding under some circumstances. Project emissions of biomass projects are described in ACM0006, in which CO_2-emissions from truck transports, fossil co-firing or electricity consumption as well as CH_4-emissions from the combustion of the biomass, weighted with the relevant GWP-factor, have to be considered. With respect to CO_2, biomass combustion is neutral, as the carbon content had only recently been absorbed from the atmosphere through photosynthesis.

[78] Baseline electricity supplied to the grid, that has to be subtracted from EGy in the case of modified or retrofit facilities, will not be considered here. The fact is of great importance for practitioners but does not contribute to the basic understanding at this point.

According to ACM0002 (page 11) leakage (Ly, see above) does not have to be considered in the case of renewable energy electricity projects.

The key feature of the determination of baseline emissions is the Emission *Factor* EF, which is calculated as a Combined Margin (CM) of the Operating Margin (OM) and Build Margin (BM) factors. Respective calculations must be based on official data and be publicly accessible. Registered CDM projects shall not be part of the respective calculations, as this, with a growing number of CDM projects, would progressingly lower the emission factors.

For the calculation of the OM the project developer has four different options:

- Simple OM,
- Simple adjusted OM,
- Dispatch Data Analysis OM,
- Average OM.

The choice must be justified and a specific "running order" is provided: first methodological choice is the dispatch data analysis. Simple OM and simple adjusted OM depend on the percentage of the so-called "low-cost/must-run" sources[79] in the grid generation[80]. If it is less than 50%, simple OM may be chosen. If it is more than 50%, the simple adjusted OM or the average OM may be chosen; the latter *only* if detailed data for the other choices is *not* available.

The simple OM factor is calculated as generation-weighted average emissions divided by electricity output (tonnes CO_2 / MWh) of all generating sources serving the system, and *not* including the low-cost/must-run plants. Average emissions are calculated as fuel consumption (F) multiplied by the emission coefficient[81] (COEFF) of the respective fuel, and summed up over all sources. The sum of generated electricity output (GEN) constitutes the denominator. Hence the simple OM emission factor can be denoted as (i: fuel / j: source / y: year):

[79] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation (see: ACM0002, p.6, footnote 5)
[80] 50%, either in the average of the five most recent years or based on long term normals for hydroelectricity production (see: ACM0002, p.6).
[81] The emission coefficient of a certain fuel is the product of the respective net calorific value, the CO2 emission factor and the oxidation factor.

$$EF_{OM,\ simple} = \sum_{i,j} (F_{i,j,y} \times COEFF_{i,j}) / \sum_j GEN_{j,y} \qquad (3)$$

The simple adjusted OM is determined in similar fashion, only that the low-cost/must-run sources are also considered and added to the simple OM, weighted with the factors λ and (1- λ):

$$EF_{OM,\ simple\ adj.} = \qquad (4)$$

$$(1-\lambda) \times \sum_{i,j} (F_{i,j,y} \times COEFF_{i,j}) / \sum_j GEN_{j,y} + \lambda \times \sum_{i,k} (F_{i,k,y} \times COEFF_{i,k}) / \sum_k GEN_{k,y}$$

where k is a plant of the subset of low-cost/must-run plants, while λ is the number of hours in a certain year during which low-cost/must-run sources are on the margin, divided by the total number of hours (8760). The method for the determination of establishing λ is provided in the methodology (p. 7 and 8) and will not be further discussed here.

For the dispatch data analysis OM, the OM-emissions are divided by the electricity generation of the project:

$$EF_{OM\ dispatch\ data} = E_{OM,y} / EG_{project,\ y} \qquad (5)$$

When determining OM-emissions, the respective project generation output is multiplied by the weighted average emissions per electricity unit of the top 10% of the grid system dispatch order for every hour of the year, and is then added together. Data from the national dispatch centre and the merit order of the plants has to be used for this analysis.

The average OM emission factor is calculated as the average emission rate of all power plants, analogous to equation (3), including the low-cost/must-run sources.

The Build Margin (BM) Emission Factor (EF_{BM}) is the generation-weighted average emission factor of a set of power plants m, that either consists of the five power plants that have been built most recently or the capacity additions that comprise 20% of the systems generation *and* have been built most recently, depending on which of the two samples is larger.

$$EF_{BM,y} = \sum_{i,\ m} (F_{i,m,y} \times COEFF_{i,m}) / \sum_m GEN_{m,y} \qquad (tCO_2/KWh) \qquad (6)$$

Project developers may either choose an ex ante approach, based on the most recent information or an ex post approach, annually updated.

The baseline Emission Factor EF_{CM} finally is calculated as a Combined Margin (CM) of the Operating Margin (OM) and the Build Margin (BM)

$$EF_{CM} = w_{OM} \times EF_{OM} + w_{BM} \times EF_{BM} \quad (7)$$

where both weightings w are 0.5 by default. Wind and solar projects however may by default use 0.75 for the OM and 0.25 for the BM. Other weightings may be used as long as they add up to 1 and the guidance in the methodology is considered.

For the purpose of determining the operating and build margin factors, a project electricity system is defined by the spatial extent of the power plants that can be dispatched *without significant transmission constraints*. Although Brazil does operate an interconnected grid, transmission constraints and factual non-transmission have led to separate consideration of the South, the South-East/Centre-West, the North and the North-East regions.

4.4.2.3 Empirical evidence

When analysing the PDDs of previously registered projects, renewable energy CDM projects in South/South-East/Centre-West region of Brazil typically have emission factors of 0.26 tonnes CO_2 per MWh electricity generated, around 0.43 in the operating margin and 0.1 in the build margin. Small scale projects *used to have* higher emission factors of around 0.53, due to the possibility of using the *average approximate OM* of AMS-I.D. until the eighth version. All other projects reviewed by the author used the simple adjusted OM emission factor.

In the North-Eastern region, emission factors are around 0.1 t/MWh which is dramatically lower than in the South. Here small scale projects at least had had factors of roughly 0.38 before the change. Rio do Fogo, a wind project currently under validation, will have an emission factor of 0.09! When considering this, it is not surprising that despite excellent conditions, hardly any CDM projects are found in the North-East. Extremely different, but only of individual nature, is the situation for a project that feeds into the Rondônia/Acre-grid and obtains a luxurious emission factor of 0.93!

From 2006 onward, the emission factors are published on the website of the Ministry of Science and Technology[82]. These factors differ substantially from the ones used in the past:

Table 2: Emission Factors provided by the DNA

Monthly average OM factors (min/max), all values in tonnes CO_2e / MWh

Region	Operating Margin	Build Margin
South	0.8161 (Oct.) – 1.0273 (Sept.)	0.1737
South-East / Centre-West	0.0782 (April) – 0.1802 (Febr.)	0.0678
North-East	0.0094 (Nov.) – 0.1671 (March)	0.0197
North	0.0001 (March) – 1.472 (Sept.)	0

Source: Ministerio de Ciências e Tecnologia

According to a representative of the Brazilian DNA these emission factors are not official ("*in terms of final*") and have been submitted to the Meth Panel for scrutiny. Interviewed CDM participants agree that these EFs are currently not binding. Dissent however exists among project developers and DOEs with respect to the question whether PPs *may* use these factors.

4.4.3 Biomass to energy

What the various types of biomass to energy projects have in common, according to ACM0002, is that they use biomass *residues* for combustion. Among the 36 registered projects the bulk (26) uses bagasse as feedstock, followed by forestry residues (7), rice husks (2) and wood tar (1). Other resources, such as coconut- and cashew nut-shells or oil seed crops, are under consideration but not even validated yet.

While the bagasse based projects are co-generating heat and electricity (CHP – combined heat and power), 9 of the other 10 projects generate electricity only, the one remaining generating only process heat. Biomass plants typically use a Rankine steam cycle, employing either condensing turbines (more in the case of pure electricity

[82] See: http://www.mct.gov.br/index.php/content/view/50871.html

generation) or backpressure turbines (as in the case of CHP). Through the direct combustion of biomass, pressurised water is transformed into steam in a boiler and expanded through a turbine that is connected to an electric generator. In CHP-facilities the waste heat is used for industrial processes, as is the case in sugar and ethanol production in Brazil. When cooled down the steam condenses back to water which is then routed back to the boiler, closing the cycle.

The bagasse based projects are part of the sugar cane industry, a traditional and well established sector in Brazil. Bagasse is a waste-product of juice extraction from sugar canes in the production of sugar and ethanol. One tonne of sugar cane has the energy content of 1.2 barrels of oil[83], two thirds of which are in the bagasse and the remaining cane waste. Through the combustion process heat and electricity needs of the plant can be met, a system that has always been common practice in Brazil. By using the resource more efficiently however, e.g. due to higher pressure boilers, an energy surplus can be generated and fed into the surrounding electricity grid. Upgrading the systems to high pressure and high temperature boilers can increase the energy generated five-fold (Sinha 2007).

The 26 Brazilian bagasse cogeneration plants registered under the CDM have installed capacities of 10 to 80 MW, with an average of 30 MW, and a total of 800 MW. Note that an energy surplus can only be generated during the harvest season, which typically goes from May to November. This drawback is partly compensated by the complementarity of bagasse based and hydro electricity generation, as the hydro reservoirs run low during the harvest season.

An important question is whether the CDM contributes to the retrofitting of inefficient cogeneration systems in the Brazilian sugar industry, against the backdrop of rising energy needs and the corresponding extension plans of the sector. From the above mentioned increase in thermoelectrical capacity of 9 GW, 1.8 GW is supposed to originate from bagasse based biomass plants (do Valle Costa 2006). Efficiency upgrading of the existing CHP facilities in the sugar industry is considered an important option for the short term increase of generation capacity. This is especially important when considering the envisaged production increases of ethanol (+50% until 2012-2013) and the fact that the necessary technical equipment can be fully supplied by the national industry (GTZ/BMZ 2007).

[83] 1 tonne of sugar cane has an energy content of 1,718 x 10^3 kCal, while 1 barrel of oil has 1,386 x 10^3 kCal (see: Sinha 2007)

So far however the vast majority of sugar mills use the resource only for in-house needs (ibid.), where it is sufficient to run low pressure systems in order to meet heat and electricity needs. In the PDDs the sector is described as "conservative" and reluctant to engage in electricity sales. The failure to motivate the sector under the PROINFA, as described above, might be interpreted as a backing of this perception. Given this situation, with 26 bagasse cogeneration projects registered under the CDM and another 17 projects in the pipeline, the CDM might have made a contribution to the efficiency upgrade of the 248 sugar mills that already have a license for self-generation (GTZ/BMZ 2007).

With regard to the other biomass to energy project types, the situation is somewhat different because the enterprises are energy market oriented right from the start, their only purpose being the generation of electricity. Of the 42 biomass to energy projects in the CDM pipeline, 25 use feedstocks other than bagasse (forestry residues (10), rice husks (8) and others), which increases their share of the biomass portfolio in the future.

4.4.4 Small hydro power

The overwhelming majority of hydro projects in Brazilian CDM are classified as small hydro (SHP – Small Hydro Power or as often seen in the original Portuguese, PCH – Pequena Central Hídrica). This must be distinguished from large or small scale *CDM projects*, or from other definitions of small hydro like the one of ICOLD (International Commission On Large Dams) or of the International Association of Small Hydro[84]. In Brazil small hydro power is defined in article 3 of ANEEL resolution 652 of December 2003 (see: http://www.aneel.gov.br/cedoc/res2003652.pdf - translation by the author) as "hydroelectric utilisation with a capacity bigger than 1,000 kW and equal or lower than 30,000 kW (…) with a reservoir area smaller than 3.0 km^2". There are two large hydro projects in the hydro portfolio of registered CDM projects in Brazil, however, this exception will not be further considered.

17 of the 22 registered projects are run-of-river plants, while the others use existing dams. Run-of-river projects, according to an Eletrobrás definition cited from a PDD, are projects where "*the river's dry season flow rate is the same or higher than the minimum required for the turbines*". This is why run-of-river plants usually have only minute dams and reservoirs to increase the water pressure. The water is routed downhill through a

[84] Here 10 MW are considered standard for small hydro.

pipe (the "penstock") and into the powerhouse where it drives the turbines. For run-of-river facilities usually Kaplan- or Francis-turbines are used, the former for larger volumes of water and small altitudes, the latter for medium volumes and medium falls (Althaus/Dötsch 2003). The capacity of the CDM projects ranges from 4 to 160 MW, with an average of 36 MW and a total of 800 MW.

Generally Brazil has excellent conditions for the use of hydro power due to its topographical and meteorological characteristics as well as the availability of national, state-of-the-art technology. Apart from the predominant use of large scale hydro (see above), small hydro also has a tremendous potential of more than 7 GW (do Valle Costa 2006). In 2006 476 plants had an installed capacity of 1.67 GW, contributing 1.73% to the electricity mix (GTZ/BMZ 2007). Over 400 existing installations are not active (they were given up on the grounds of low profitability due to extremely low electricity tariffs from large hydro), and could potentially be re-activated (do Valle Costa 2006).

Therefore we ask again: can the CDM play an important role here? Or would CDM registry be a redundant subsidy for a running process? The fact that close to 500 plants are operating raises concerns of additionality. The very limited extension between 1998 and 2005 (see: GTZ/BMZ 2007) on the other hand, could be an indicator for the existence of substantial barriers against an extension of SHP. According to a case study highlighting the contribution of carbon credits to project finance of SHP facilities, IRR increases of 7.5% to 15% are estimated, considering CER prices of 10€ to 18€ (de Souza Leão 2007).

Under the PROINFA, 63 SHP projects were contracted and the 22 registered CDM projects will be joined by another 27 which are in the pipeline[85]. So, with certain extra stimuli, an extension of small hydro projects might be triggered.

4.4.5 Wind energy

Wind energy takes advantage of air currents caused by air pressure differentials. Modern wind turbines capture the kinetic energy of the wind with rotor blades that are attached to a hub and transform it to electricity via a generator. In most cases[86], the rotation has to be transformed using a gearbox to achieve the right frequency for AC generation

[85] Most projects are either PROINFA or CDM projects. There are 14 exceptions though, see: www.eletrobras.com ► programas ► PROINFA

[86] ENERCON (Wobben in Brazil) uses gearless turbines, which is a competitive advantage because the gearboxes are extremely sensitive to wear.

(Althaus/Dötsch 2003). The electric power generated in a wind farm is usually fed into the local electricity grid.

Because wind speed varies, wind energy is considered an intermittent energy source. Like bagasse based biomass, wind energy has a favourable complementarity with hydro power, as the wind profile shows its strongest generation capacity in periods when the reservoirs run low.

Wind energy is the problem child among renewable energy projects in Brazil, irrespective of within or without the CDM. It remains far behind the considerable potential it has, considering the excellent wind conditions in the North-East, South-East and the South of the country. According to the "Atlas do Potencial Eólico Brasileiro"[87] there is a potential of more than 140 GW, while in 2006 15 plants with a joint capacity of 0.237 GW were installed (GTZ/BMZ 2007). Comparing this with more than 18.4 GW in Germany[88] one gets a feeling for the future potential of wind energy in Brazil.

Wind-rich areas are well surveyed (ibid.), measurements stating average wind speed values of 7 meter/second, often reaching more than 8 m/s at altitudes of 50m[89]. An important variable is the capacity factor, which is the average power output during one year, divided by the nominal power of the turbine. In Brazil, most areas are estimated to render capacity factors of 0.3, while in some states in the North-East, a factor of 0.4 can be expected[90] (Molly 2004).

The wind industry in Brazil however is confronted with comparatively high production costs per unit of 70-80 USD/MWh (do Valle Costa 2006) which are incompatible with the usual low electricity prices. Wind energy is very new on the Brazilian market and there is only one manufacturer in the country, Wobben Windpower which is the Brazilian subsidiary of the German market leader Enercon. This situation does not contribute to the expected and necessary cost reduction of wind projects (Molly 2006).

Although the auctions for *new energy* offer substantially higher prices, this is still far below what is needed to run a wind farm, as was shown at the renewable energy auction of 24 May 2007, where wind entrepreneurs participated only symbolically in order to

[87] See: http://www.cresesb.cepel.br/publicacoes/atlas_eolico_brasil/atlas-web.htm
[88] See: http://www.erneuerbare-energien.de/inhalt/4642/
[89] From 4.5 m/s on wind turbines can be run economically in Germany (Althaus/Dötsch 2003).
[90] The average capacity factor in Germany is 2.3 (see: Molly 2004)

demonstrate their potential to the government, at the same time demonstrating that wind energy will not advance in this way [91].

In order to kick off wind energy in Brazil, the technology was included in the PROINFA and allocated with the highest of premium prices of 230 RS/MWh (roughly 85 €). Indeed more than the initially envisaged 1100 MW were submitted and contracted (92 proposals with more than 3,400 MW were submitted for wind energy alone, see: Molly 2004). In later stages however, there were complaints by the project owners/developers that the tariff was still not high enough to run projects economically (see for example: Molly 2004 and 2006) and that therefore, some of the projects might never be built at all[92].

A serious source of delay is the above mentioned supply bottleneck. Besides Wobben, who have full order books until 2009, and the German manufacturer Fuhrländer and Argentine IMPSA, who are to open their plant in 2008[93], there are no other manufacturers who feel attracted to settle in Brazil, due to the uncertainties of the future in the promotion of renewable energy. Since both, PROINFA as such, and the financing facility of the BNDES (also relevant for CDM projects) require national equipment and service quotas of 60%, this supply shortfall poses a serious restriction on the implementation of wind energy projects in Brazil.

While the PROINFA at least gave some push to wind energy, this technology lacks momentum within the CDM. Four projects are registered and only three (!) are in the pipeline. Out of these seven projects, three are at the same time part of PROINFA. It remains to be seen what results the special auction for wind energy will bring, which is planned for 2008.

4.5 Viewpoints of Brazilian CDM stakeholders

In this section a brief summary of consenting and diverging viewpoints of Brazilian CDM stakeholders will be presented. Among the interviewed persons were project owners, project developers, DOEs, DNAs, NGOs and Brazil's scientific community. Except for some e-mail interviews, all interviews were held personally by the author in September and October 2007. Please see Appendices E, F and G for a more comprehensive summary, as well as a list of interviewed persons and the questionnaire.

[91] There was a price roof of 140 RS in the auction.
[92] According to Afonso Pacheco of DEWI do Brasil in an personal interview with the author.
[93] See: www.impsa.com.ar

There is an outspoken consent with respect to the positive contribution of the CDM to the establishment of renewable energies in Brazil, both, on an economic as well as on a consciousness level. Views as to the extent to which this incentive can be considered significant however differ among the respondents. Energy demand would rise much faster than what the small RE projects could provide for, some respondents stated. Additionally, a number of serious obstacles, such as delays caused by the DNA and the UN, exorbitant bureaucracy and transaction costs, uncertainties and the extremely low emission factor in Brazil would hamper a substantial promotion of renewables by means of the CDM.

Different stakeholders identified a variety of RE technologies as promising future options within the CDM, such as rural electrification and urban water heating under the programmatic CDM, biomass cogeneration in the industrial sector, afforestation/reforestation, energetic use of captured methane from pig farming and of waste incineration or pyrolysis, as well as the already established technologies of bagasse cogeneration (also including the use of sugar cane *straw*) and SHP.

Regarding additionality, it is generally accepted that the concept has its right and significance, being part of "the rules of the game". A strict application is considered important due to the linkage with the carbon sectors of the industrialised countries. Consequently it has to be demonstrated and checked. The suitability of the barrier test is viewed rather inconsistently. Some respondents consider the analysis "*adequate and credible*" while others rather judge it "*extremely subjective and non-scientific*". Also the various barrier types are viewed differently with respect to their capacity to prove the existence of significant barriers. Some respondents clearly prefer the investment analysis, pursuant to Step 2 of the AT, as it is considered a more objective tool. Respondents of nearly all stakeholder groups criticise the copy-and-paste manner some project developers prepare the PDDs with.

Most of the interviewees acknowledge that in the past a certain share of non-additional projects "*has slipped through*". There is a unanimous perception of an ever stricter project scrutiny by the EB, a development welcomed by the DNA, DOEs and NGOs. Most respondents would say that the EB generally "*does a good job*" in navigating the CDM. There is however substantial criticism regarding the way the EB communicates, with respect to project-related clarification and review requests. The shortness and vagueness of the EB review requests and the fact that all requests are identical is unanimously criticised by the respondents. Furthermore the ruling on projects by the EB is perceived as extremely inconsistent, which is attributed to the fact that the RIT staff changed and that the members work on their own and seldom meet to coordinate their work. Frequently the outcome would be a situation where out of a group of identical projects some were registered while others would be rejected.

Below, important viewpoints of particular stakeholder groups are summarised. Following the logic of the project cycle the presentation will start with the project owners, who unanimously consider it worthwhile that their company is active in the CDM. When asked whether the expected CDM benefits were considered a decisive factor in the decision to go ahead with the project, more than half of the respondents said that the project would have been implemented anyway.

Project developers, acknowledging the necessity of an additionality check, feel inclined to an interpretation of additionality according to which the existence "*of at least one barrier in relation to the baseline*" would make a project additional.

DOEs share the view that the additionality concept aims at projects that wouldn't have come about anyway. This prevailing interpretation is regarded as meaningful for the avoidance of windfall profits and price deterioration due to a credit inflation (a view shared by NGOs). Furthermore, unlimited project registration would lead to a crowding out of new technologies that often are extremely beneficial but still expensive. DOEs acknowledge that quite a number of projects are submitted to them where it is absolutely obvious that they would have been carried out anyway. Barriers would often be exaggerated and artificial barriers were created. Currently up to 10% of submitted projects would be rejected, lacking additionality being the dominant reason. Of the ones that pass, the vast majority would undergo substantial changes throughout validation. When asked to comment on the perception that sometimes project developers play DOEs off against each other, most respondents explicitly agreed. In the light of ever stricter EB ruling this sort of gaming would soon come to an end however. In general, DOEs were chosen by project developers according to a variety of criteria. In unilateral projects it would be only price and speed, while in bilateral projects criteria such as experience or long-established relations would play a larger role.

A representative of the Brazilian DNA described the performance of the DOEs as varied. Some would not live up to the expected quality requirements, e.g. with respect to the scrutiny of additionality argumentation in the PDDs. They would often raise important questions and then just state “solved”, although no substantiation can be observed. The baseline methodology ACM0002 is not considered suitable for a country like Brazil that has an extremely high share of hydro in the energy matrix. This would create emission factors that are so low that the contribution of carbon finance to project finance is negligible.

Representatives of the German DNA stressed that soon the first projects would request prolongation of their 7-year crediting period and that the resulting re-evaluation would contribute substantially to a further improvement of the entire project scrutiny of the EB.

The interviewed representatives of Brazil’s scientific community reflect the entire range of extreme positions on the existence, significance and credibility of alleged barriers of CDM projects in the country. While one respondent considers the barriers typically referred to be exaggerated and the prevailing technologies of bagasse cogeneration and SHP non-additional, others believe that substantial, credible and robust barriers do exist and that, considering the resulting unfavourable investment climate, the CDM incentives would definitely provide for a decisive “push“. Representatives of science and NGOs share the view however that in addition to the CDM a much stronger focus should be given to sectoral policies to foster the development of renewable energies, not only in Brazil but throughout the developing world.

5 Empirical evidence: an analysis of validated and registered renewable energy CDM projects in Brazil, with regard to the application of the barrier analysis

5.1 History of project submission and registration

Before being formally registered by the CDM executive board, projects have to be approved by the Brazilian DNA, which requires prior validation by a DOE (see above for details). Theoretically, the point in time of project validation and submission to the DNA is one and the same. This is because after a positive validation, the project developers have a strong interest to move ahead quickly with the approval of the host country. Of course in real life there are possible circumstances that might cause these points in time to fall apart, but for the further appraisal these special cases shall not be considered. Hereinafter, the universe of all of the Brazilian renewable energy CDM projects will be divided into the following groups:

- *Registered projects*, including those that only have requested registration or are currently under review;
- *Validated projects*, that is, all projects that have been submitted to the DNA, excluding the registered projects[94]. This subset contains projects with a LoA of the DNA that haven't officially requested registration yet, others that are under revision by the DNA and some that only recently have been submitted to the DNA. Note that from here on, the term 'submission' refers to the submission to the DNA, not to the EB. All of these projects have in common that they have been positively validated by a DOE but haven't yet entered the official EB registration procedure;
- *Rejected projects,* which have definitely been denied registration by the EB;
- *Others,* projects in earlier stages of the project cycle, which won't be further considered in this paper[95].

There are 64 projects belonging to the sample of *registered projects* (only 3 of them either being under review or having only recently asked for registration). Exactly the half, 32 projects are *validated projects*, again about half of them already with an approval by

[94] Of course in the strict sense all registered projects are validated too, *per definitionem*. What is meant here are projects that are "only validated" and not yet registered.
[95] Although some projects may indeed have been validated positively and may just not have appeared on the DNA website yet, this is a special case and will also not be further dealt with.

the DNA. Only two projects have been rejected by the EB, one of which was rejected on the grounds of insufficient additionality demonstration (Cargill Uberlandia Biomass Fuel Switch) and these will not be further considered here[96].

Figure 19 shows the chronological development of project validation and registration of Brazilian renewable energy CDM projects:

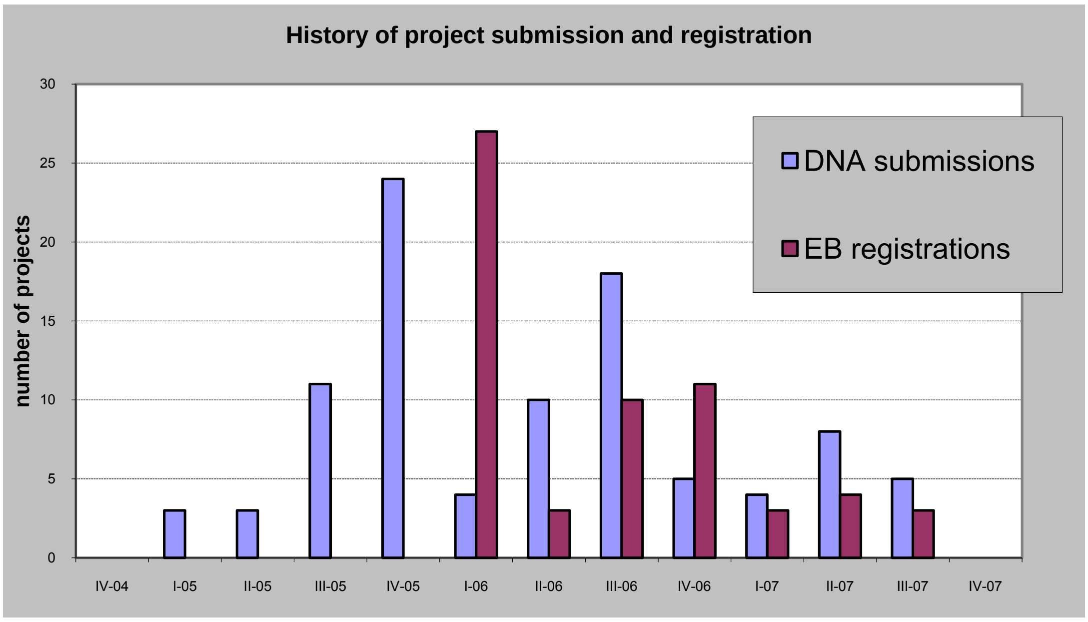


Figure 19: Chronological development of Brazilian RE CDM projects

The light blue columns denote submitted (validated) projects and the dark purple columns represent registered projects. At any given period of time *t,* the subset of *validated projects* can be calculated as *submitted projects cumulated*$_t$ minus *registered projects cumulated*$_t$. When analysing the graph, one gets a feeling for the time gap between project validation and final registration, especially in the beginning of the registration practice. One also can clearly perceive a certain slowdown in the Brazilian CDM process[97].

[96] Due to the fact that the Cargill Uberlandia project had used the investment analysis the case would not have provided deeper insight in the topic under research here anyway.

[97] Of course the figures only represent the renewable energy projects as defined in section 4.4.1 above. The overall development however is not much different and presents a sharp contrast to the development in China and India.

5.2 Quantitative and qualitative analysis of validated and registered projects

In the following appraisal, the barrier demonstration of small scale projects will not be distinguished from the barrier analysis of the additionality tool. Firstly, many small scale projects use the "large" additionality tool (see below), especially among the subset of registered projects. Secondly, although small-scale projects benefit from "simplified modalities and procedures", according to para 3 of the Appendix B of this document, they too have to demonstrate "(…) *that the project activity would otherwise not be implemented due to the existence of one or more barrier(s)* (…) (see EB07, Annex 6). So therefore, the prohibitive nature of barriers is also to be substantiated here, just as with large projects. This is especially important as the Certified Emission Reductions (CERs) stemming from small-scale projects, which as we know, lead to extra emissions in industrialised countries, add up to a considerable amount[98].

5.2.1 Quantitative analysis

Only 8% of the registered projects use Step 2 of the additionality tool (the investment analysis) in order to demonstrate additionality[99]. Of these five projects, just three use *only* the investment analysis while two present the investment analysis *and* the barrier test. In the sample of validated projects 28% use the investment analysis (9 projects), less than half of them (4) exclusively.

Although roughly 40% of the registered projects are small scale projects, only 20% use the simplified small scale additionality demonstration according to Attachment A to Appendix B. This means that half of the small scale projects use the (stricter) additionality tool for large projects, which can be interpreted as a sign of goodwill. Also in the subset of validated projects, about 40% are small-scale but here nearly all of them (38%) use the simplified small scale tool.

While the first fact, the more frequent use of the investment analysis, could be an indicator for an improved and more substantiated additionality demonstration among the recently developed projects, the fact that small scale projects consequently use their simplified option, might point in the other direction. We will examine further below which

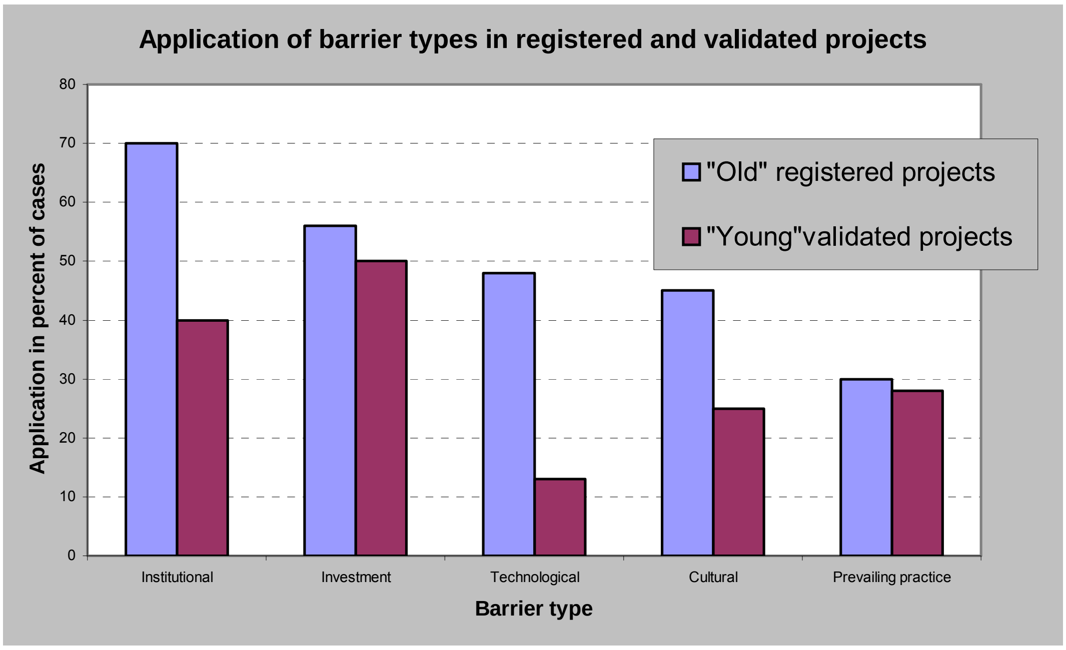
[98] Just the expected CERs from the small-scale, registered, renewable energy projects in Brazil add up to 1.6 million tonnes of CO_2e annually.
[99] As a reminder: project developers may choose between Step 2 and Step 3 of the tool.

of the two influencing factors will have a stronger effect on the quality of additionality demonstration.

Among the 64 registered projects the institutional barrier was the most frequently used[100] with 70% of all cases, followed by the investment barrier with 56%, the technological barrier with 48% and cultural barriers with 45%.

In the younger subset of validated projects the investment (50%) and the institutional barrier (40%) have swapped places but are still the most frequently used, while technological barriers (13%) seem to have lost relevance, being surpassed by prevailing practice (28%) and cultural barriers (25%).

Figure 20: Use of barrier types in the project subsets



When performing the same analysis limited to only certain sectoral scopes, or specific project developers respectively, the application patterns become even clearer: 77% of SHP projects use the investment barrier and 60% use the institutional barrier. 96% of bagasse cogeneration projects use the institutional and the cultural barrier, followed by 77% of technological barriers. It comes as no surprise then, that individual project developers also show specific barrier patterns: bagasse specialist Econergy uses

[100] In this appreciation the barriers are analysed and counted in the very way that project developers had called them, irrespective of their logical content. Further down we will take a look at what is behind these concepts.

technological barriers in 90% of their PDDs, followed by institutional and cultural barriers with 76% each. Hydro focused Ecoinvest use investment barriers in *all* their PDDs, followed by institutional barriers in 85% of the cases.

5.2.2 Qualitative analysis

Having determined the barriers most frequently used to demonstrate project additionality, it is worthwhile taking a closer look at the "inner content" of the barrier argumentation. In order to briefly recall the rationale of the barrier test, the presented barriers must be realistic, credible and *prevent* the project implementation *if the project is not registered as CDM project*. The logic of the last subclause is further underlined by the explicit stipulation that "*If the CDM does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional*." (version 3 of the additionality tool, p.7). Barriers shall be based on "*transparent and documented evidence*", such as legislation, studies, statistics, market data, independent expert judgements etc.

According to Sub-step 3b of the additionality tool, PPs need to demonstrate how the barriers that have just been identified in the previous step "*would not prevent the implementation of at least one of the alternatives*" to the project activity (see above, sections 3.3, 3.4). In most of Brazilian renewable energy projects, especially the cogeneration projects, the only alternative to the project activity is *not* to do the project, that is, continuation of the current situation.

5.2.2.1 Institutional barriers

Although the term institutional barrier is mentioned nowhere in the additionality tool (it is however introduced in Attachment A to Appendix B; see above: section 3.3), the vague formulations "*Such (…) barriers may include, among others:*" and "*Other barriers, (…)*" (see: version 3 of the additionality tool, p.7) leave it up to the project developers on how to fill in this void.

The main arguments regarding institutional barriers are the unstable regulatory situation in Brazil and the weak position of independent energy producers (see above, section 4.1.2 and Appendix G: other stakeholders). With the beginning of the privatisation of the energy sector in 1995, legislation kept being changed back and forth ("The reform of the reform", see: do Valle Costa 2006), which created an unfavourable investment climate due to substantial regulatory risks. The failure of the policies to keep up the capacity extension with the rising energy demand led to severe power shortages and in consequence to a paradigm shift towards natural gas: the thermoelectric priority plan PPT that envisaged 40 thermoelectric power plants fuelled by Bolivian natural gas. The unpredictability of the "regulatory chaos" also led to extremely volatile electricity prices, which make sound investment planning very hard. This is aggravated by the lack of guarantee that "self-producers" of power would get a chance to sell their electricity to the grid. On the contrary, the "concessionaires" (local utilities) were unwilling to accept the independent producers and showed prejudices regarding the "*unreliable, seasonal and fluctuating*" energy sources.

One project developer mixes the institutional barrier with cultural barrier aspects and argues that sugar mills are largely family businesses that do not want to get involved with the electricity sector and "*external financial agents*".

In the section "Impact of CDM registration" however it is merely stated that "the registration (…) will contribute to overcome *all* the barriers described in this tool", although it is not shown how. There is no word on how the CDM registration removes the regulatory or institutional risks. So, although it can be acknowledged that the stated barriers are likely to complicate or in some cases even impede the implementation of a certain project, the demonstration does not comply with the requirements of the additionality tool and thus is not a valid argument. This is true as long as it cannot be shown how the CDM registration removes this particular barrier. Some doubts concerning the additionality foundation may arise when considering that 70% of the registered projects base their additionality demonstration on institutional barriers.

5.2.2.2 Investment barrier

Before typical arguments are summarised, the term investment barrier needs some clarification. In the simplified additionality demonstration pattern pursuant to Attachment A to Appendix B, an investment barrier means that "*a financially more viable alternative to the project activity would have led to higher emissions*". This concept is similar to the rationale behind the far more complex investment *analysis*, Step 2 of the large scale additionality tool, where it must be demonstrated that the proposed project is unlikely to be the most financially attractive alternative or financially attractive at all. The barrier test, Step 3 of the tool, however suggests investment barriers "*other than the economic/financial barriers in Step 2 above*". As already outlined above (section 3.4), what is meant here are situations in which similar activities only become viable due to some "*grants or other non-commercial finance terms*" to which the project proponent has no access, *or* a lack of access to loans from the capital markets to finance the project. As we will see in the course of this chapter, basically none of the Brazilian project developers followed this generic idea of investment barrier. What they did instead in the majority of cases, was to conduct a financial analysis similar to the description in Step 2, only *without* the sensitivity analysis, because the latter is of course not required in Step 3. It is debatable whether this is consistent with the requirements of the tool, but since the wording is so vague (see above, "Institutional barriers"), it cannot really be held against the project developers.

In most of the cases where the investment barrier is used, the project developer compares the projects' Internal Rate of Return (IRR) to specific benchmarks, like the interest rate of the loan or the missed interest for an alternative financial investment (opportunity costs). In almost all of these cases the major part (up to 80%) of the project costs were financed on a debt finance basis, by a loan from the Brazilian development bank (BNDES – Banco Nacional de Desenvolvimento Econômico e Social). The interest rate for these loans varies from 13% to 15% p.a.. It is never pointed out however, on what basis the remaining part of the project costs are financed. Therefore one can guess that it might be equity.

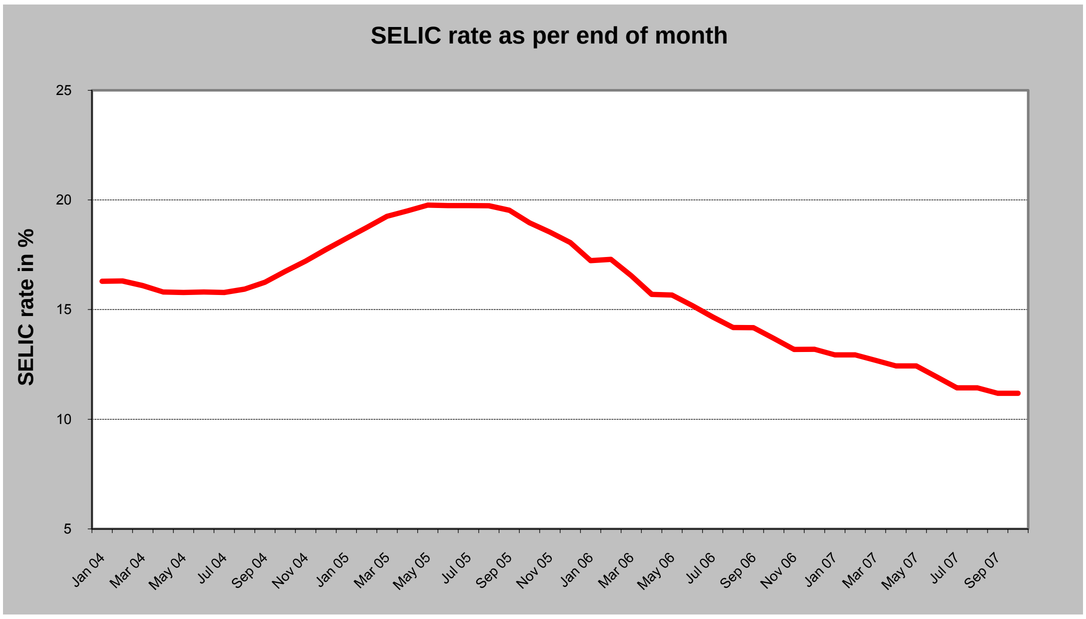


Figure 21: Development of the SELIC rate

Own illustration, source: Brazilian Central Bank data (see: http://www.bcb.gov.br)

The second benchmark is the SELIC, the Central Banks' overnight lending rate (Sistema Especial de Liqidação e de Custôdia, see: The Brazilian Central Bank, www.bcb.gov.br). The SELIC rate is indexed to the LFT one-day government bond that accounts for 57% of domestic debt in 2005 (ANDIMA 2005). This bond is considered a worthwhile and reliable alternative asset for any equity holder to take advantage of. The SELIC rate has gone through a turbulent phase in the late 90ies with peaks at 45%. At the beginning of this decade it has oscillated between 15% and 20%, with the exception of mid 2003 when it went up to 25%. Figure 21 shows the development since 2004:

In order to evaluate the project developers' argumentation, we have to take a look at the concept of the IRR. The IRR is the discount rate at which the Net Present Value (NPV) of all financial flows of an investment is just zero. (Wöhe 2002). This means that a project turns profitable when its IRR is higher than the relevant benchmark interest rate. The decision with which benchmark to compare the IRR depends on the way a project has been financed. If it is debt financed, that is through a loan, the interest rate of the loan must be lower than the IRR in order to provide a positive NPV. If a project is equity financed, the yield of an accessible alternative investment, that is, the missed returns, should be lower than the projects IRR in order to render a positive NPV (Bitz 2004).

So if a project's IRR (without the consideration of possible income streams from carbon credits) is lower than the SELIC rate, as was often the case until 2003, textbook economics will tell us that the rational investor should opt for the government bond. But this argument only holds if the project is indeed equity financed. It can be assumed that loans from the Brazilian Development Bank are project bound and that the financial means cannot be deviated to speculative alternative investments.

Returning to the actual investment barrier argumentations: while all projects were to a large extent financed by BNDES loans at interest rates of 13-15%, the respective project developer keeps comparing the projects' IRR with the SELIC rate at the time of decision making, an argumentation which is clearly improper, as we have just seen. In many cases the IRR (without carbon) is higher than the loan interest, which makes the project profitable and hence turns the barrier into a "no barrier". There are cases where the IRR (without carbon) is even higher than the SELIC rate and it is argued that this spread would make out for the fact that the project is much riskier.

Indeed, risk is a topic worth looking at: in the PDDs it is frequently stated that the investment in a government bond holds significantly lower risks compared with a renewable energy project. This might be true in a short term perspective. But, as the chart in Figure 21 above indicates, government bonds may also lose their value, while in the long run, renewable energy projects, especially those with well established technologies such as hydro-power, have operational spans of 20 to 30 years. So from an ex-post perspective, the risk argumentation was clearly proved wrong. It is evidently improper to compare a one-day bond to an investment with a lifetime of several decades (Michaelowa 2007).

With respect to the comparison of the project IRR with a certain benchmark another frequent constellation can be observed: neither the IRR without the consideration of carbon related income streams, nor the IRR with carbon are higher than the lowest benchmark. While this type of situation might be adequate if discussed in the financial analysis pursuant to Step 2 ("...*if the project is unlikely to be financially attractive*..."), this is definitely incorrect in the barrier analysis as in such a situation, the CDM registration does not remove the alleged barrier. As outlined above, such a project is to be considered non-additional. Supposing that nobody voluntarily starts projects in order to destroy capital, such a situation either means that a PP would have done the project anyway, even facing losses, due to other reasons, such as prestige or energy security. It may also mean that his IRR calculations are manipulated in a way that the project looks less attractive than it really is. It is hard to tell where the truth really is in such cases. But when taking the additionality tool and its rules seriously, this type of barrier demonstration is invalid.

Of course, investment return expectations on the one hand and levels of risk aversion on the other, differ from company to company, what makes a generally accepted and binary discrimination additional/non-additional impossible. The CDM however is not made to account for all intricate differences in company investment behaviour, as the environmental integrity of the system has to be safeguarded (Langrock et al. 2000).

In some PDDs project proponents just claim "*high project costs*", "*high interest rates*" or "*a low probability of a positive economical feasibility*" as investment barriers, while one PDD simply states "*It has proven very difficult to find partners and potential investors for the project development*", without any substantiation whatsoever. In the same paragraph it turns out that the respective project owner could have received BNDES funding, it just would have taken too long for them and so in the end they financed the project on an equity basis. So what they actually explained was that, while business sometimes is cumbersome, in the end there were *no* barriers.

In conclusion it can be said that the investment barrier is applied in an extremely inconsistent way, at best poorly substantiated and without a sensitivity analysis, but often simply trivial or even contradictory. Given that right after the institutional barrier, this barrier is the second most frequent pillar of additionality demonstration, again serious doubts regarding the quality of the application of the barrier test arise.

5.2.2.3 Technological barriers

According to the small scale simplified additionality assessment of Attachment A to Appendix B, a technological barrier means that "*a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new the new technology adopted for the project activity and so would have led to higher emissions*". The additionality tool elaborates more on this aspect, suggesting "*inter alia*" the lack of skilled labour to operate and maintain the technology, which leads to an unacceptably high risk of equipment disrepair or underperformance, the lack of required infrastructure (for a certain technology – not in general!), the higher risk of technological failure under particular local circumstances, or finally that a certain technology simply isn't available in the relevant region.

One project developer pointed out in some of his PDDs that the applied cutting-edge technology comes from Germany requiring extremely precise operation and hence specialised labour, and that therefore all technical assistance and replacements had to come from Germany, which is a plausible argumentation in line with the tool. Another project developer claims the lack of transmission and communication lines in the area, and states that x km of transmission lines had to be built. Building transmission lines surely presents no technological barrier. Depending on who paid for the transmission lines the construction might contribute to the project costs. If so, these costs have found their way into the IRR calculation and should be dealt with elsewhere. Furthermore it is claimed "*hard to find qualified individuals in the construction, operations and maintenance*" of the project. The question is whether this barrier really is apt to prevent the project implementation, or whether it isn't just a generic business difficulty any entrepreneur faces and which can be removed by either offering higher wages or by training staff. Corresponding costs can then be discussed in the investment analysis. Further down in the same document under "*other barriers*", it is stated that the PP received technical support of the technology manufacturer "*throughout the entire process*"!

In one of the PDDs, the following technological barrier is presented: "*Biomass furnaces are more laborious than LPG furnaces and required hiring and training of new workers. The activities related to biomass required a larger stock area, storage of biomass and transportation of biomass from storage area to the furnaces. The activities related to the LPG were much simpler than that (…) without human intervention.*" It is really hard to see a technological *barrier* here and it is definitely concerning when the demonstration of additionality is based upon such trivial and empty complaining. Besides, hiring and training of staff should be a "noble task" for PPs that in the introductions of their PDDs boast about the enormous sustainable development impact of their projects!

The bulk of technological barriers can be found "copied and pasted" in all the bagasse cogeneration PDDs of one particular project developer. The argumentation is based on a study of 1999 and does not consider the individual project at all. It rather explains generally that although the Rankine-Cycle technology is well known in Brazil (thus no technological barrier!) there is no incentive for sugar mills to move away from their inefficient low pressure boilers because the resulting unitary costs would be too high given the scale of the plant. Moreover, high efficiency boilers would not be considered due to "conservativeness, lack of knowledge or even lack of interest". While the first argument should be discussed in a financial analysis, the latter is more a cultural barrier and almost impossible to prove. It is concerning that first, the mentioned study is rather outdated and second, that this is just a very general perception, which is not considering the individual project.

5.2.2.4 Cultural barriers

Cultural barriers are a true invention of the PDD writers as they had neither been introduced in the small scale additionality pattern nor in the tool. Cultural barriers are usually claimed with respect to the bagasse cogeneration projects and are laid out very briefly in the PDDs, like an "extra", backing up the previous additionality arguments. It is said that the sugar mills were used to fixed prices, subsidies and commodity trading with its own characteristics and thus the marketing of electricity would mean an extreme deviation from their core business model. Based on a study from 1994 (!) it is claimed that a lack of managerial capacity would prevent the sugar mills from undertaking "investments in new technologies", speaking again for the whole sector instead of an individual project, as previously verified above.

5.2.2.5 Prevailing practice barriers

The term *barrier due to prevailing practice* was first introduced in the simplified modalities and procedures for small-scale project activities (Attachment A to Appendix B), stating that "*prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions*". In the (large-scale) additionality tool, the barrier due to prevailing practice gains another significance, hinting at project types that are the "first of its kind". While the first interpretation is more focussed on the "investment environment", the second reading aims at the quality of the project itself, or better its innovative character in a certain environment.

In the Brazilian project design documents, the prevailing practice barrier frequently occurs and is being used by all project developers. In most cases the perspective of the respective decision maker or rather, the investor, is pointed out: the implementation of the proposed project activity would be a "*deviation from the core business*", it would further "*rather complicate than alleviate the management, while the trend* ("outsourcing of energy generation") *would point in the opposite direction*". These are arguments very similar to those of the cultural barrier.

One project developer has presented exactly the *cultural barrier* of one of his PDDs as a *prevailing practice barrier* in another (that the sugar mill industry is used to commodity trading and therefore unwilling to engage in long-term PPAs). Another project developer repeated exactly the same arguments (in slightly different wording) he had just given previously regarding technological barriers (biomass handling resulted in higher operational costs, LPG operation was so much easier, we had to train staff…etc).

Wind energy proponents stress the second reading of the prevailing practice concept, the "first of its kind" interpretation. They state that in 2005, only 0.03% of the generated electricity in Brazil came from wind energy and that this has to do with the high generation costs compared with the prevailing large hydro. One project developer substantiated the "first of its kind" claim with exactly one sentence ("*There is no similar project that uses wind power generated electricity in oil production activities in Brazil*")! The question is, whether a good idea is automatically prevented by prohibitive barriers just because it is new.

The same holds for cogeneration of agricultural residues: one prevailing practice barrier is substantiated by the two sentences "*Using biomass waste as fuel for electricity* *generation is not a standard waste management practice in Brazil (…). The project activity is, therefore, highly unlikely to be the natural choice.*"

An innovative interpretation of the prevailing practice concept was chosen by one project developer: the prevailing *business* practice, stating that "*the prevailing business practice in Brazil as far as obtaining financing and financial guarantees to project is a barrier to investment (…)*".

Another typical line of argumentation follows more the first reading of the prevailing practice concept, stating that it would definitely be prevailing practice in the *country* to set up large hydro and thermoelectric plants and that the introduction of programmes like the PROINFA were proof that small renewable plants are *not* prevailing practice.

In conclusion, the lines of reasoning presented here do show in what way the implementation of projects is complicated by certain aspects related to the country- or company-specific situation. However, they fail in demonstrating both how exactly the barrier(s) prevent the individual project, and how the CDM registration might alleviate the barrier(s).

Before turning to the overall performance of the barrier test, it remains to be said that the barrier argumentation in the analysed PDDs was extremely inconsistent and confusing. Frequently logical errors became evident, institutional barriers were presented as investment barriers, economical and cultural barriers as technological barriers and so on.

5.3 Attempt of an evaluation of the quality of the barrier analysis

5.3.1 Method

In order to illustrate the quality of the additionality demonstration of the analysed projects, and in order to make it comparable, a scoring method was developed by the author for this paper and applied to all the respective 96 PDDs. Points were attributed for certain facts regarding the barrier tests. The rating procedure was calibrated in a way that one plausible, documented and substantiated barrier in one PDD could outdo the conglomeration of various unsubstantiated allegations in another. This is achieved by the following criteria: each barrier presented receives one point, unless it is so contradictory, or apparently *no* barrier, or it is a mere repetition of another barrier. Arguments like "*we* *couldn't find external funding so we financed the project ourselves*", or "*we received continuous technical assistance from the manufacturer*" will receive 0 points.

What is counted are the barrier categories, as laid out above, which means that if under an *institutional barrier* various arguments are presented, it still counts as one barrier, that is, a single point. This is justified by the impression that in most cases a barrier was established around one main idea and that additional arguments were collected to back up the first aspect in a "brainstorming" manner.

Extra points are attributed according to the motto "demonstration, documentation and foundation". With demonstration it is meant that through the argumentation it becomes clear, how exactly a barrier prevents the project and how the CDM removes or alleviates that barrier. Documentation can be an IRR or a cash flow analysis, a study or a government decree that refers to the specific project circumstances. Foundation in this context means an explanation of the robustness of the previous argumentation and is best operationalised by the means of a sensitivity analysis. For each of the three elements 2 extra points are attributed in addition to the one point of the respective barrier (e.g.1+2+2+2). However, the one point for the barrier is dominant, which means that even if an argument is well documented and substantiated, while at the same time the main statement itself rather suggests the non-additionality than additionality, the extra points too become null and void (e.g. 1+2+2-(1+2+2)). It does not matter for example, how well the statement "*my IRR is 17% while the interest of my loan is 15%*" is substantiated, as this is clearly an invalid argument to demonstrate additionality.

So, in consequence, a PDD with a perfectly well substantiated investment barrier plus 2 plausible but unsubstantiated other barriers would receive 1+2+2+2+1+1 = 9 points, while a creative summary of five unsubstantiated arguments would only receive 1+1+1+1+1 = 5 points.

5.3.2 Assumptions

It can be assumed from the various expert interviews, that at least some of the Brazilian renewable energy projects are additional. Further assuming that the quality of the barrier argumentation at least serves as a proxy for the additionality of the project, the spread of barrier scores shall represent the span from "very well substantiated" to "clearly insufficient". The projects with the best scores therefore set the standard. Projects with medium scores can be considered as “critical projects” as here the classification to either one side or the other largely depends on individually subjective interpretations.

5.3.3 Limitations

The above developed method faces clear limitations, one of which has already been mentioned. Even if the quality of the barrier argumentation is correctly reproduced by the scoring procedure, it can at the most serve as a proxy for the additionality of the project. Projects with well elaborated PDDs might still be completely non-additional while projects with low scores due to poor argumentation might never have been implemented without the CDM. Such contradictory cases however should be rare exceptions while in most cases the quality of the argumentation correlates with the additionality of the project.

Second, the method is clearly subjective. What is contradictory or trivial according to the author’s understanding might be plausible and significant to someone else. Acknowledging this, the method still is consistent in itself, so even if the score 7 would not *mean* “satisfactory” and the score 3 would not *mean* “insufficient”, the two evaluations do allow for a comparison. Plus, over the sheer number of analysed projects, individual mistakes should balance each other out.

5.3.4 Complications

The already challenging task of moulding a universe of different arguments into a handful of scores was further complicated by two difficulties: the PROINFA issue and the fact that many project developers used Step 2, the investment analysis (which actually is not subject of this investigation) *and* the barrier analysis at the same time.

As already pointed out above the PROINFA is a programme for the incentivation of renewable energy projects that *per definitionem* makes projects viable and hence non-additional. In order to avoid a possible perverse incentive of the CDM on developing country governments, *not* to introduce emission reducing programmes in order *not* to lose the CDM potential, the E- decision was taken by the executive board. The actual wording is as follows: “*National and/or sectoral policies or regulations that give comparative advantage to less emissions-intensive technologies (…)(e.g. public subsidies to promote the diffusion of renewable energies (…).”* These policies and regulations *“that have been implemented since the adaptation by the COP (…)(*at Marrakech in 2001*) need not to be taken into account in developing a baseline scenario* *(i.e. the baseline scenario could refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place)"* (see: Annex 3 to the report of EB 22, omissions and insertions by the author). This is generally interpreted such that PROINFA[101] projects can become CDM projects. But what does this mean *exactly*? Is additionality now granted automatically, so to speak – just because profitability and the lack of investment barriers cannot be held against the additionality requirement? How to evaluate such projects with respect to their barrier test application? It will come of no surprise that a PROINFA project like Aquarius has an IRR of 21.3% *without* carbon which, compared with the SELIC rate of between 15.8% and 17.8% at the time of decision would leave the project clearly non-additional.

In order to to take this complication into account in the evaluation of the barriers, several options were considered. The 14 projects that are simultaneously PROINFA and CDM projects could have been taken out of the consideration, or "correction factors" could have been introduced to make up for the fact that project developers cannot use their investment barriers, as the PROINFA membership "destroys" this option. The latter approach would however be extremely arbitrary. In the end, taking a look at the actual outcome of the evaluation of the aforementioned "hybrid" projects, it turns out that the scores range from 0 to 9 and that the PROINFA issue would therefore not distort the overall results. This finding shows that, even under PROINFA some project developers took their additionality demonstration quite seriously, while others obviously considered the E- decision as a free riding invitation with respect to additionality. Thus it seems only fair to account for these differing approaches by treating the respective projects like all others.

Regarding the investment analysis, we have found above that in 7 PDDs only the investment analysis pursuant to Step 2 of the tool is used, while in another 7 PDDs the investment analysis *and* the barrier analysis of Step 3 are used to demonstrate additionality. Here too all 14 projects could have been taken out of further consideration, an option always considered as second best by the author. Another option would have been to simply exclude the 7 projects with only an investment analysis. But then of course the remaining 7 projects could have been judged only by the content of the barrier analysis. Acknowledging that voluntarily undertaking both steps demonstrates a considerable degree of good will by the respective project developers, and further acknowledging that the investment analysis already constitutes a quite laborious

[101] PROINFA was indeed introduced between 2002 and 2004, that is, after Marrakech and is therefore eligible to E-.

procedure, the mere consideration of the remaining barriers might create an unfair bias against the respective projects.

The approach chosen by the author moves away from the structure of the additionality tool and the differentiation between the investment and the barrier analysis. The investment analysis can be considered as a barrier demonstration in line with the criteria of the evaluation method described above: barrier (1), demonstration (2), documentation (2) and foundation (2). Consequently for every investment analysis 7 points were attributed and – where this occurs in addition to a barrier analysis – added to the points for the barriers.

5.3.5 Sample separation

In the following section, the barrier test scores will be presented for different subsets of the project universe. While some of the subsets do not need any further explanation (technologies, DOEs or project developers), the separate consideration of "old" registered projects and "younger" validated projects deserves a little background: as we have seen earlier, the process of project scrutiny through the CDM executive board has lived through several stages in the past and it is common understanding that the criteria have become stricter and to some extent more consistent. This development can be attributed to the accumulation of experience but can also be related to institutional elements, like the creation of the RIT or the counter check through the UNFCCC secretariat (see above, section 2.5, p.11). The increasing strictness can be illustrated through the increasing number of reviews by the EB. Figure 22 shows the historical development of project submissions of Brazilian renewable energy CDM projects as in Figure 19 above and at the same time contains the quarterly numbers of reviews due to additionality concerns. The fact that the former dimensions are related to Brazil and to one sector only, while the latter relate to the world and the whole sectoral scope is no contradiction. Most project developers are global players and the review and rejection practice is commonly known world wide. There is a perception that they react quickly to signs from the EB on interpretation of additionality testing (Michaelowa 2005c).

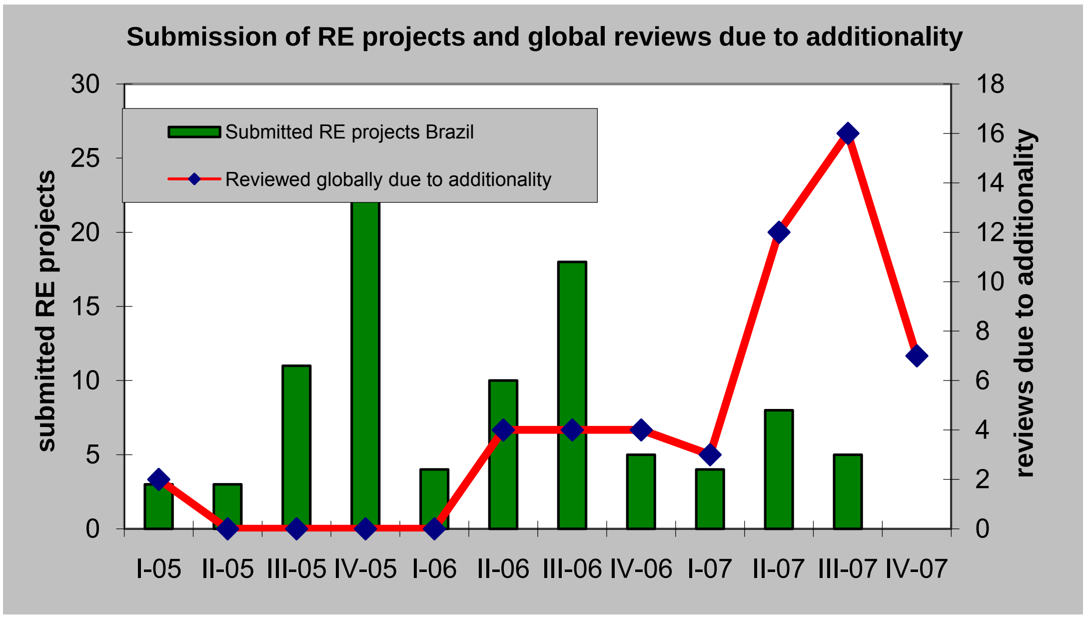


Figure 22: Submission of RE projects in Brazil in light of strictening additionality scrutiny

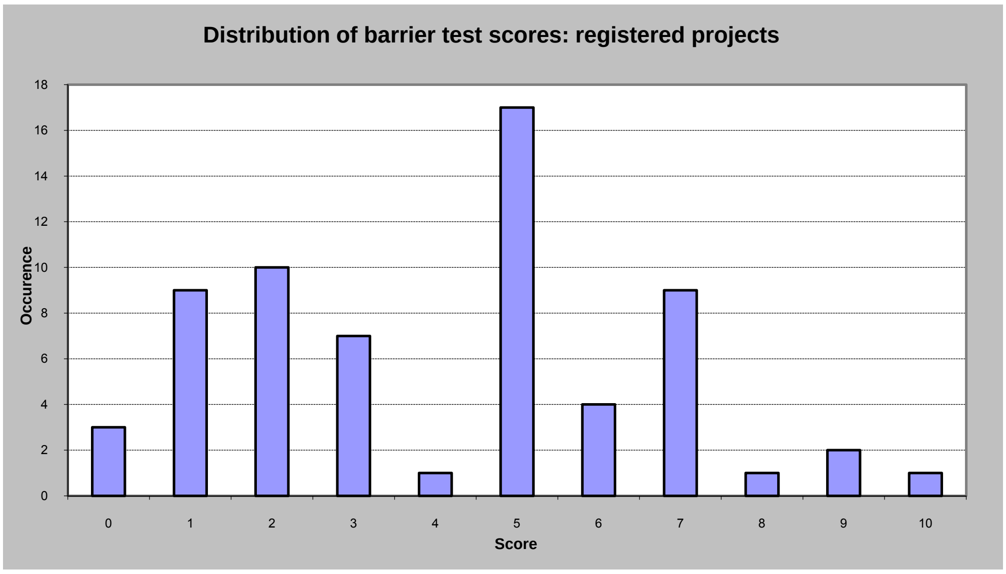
It can be expected that recent projects were developed under the impression of the "*new paradigm*" that became apparent by the recent review and rejection practice. We will therefore consider the "*younger*", that is, validated projects seperately in order to find out, whether the perceived stricter project scrutiny of the UN has led to a different quality of additionality demonstration.

5.4 Findings of the evaluation

5.4.1 Registered versus validated projects

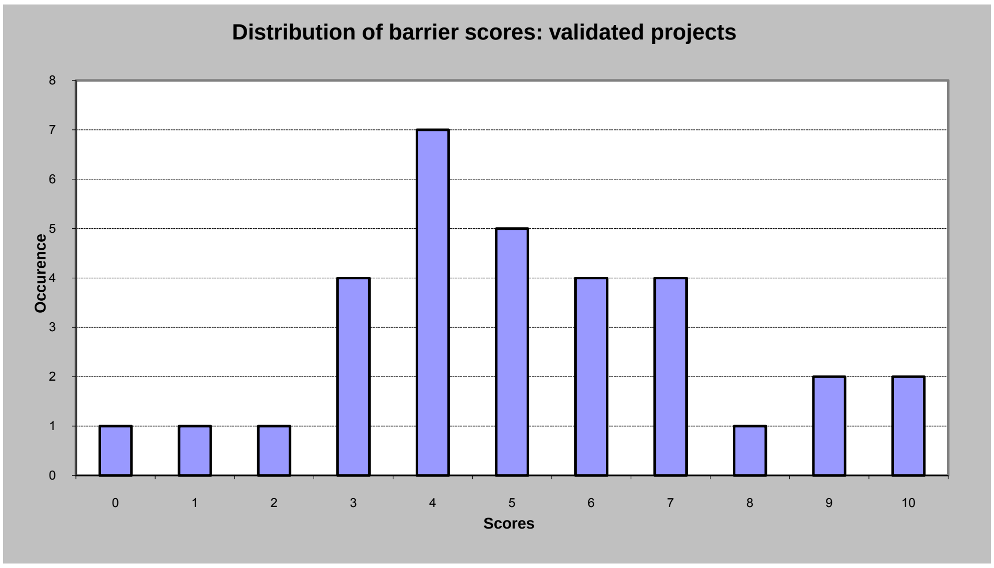
The subset of registered project has an average score of 4.1.
Figure 23 shows the distribution of scores for this sample. One can clearly identify the bulk of projects with an intermediate score (most of them belonging to one project type - the bagasse CHP projects) and a rather high share of below-than-average scores.

Figure 23: Barrier test scores of registered projects



The “younger”, more recent sample of validated projects shows a completely different distribution of barrier test evaluations, with an average score of 5.2.

Figure 24: Barrier test scores of validated projects



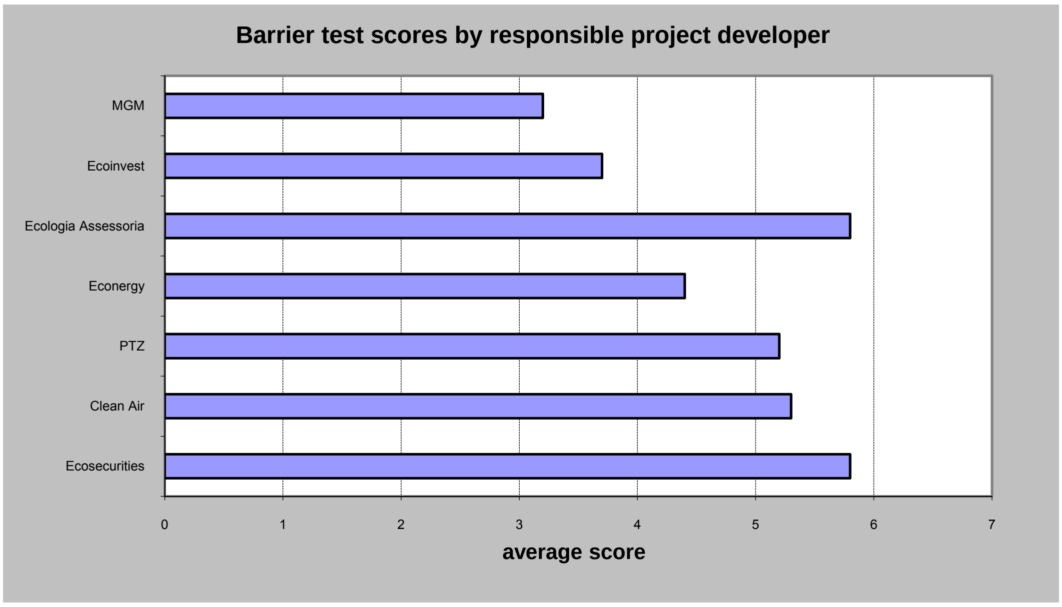
Remaining aware of all the above mentioned limitations to the evaluation method, the fact that the sample of more recent projects displays a higher score could be seen as an indicator for the impact of a more stringent project assessment through the UN bodies. At least under this evaluation method, the more frequent use of the investment analysis has had a stronger impact on the outcome compared to the more frequent use of the small scale barrier assessment pattern according to Attachment A to Appendix B.

5.4.2 Project developers and DOEs

So, according to this finding, project developers and DOEs seem to have learnt their lesson. A more detailed look at their respective outcome will emphasise this perception.

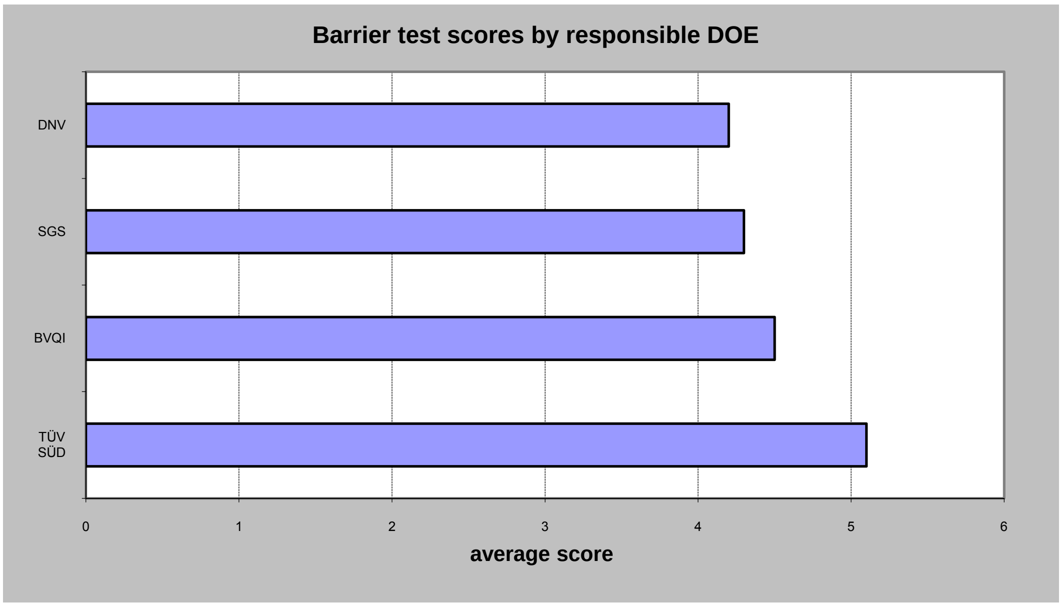
Starting with the most important project developers, Ecoinvest has an average score of 3.7. There was a significant improvement between past projects and recent ones, the score going up from 3.2 to 6.0. Econergy holds an average score of 4.4, their initial score of 4.6 plunging to 3.6 however. Their competitor Ecosecurites was attributed the best average score of 5.8, improving from 5.4 to 6.4. Project developers with smaller market shares are MGM with 3.2, PTZ with 5.2, Clean Air with 5.3 and Ecologia Assessoria with 5.8.

Figure 25: Barrier test scores of project developers



DOEs show a more balanced level and only one of them stands out. DNV holds an average value of 4.2 (4.1/4.7), SGS of 4.3 (2.6/5.5) and BVQI of 4.5. Only TÜV SÜD reaches a score of 5.1, going up from 4.9 to 5.8. According to the outcome of the present evaluation pattern, the performance of project developers and DOEs varies substantially. But basically, all of them seem to have “understood the message and done their homework”.

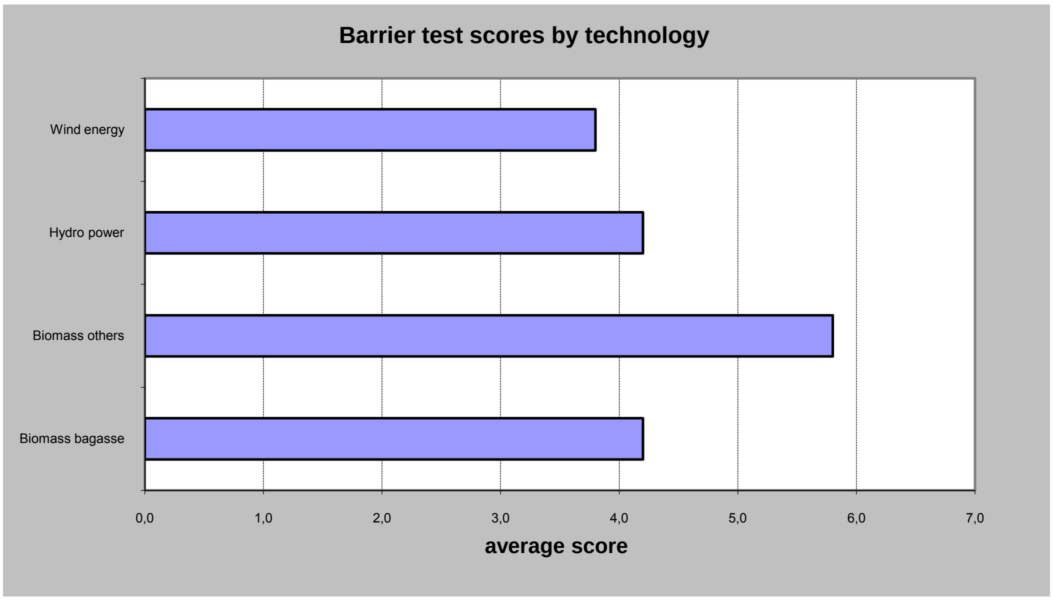
Figure 26: Barrier test scores of DOEs



5.4.3 Sectoral scopes

Also the different technologies show specific characteristics regarding the quality of additionality demonstration, displaying a significant difference between wind energy and biomass using agricultural and forestry residues. Wind energy projects especially show an extremely high variability, scores ranging from 0 to 9.

Figure 27: Barrier test scores of different project types



5.5 Case studies

In the following section we will take a closer look at three projects, one from the low end of the score span, one from the upper end and one from the medium range. Unless otherwise indicated, all information is taken from the project design documents or the validation reports[102].

Both, the low and the high score examples are projects prepared by the same project developer but differ with regard to their technology. They were chosen because they demonstrate clearly the common strengths and weaknesses of the barrier argumentations. The high score example achieved its rating without the “extra push” of the investment analysis, just by employing a comprehensive and plausible barrier analysis. The medium score example was chosen because it was the first of a certain kind und hence served as a blueprint for a whole range of projects (with almost identical PDDs).

In the case of the high and low score projects, the relation between barrier argumentation and additionality becomes quite evident. In contrast, the medium score project touches upon the big dilemma: being very much subject to individual interpretation and evaluation, due to its sheer frequency, the classification as either “sufficiently substantiated barriers” or “insufficient” immediately turns around the perception of the entire Brazilian renewable energy project portfolio.

5.5.1 CDM-Project 0519: Passo do Meio et al. – SHP – Brascan

Project 519 (Passo do Meio, Salto Natal, Pedrinho I, Granada, Ponte and Salto Corgão Small Hydroelectric Power Plants – Brascan Energética S.A.)[103] is a *large* scale CDM project but consists of six *small* hydroelectric power plants scattered over four Brazilian states. The project was validated by DNV in May 2005, approved by the DNA in June 2006 and registered as a CDM project by the EB in October 2006. The second host party and credit buyer are The Netherlands. The PDD was developed by Ecoinvest and the project owner is Brascan Energética S.A. from Curitiba. Brascan Energética is subsidiary of the Canadian Brascan holding and at the same time major shareholder of the plants.

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[102] For project documentations refer to the unfccc site: http://cdm.unfccc.int/Projects/index.html
[103] For Project Design Document and Validation report, please see: http://cdm.unfccc.int/Projects/DB/DNV-CUK1152830265.44/view

The projects were planned between 2001 and 2002 and went into operation between June 2003 and April 2004, with an operational lifetime of 25 years. On page 16 of the PDD it is stated in a very general manner within only a few lines and not substantiated by documented evidence, that the CDM was seriously considered in the planning stage of the projects.

The six run-of-river plants have a joint installed capacity of 128.4 MW and are able to generate 670 MWh a year. Following the baseline methodology ACM0002, the project is expected to render an annual average of 156,110 tonnes of CO_2 emission reductions, based on a grid emission factor of 0.2636 tonnes of CO_2e per MWh. The crediting period is ten years (non-renewable), leading to a total of 1.56 million certified emission reductions. Table 3 summarises the technical and economical data of the single plants:

Table 3: Technical and economical characteristics of project 519

Characteristic	Passo do Meio	Salto Natal	Pedrinho I	Granada	Ponte	Salto Corgão
Installed capacity	30MW	50 MW	16 MW	16 MW	24 MW	27 MW
Annual generation	156,200 MWh	79,700 MWh	74,300 MWh	73,800 MWh	126,000 MWh	169,700 MWh
Capacity factor	63% - 5% due to losses	63% - 5% due to losses	55% - 5% due to losses	49% - 5% due to losses	62% - 5% due to losses	76% - 5% due to losses
IRR w/out CDM	12.7%	13.9%	19%	17.7%	17.7%	18%

Source: PDD

The employed Francis turbines and generators are supplied by Alstom Power Brazil and constitute a well established technology in the country. Brascan Energética can rely on support and technological expertise of its parent enterprise Brascan Power from the US and Canada.

In the eyes of the project proponents, the only alternative to the project activity is not to invest in energy, but rather in the financial markets or in other sectors in which the holding is active. In Step 3 of the additionality tool, barriers against the project implementation are presented. Following a comprehensive explanation of the Brazilian energy sector as well as the privatisation process and the financial situation, the investment barrier is outlined first. The PPs receive project finance from the BNDES. The BNDES loan covers 70% of the project costs at an interest rate of 14.25%. Based on a worksheet (which is not displayed in the PDD but which is supposed to be available for the validator) the project's average IRR is 16.3% without carbon credits resulting from a CDM registration. The inclusion of CER revenues would increase the IRR to 17.7%. The project proponents do not go into the comparison with the loan interest rate but rather stress that the comparison between the IRR and the SELIC rate is not accurate because the investment in a hydro power project involves more risk. This claim however is not further substantiated, neither with respect to the SELIC rate (which may rise but also fall – as the earlier and the later development proved), nor regarding hydro power investments (what are the risks, what are the probabilities for certain developments and how would that affect the earnings, how long is the lifetime of the project anyway?). It is further argued that the existence of programmes like the PROINFA could be seen as an "*indication*" that renewable energy projects would not be implemented otherwise.

The investment barrier is backed up by an infrastructural barrier and an institutional barrier. The "*Lack of infrastructure*" is substantiated within three and a half lines, stating that in the isolated and underdeveloped areas of the plants, roads and communication lines were missing and that no qualified personnel was available due to a lack of schools and universities. It is not further elaborated who built the roads, how much it cost and how that materialised in the IRR of the project. It remains open, what the fundamental difference is between building a dam and building the road to a dam (a view shared by the validator DNV in its report). The institutional barrier finally is seen in the regulatory instability in the country and the resulting volatility of the electricity prices. Since the PPs did manage to negotiate a power purchase agreement with fix tariffs this argument too is void.

In conclusion, the whole claim for additionality is based on the investment barrier. The fact that the project proponents did receive loan financing through the BNDES however, contradicts the existence of an investment barrier. It could still be interpreted as an economical barrier though. The inner logic of the concept of the internal rate of return however proposes a comparison with the benchmark according to the source of finance, which in this case is debt finance at 14.25% interest. An IRR of 16.3% would in this case be a clear signal to any rational investor to go ahead with the project. Additionally, several variables could not be considered within the scope of this research but shall not remain unmentioned: first, in the PDD the low capacity factors of the hydro plants are not justified anywhere, which is worrying considering their function as a “discount factor”. Second, the fact that the IRRs with and without carbon are compared, suggests that the IRR without carbon is also calculated for the 10 years of the crediting period, which would be clearly improper as for the IRR all the income streams of the lifetime have to be considered. If this is true, the IRR, without carbon but considering 25 years, might even turn out to be higher. The fact that the validator DNV in the validation report states that a) the above mentioned worksheet has *not* been presented to him and b) in a previous version of the PDD the projects had had an IRR of 19.4% (see validation report, pages A-13, A-14) does not contribute to the alleviation of such concerns. The question why the validator did not consider these issues remains open too. The project was also not reviewed by the CDM EB before registration.

Step 3 of the additionality tool ends with Sub-step 3b and the demonstration that the barriers identified would not prevent the implementation of at least on of the alternatives. The PPs state that they could have invested their “*resources in different financial market investments*”, which is a clear contradiction because after all they did not invest *their* money but rather a project specific loan. Moreover it should not be lost out of sight that BRASCAN is (among other business segments) an energy, engineering and construction company!

In the author’s view, this project is clearly non-additional as it will render a positive NPV[104] and all the barriers presented are generic business difficulties which any entrepreneur has to cope with. This finding is reflected in a barrier score of 1 attributed for the (generic) institutional barrier. The fact that close to 500 small hydro facilities exist in Brazil does not contribute to counterevidence (see GTZ/BMZ 2007). Considering the fact that more than 1.5 million tonnes of CO_2 will be able to be emitted additionally in Europe through this project alone, puts this finding into an ominous context.

[104] This finding can be considered robust as no project proponent has an incentive for an over-estimation of the financial parameters in the PDD because this would contradict the additionality claim and lower the chances for a positive validation and registration.

5.5.2 CDM-Project 0228: Koblitz – Piratini – Biomass Power Plant

Project 228 (Koblitz – Piratini Energia S.A. – Biomass Power Plant – Small Scale CDM Project)[105], a biomass facility in the southernmost state of Rio Grande do Sul, is a small scale CDM project. It was validated by TÜV SÜD in July 2005, approved by the DNA in December 2005 and registered by the EB in February 2006 for a seven year (renewable) crediting period. Annex I approval came from the government of Japan. This PDD too was prepared by Ecoinvest and the project owner is Piratini Energia S.A., subsidiary of Koblitz Ltda. from Recife.

The project was planned throughout 2000 and 2001 and went into operation in the beginning of 2002, with an operational lifetime of 25 years. It generates electricity through a thermoelectric power plant using wood residues from nine wood processing companies in the City of Piratini. The sawmills receive their wood from "sustainable" forests in the region. The plant consumes 160,000 tonnes of wood residues annually that can be provided entirely by local enterprises.

Electricity is generated applying the Rankine cycle, with a high-pressure boiler and a multiple stage condensing steam turbine coupled to a 10 MW power generator. Assuming a capacity factor of 75% and own consumption of 7,500 MWh about 58,200 MWh can be fed into the southern interconnected grid. A PPA could be signed with the local utility until 2015. The well established technology and equipment for the project were developed and manufactured locally, except for the turbine and the generator which were built by Westinghouse in 1973 and were acquired "second-hand".

Before project implementation the wood residues were stockpiled and left to decay, causing methane emissions. Hence, the project contributes to the avoidance of CO_2 emissions related to the grid electricity and at the same time to the reduction of CH_4 emissions due to the avoided biomass decay. Consequently two baseline methodologies are applied, AMS-I.D. and AMS-III.E. (see Appendix C). Due to the high GWP of methane, the project is expected to render average annual emission reductions of 172,763 tonnes of CO_2e. The grid emission factor used is 0.5258 tCO_2e/MWh (applying an average operating margin of 0.9472 and a build margin of 0.1045 with equal weighting).

[105] For Project Design Document and Validation report, please see: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1135872521.94/view

Although the project is small scale and might therefore follow the simplified modalities and procedures, it does apply the large scale “tool” to substantiate the claim of additionality. The early consideration of the CDM in the project planning phase is well documented. Alternatives to the project activities would be the implementation of the project *without* CDM registration or simply *not* carrying out the project. Also this barrier analysis starts with an investment barrier, after an identical introduction to the development and the peculiarities of the Brazilian energy sector and the SELIC rate. This project too was able to receive a loan from the BNDES covering 80% of the project costs at an interest rate of 15%. The project’s IRR is 11% which is backed by a calculation spreadsheet available to the validator. The consideration of income streams from carbon credit sales increases the IRR to 42%. This result is complemented by a small sensitivity analysis that shows, regarding the 80% project finance with 15% interest, the NPV would amount to roughly –1.1 million Reais in contrast to about 10 million RS when including CERs. From the table we can also learn that when considering carbon, no matter how the remaining 20% is financed, the discount rate can rise well over 22% and still render a positive NPV (probably between 30 and 40%). The analysis clearly shows how the CDM registration makes an unprofitable project feasible.

The investment analysis is backed up by the same institutional barrier as in project 519 (see above), plus a cultural barrier, stating that the local population and environmental NGOs faced the project with mistrust and opposition due to questions of reliability and environmental impacts. Despite being plausible, these barriers do not really demonstrate how they would have prevented the project if it was not implemented under the CDM.

Nevertheless, by means of the comprehensive economical discussion in the investment barrier, in the author’s view the project proponents sufficiently demonstrated how unlikely the project implementation without the CDM option would have been. Project 228, Koblitz–Piratini, receives the maximum rating for projects that haven’t used the investment *analysis* of 9 points and can be considered as additional.

5.5.3 CDM-Project 0199: Vale do Rosário Bagasse Cogeneration (VRBC)

VRCB[106] is a large scale CDM project and "the first of its kind", as it is based on a baseline methodology that was specially developed for the project by the Vale do Rosário sugar mill, the project developer Econergy and the DOE TÜV SÜD (see: Chaves 2007). It was validated by TÜV SÜD in May 2005, approved by the DNAs of Brazil in December 2005 and Sweden in September 2005 and finally registered by the EB in March 2006 for a 7 year renewable crediting period. Vale do Rosário, located in the North-East of the state of São Paulo, is one of the largest sugar and ethanol producers in Southern Brazil.

The project consists of upgrading the cogeneration capacity of the sugar mill in order to feed electricity into the Brazilian interconnected grid. Although the bagasse, which is a fibrous waste product from the sugar cane processing, had always been used for process heat and also for on-site electricity consumption, a *surplus* of electricity can be generated only by a significant efficiency upgrade. Although in 2001, 700 MW of cogeneration capacity had been installed in sugar mills in the state of São Paulo alone (entirely for on-site consumption) there were no incentives to increase the efficiency for surplus electricity generation. Because of the constraints for independent power producers to the electricity market maintaining inefficient steam use was the most rational option for the plants. "*Low-pressure boilers, very little concern with optimal use and control of steam, crushers mechanically activated by steam, energy intensive distillation methods, are a few examples of (…) normal routine*".

At VRBC, an upgrading process has taken place in several steps from 1990 onwards. Only the third and fourth step from 2001 and 2003, the refurbishment by addition of one 15 MW and two 25MW turbo generators and a 65 bar high pressure boiler, comprise the actual CDM project activity. The project has an operational lifetime of 25 years. For the Rankine steam cycle system Swedish ABB turbines and Brazilian boilers were used. Technical assistance had been incorporated into the CDM project by the Swedish Energy Agency. Along with the upgrading of the steam generation went an efficiency improvement of the sugar and alcohol production to reduce on-site power consumption.

[106] For Project Design Document and Validation report, please see: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1135253521.0/view

With all the upgrading completed, VRCB has an installed capacity of 101 MW (65 MW resulting from the CDM project activity). PPAs with the local utility could be signed for 10 year periods. The project is estimated to produce 120,000 MWh annually and to render an average of 25,300 tonnes of CO_2 emission reductions. Over the first crediting period of 7 years (2001-2008), these are expected to add up to 177,000 CERs. The baseline methodology developed (AM0015) served as a blueprint for ACM0002 which was introduced earlier in this work (see above, section 4.4.2.2). The combined margin grid emission factor was calculated as 0.2677, composed of an operating margin factor of 0.431 and a build margin factor of 0.1045 (tCO_2e/MWh). The data was calculated according to the methodology, applying the simple adjusted OM option and option 1 for the build margin and based on ONS data.

That the CDM was seriously considered during the planning phase prior to the above mentioned phases 3 and 4 of the upgrading investment, is very well documented in Step 0, the introductory comments of the additionality tool. As an alternative to the project activity only investment in the core business (sugar and alcohol), without further expanding the electricity sales, was identified. Electricity is a product with entirely different characteristics to those of sugar and alcohol commodities. While the latter can be stored and price variations can be exploited, electricity sales involve long term contracts (PPAs) for fixed prices and delivery guarantees, which is worrying due to high volatility in sugar cane supply. On the other hand, the fact that from 1990 onwards electricity was sold by the enterprise to the state-owned utility does not really contribute to the credibility of the binary nature of the alternatives.

The barrier analysis is largely based on a then recent study titled “Mechanisms for the implementation of cogeneration of electricity from biomass: a model for the state of São Paulo” (translation of the title into English by the author), by S.T. Coelho from 1999. The basic reasoning of the technological / institutional / investment and cultural barriers has been elaborated earlier in this work (see section 5.2.2) and shall not be repeated here. Although plausible in themselves all the barriers presented remain on a general, “sector” level, none of them really touching the respective project. For example in the institutional barrier the reluctance of the distributors to purchase bagasse based electricity is stressed, while the actual VRBC never had had a problem in arranging a PPA. In the investment barrier, based on a study from 1997[107], the costs for co-generated electricity are compared with the marginal costs of electricity expansion, to substantiate the

[107] Swisher, J.: “Using area-specific cost analysis to identify low incremental cost renewable energy options – a case study cogeneration using bagasse in the state of Sao Paulo“, prepared for the GEF.

reluctance of utilities to buy electricity from sugar mills. First of all, at the time of project planning the study was already four years old, secondly the reasoning again remains very general. What is the price of the PPA in the actual contracts? As already mentioned above, while there are no technological barriers in the strict sense, as the technology is well established in Brazil, it is argued that unitary costs would turn out too high, given the small scale of the sugar mills. This too is a general statement for the whole sector, avoiding any discussion of how the investment in the efficiency upgrade affects the economical parameters of the cogeneration unit and the entire plant. Could it not be that, considering the efficiency improvements on both sides of the process as outlined above, this pays off for the enterprise after a reasonable time span? And wouldn't this have provided sufficient grounds for the investment on its own? As any detailed discussion is avoided, we can only guess.

The barrier analysis receives one point for each of the barriers except the technological barrier because its content is already part of the other barriers and actually there is no technological barrier. 2 points are attributed to the documentation of the mentioned study, resulting in an intermediate score of 5.

The fact that two out of three respondents to the interview among project owners that belong to the bagasse sector stated that they would have implemented the project anyway, matching with the analysis of one of the biggest environmental NGOs of the country (see below, Appendix G) and representatives of the scientific community, contributes to the author's doubts regarding the additionality of the bagasse co-generation projects. From the PDDs at least a sufficient additionality demonstration cannot be deduced. On the other hand the VRBC was awarded "Best CDM Project" by the super-critical NGO CDM Watch in 2004 (see: Chaves 2007).

5.6 Conclusions from the empirical section

The first finding of the empirical analysis shows a significant decrease of project submissions and registrations of Brazilian renewable energy CDM projects since their peaks at the end of 2005 and the beginning of 2006. At the same time, the more frequent application of the investment analysis in the "younger" subset of validated projects, often in addition to the barrier analysis, and the fact that in this sample the investment barrier is the most frequently used barrier, have contributed to a better average score of these more recent CDM projects.

The latter development is to be welcomed, as the investigation has shown that the additionality demonstration of the registered projects through the application of the barrier test was often based "on thin ice". The continuously stricter project scrutiny through the UNFCCC and the CDM executive board, might have had an impact on the attitude of project owners, developers and DOE staff, when regarding additionality. While, with respect to the quality of additionality argumentation, the performance of the different project developers varies substantially, most of them have earned better average scores for the recently validated projects. The same is true for the DOEs although their average performance is much more at the same level.

A further increasing level of "argumentation discipline" would indeed be very helpful. Barriers should be consistent within themselves, that is, a technological should be a technological barrier instead of another hidden economical barrier etc. Moreover, barriers should be substantiated and backed by some kind of documentation or else should be left out. Nobody is keen on reading pages upon pages about how hard life is for business, without learning how a particular barrier prevents the realisation of a certain project and how exactly the CDM registration contributes to overcoming the alleged barrier. DOEs should persistently demand delivery on these questions! When presenting economical barriers (mostly called investment barriers) project developers should stick to economically sound reasoning. If a financial analysis is conducted within the barrier test, a sensitivity analysis should also be mandatory. Clarification upon the operationalisation of the E- rule is urgent! A clear guidance by the EB would shed light on this tricky issue.

With respect to the project types, i.e. the different technologies, non-bagasse biomass projects had the least difficulty in demonstrating how the CDM registration lifts them over the feasibility hurdle. Wind energy projects achieved the lowest scores and the highest standard deviation (3.89). Recalling the statement of the representative of the Brazilian DNA, wind energy projects *have* to be non-additional, due to the extremely low emission factor in the wind rich areas of the North-East and the resulting minute contribution of carbon to the project finance. Project developers tackled the challenge of demonstrating additionality in spite of PROINFA membership in very different ways, some projects receiving 1 or 0 points, others scoring significantly higher. The big unknown variable among Brazilian renewable energy projects is the bagasse sector. Since the additionality demonstration of most of the bagasse cogeneration projects is based on almost identical barrier tests, the evaluation of the entire CDM portfolio pretty much depends on the classification of the three verbal and generally documented barriers described above. Recalling the conflicting assessment of the Brazilian scientific community it will be hard to come to a definitive evaluation of the additionality of the respective projects.

Although there was ample consent among the interviewees about the existence of “psychological barriers” against the implementation of new technologies, the author tends towards the perception that most of the bagasse projects, as well as a considerable share of the small hydro projects, would have been implemented anyway sooner or later, following their own business logic. Statements of respective project owners confirm this estimation.

6 Final conclusions and outlook

This final section attempts to put the pieces of the above findings together. Looking at the perceived difficulties of the mainstream RE projects to prove their additionality from a more abstract level, the following question arises: what is the real reason for the questionable additionality? Simply speaking, projects are either too profitable or too *un*profitable. Some of the SHP and Bagasse CHP projects seem to belong to the first group, while wind energy would be an excellent example for the latter. And although it is problematic to try to determine additionality by a single criterion and non-monetary barriers may play a significant role (Michaelowa et al. 2001) it were exactly these non-monetary barriers that were in many cases so utterly unconvincing.

This general situation is aggravated by the low emission factors as the carbon contribution to project finance is so minute that in only a few cases it has the capacity to lift a certain project over the hurdle. If this were not the case, at least among those projects which are too *un*profitable more projects could be made feasible through the CDM.

Is this situation likely to change in the near future? Admittedly, the carbon content of the Brazilian electricity net is likely to rise over the next decades, but this will only very slowly materialise in a rising emission factor. Other factors that determine the revealed additionality demonstration are the regulatory inconsistency of the past decade, low and volatile electricity prices and, in the case of wind energy for example, expensive and new technology. Although it is very hard to predict the future with respect to these aspects, it seems likely that the barriers mentioned are becoming rather less than more restricting. This would then further complicate additionality demonstration.

The latter scenario is to be seen in the light of an ever stricter project scrutiny by the CDM executive board. The above finding, that submission and registration of RE projects in Brazil decreases while project types with the best barrier test ratings increase their share in the portfolio, might be considered a backing of this scenario. It might be an indication that it is ***becoming increasingly difficult to get established renewable energy projects registered under the CDM in Brazil***.

If we then remember the share of the expected emission reductions that these projects have in the whole CDM portfolio in Brazil (2.9 out of 16.7 million tonnes, which is roughly

16%) the question arises whether these projects really deserve their dominant role among the current portfolio of CDM projects, or, the other way round, whether the CDM is the promotional tool of choice for mainstream renewable energy technologies in a country that already has an extremely clean energy matrix.

What really becomes evident here is how efficiently the CDM works: the fact that in areas with a low emission factor the contribution of carbon to finance is so low is not the expression of some mean bureaucrat or regulator but rather reflects the underlying rationale. The EF in these areas is so low *because* the energy matrix is so clean there. So if still more renewables are wanted there, they have to be promoted by some policy other than the CDM. And instead of lamenting this, project developers should rather go out and identify those areas, where high emission factors (or, in sectors other than electricity: high global warming potentials) reflect a higher *environmental necessity*. In an analogy to economic theory this is what could be called *environmental efficiency*, moving factors to where they are needed most.

As for the case of Brazil, from all we have learnt now, this should mean renewable electricity generation in areas with high emission factors like the South, or even more so in isolated areas that are currently powered by diesel generators (and that are not eligible for PROINFA because they do not supply the interconnected grid). The programmatic CDM might open the door for this, providing also a chance for reconciling the

CDM with sustainable development. But not only for electricity: a country that has one of the CO_2-free energy matrices in the world should concentrate more on the abatement of non-CO_2-GHG, like methane or nitrous oxide. One of the biggest challenges for Brazil however is, in the author's view (and backed by the above mentioned data from the greenhouse gas inventory), the reduction of emissions from deforestation of primeval rainforests. How to incorporate this into the CDM is an urgent topic on the international climate agenda.

To counter potentially wrong impressions: electricity generation from renewable sources is of utmost importance for both, the mitigation of climate change as well as for poverty alleviation and energy justice. Within the CDM however this should be done mostly in those countries that, like China, have an outspoken coal-based energy matrix. The fact that all interviewees unanimously acknowledged the positive contribution of the CDM to the promotion of renewable energies can be considered an encouraging message to these countries in this respect.

This paper comes to the conclusion that a strict application of the additionality demonstration by the barrier test in Brazil has a tendency of contributing to environmental efficiency.

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Abbreviations

a	year (annum)
AAU(s)	Assigned Amount Units
ACM	Approved Consolidated (baseline) Methodology
AI	Annex I of the UNFCCC, synonym for industrialised countries
AIJ	Activities Implemented Jointly, prototype for JI and CDM
AM	Approved (baseline) Methodology
AMS	Approved (baseline) Methodology (for) Small-scale (projects)
ANEEL	Agência Nacional de Energia Elétrica
Art	Article
AT	Tool for the demonstration and assessment of Additionality
BAU	Business As Usual
BM	Build Margin (emissions factor)
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BNDES	Banco Nacional de Desenvolvimento Econômico e Social (Brazilian Development Bank)
CAR	Corrective Action Request
CCC	Conta Consumo de Combustível
CDM	Clean Development Mechanism
CEIT	Countries with Economies In Transition
CER(s)	Certified Emission Reduction(s)
CH_4	Methane
CHP	Combined Heat and Power
CIMGC	Comissão Interministerial de Mudança Global do Clima, Brazilian DNA
CM	Combined Margin (emissions factor)
CO_2	Carbon Dioxide
CO_2e	CO_2 equivalents
COP	(annual) Conference Of the Parties of the UNFCCC
COP/MOP	(parallel) Meeting Of the Parties of the Kyoto Protocol
D	here: Decision
DEHSt	Deutsche Emissionshandelsstelle, part of UBA, German DNA
DEWI	Deutsches Windenergie-Institut

DNA	Designated National Authority
DOE	Designated Operational Entity
EB	CDM Executive Board
EB0x	x^{th} meeting of the EB
EF	Emissions Factor
EU	European Union
EU ETS	European Union Emissions Trading Scheme
EUA(s)	European Union Allowance(s)
FBOMS	Brazilian Forum of NGOs and Social Movements for the environment and development
FoE	Friends of the Earth
GEF	Global Environmental Facility
GHG(s)	Greenhouse Gas(es)
GTZ	Gesellschaft für Technische Zusammenarbeit
GW	Gigawatt, 10^9 W
HFC(s)	Hydrofluorocarbon(s)
IBGE	Instituto Brasileiro de Geografia e Estatística
ICOLD	International Commission On Large Dams
IEA	International Energy Agency
IET	International Emissions Trading
IETA	International Emissions Trading Association
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
JI	Joint Implementation
KP	Kyoto Protocol
Kt	1000 tonnes
LoA	Letter of Approval (in this context: of a CDM host country)
LPG	Liquefied Petroleum Gas
m	meter
MA	Marrakech Accords
MOP	see: COP/MOP
MW	Megawatt, 10^6 Watt
NAP	National Allocation Plan (within the EU ETS)
N_2O	Nitrous Oxide
NAI	Non Annex I
NGO	Non Government Organisation
NM	New (baseline) Methodology

NPV	Net Present Value
OECD	Organisation for Economic Cooperation and Development
OM	Operating Margin (emissions factor)
ONS	Operador Nacional do Sistema Elétrico
PCH	Pequena Central Hídrica, see: SHP
PDD(s)	Project Design Document(s)
PFC(s)	Perfluorocarbon(s)
PIN	Project Idea Note
PoA	Programme of Activities, *programmatic CDM*
PP(s)	project proponent (s), that is, project owners and developers
PPA(s)	Power Purchase Agreement(s)
PRODEEM	Programa de Desenvolvimento Energético dos Estados e Municípios
PROINFA	Programa de Incentivo às Fontes Alternativas de Energia Elétrica - Incentive Programme for Alternative Sources of Electric Energy
PV	Photovoltaics
RE	Renewable Energies
RIT	Registration and Issuance Team, sub-panel to the EB
RS	Reais, Brazilian currency
SELIC	Sistema Especial de Liqidação e de Custôdia, Brazilian Central Bank's overnight lending rate
SHP	Small Hydrp Power
SIN	Sistema Interligado Nacional – Brazilian Interconnected Grid
SSC	Small Scale (projects)
t	tonne
TWh	Terawatthours, 10^{12} Wh
UBA	Umweltbundesamt (German Federal Environmental Agency)
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organisation
USD	US Dollar
VRBC	Vale do Rosário Bagasse Cogeneration (project)
WWF	World Wide Fund for nature

Appendices

Table of appendices

Appendix A: Excerpt from the database of analysed projects

Part 1

Proj. No.	ID	name	date of registry	date of subm. to DNA	developer	DOE	scale	technology	specification	barriers a)	b)	c)	d)	e)	f)	g)	h)	ssc-tool	reduc-tions t/a	MW installed	State	Score per project
1	143	UTE Barreiro	Jan 06	Jan 05	Ecosecurities	DNV	small	biomass to electricity	wood tar +	1			1		1			1	48.565		MG	2
2	228	Koblitz Piratini	Feb 06	Nov 05	Ecoinvest	TÜV S	small	biomass to electricity	forestry residues		1	1				1			172.763	10,0	RGS	9
3	231	CAMIL Itaqui	Feb 06	Dec 05	PTZ Bionergy	TÜV S	small	biomass to electricity	rice husks			1	1						57.341	4,2	RGS	6
4	178	Santa Elisa	Feb 06	Sep 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			45.801	42,0	SP	5
5	179	Nova America	Feb 06	Sep 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			12.027	10,5	SP	5
6	181	Alta Mogiana	Feb 06	Oct 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			12.024	37,5	SP	5
7	65	Santa Candida	Feb 06	Sep 05	Econergy	DNV	large	biomass to electricity	bagasse	1		1	1			1			10.604	29,0	SP	5
8	242	Pesqueiro Energia	Feb 06	Jul 05	Ecoinvest	DNV	small	small hydro power	run-of-river		1	1	1		1				42.009	12,4	Pa	5
9	43	Lucelia	Mar 06	Sep 05	Econergy	DNV	large	biomass to electricity	bagasse	1		1	1			1			14.362	32,0	SP	5
10	185	Coruripe	Mar 06	Nov 05	Econergy	DNV	large	biomass to electricity	bagasse	1		1	1			1			5.784	16,0	Al	5
11	199	Vale do Rosario	Mar 06	Sep 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			25.277	65,0	SP	5
12	203	Cerradinho	Mar 06	Sep 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			34.742	49,8	SP	5
13	180	Colombo	Mar 06	Sep 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1	1	1				1			28.018	80,0	SP	5
14	187	Jalles Machado	Mar 06	Sep 05	Econergy	DNV	large	biomass to electricity	bagasse	1	1	1				1			8.955	31,8	Go	5
15	215	Coinbra-Cresciumal	Mar 06	Dec 05	Econergy	DNV	large	biomass to electricity	bagasse	1		1	1			1			17.481	30,9	SP	5
16	213	Serra	Mar 06	Nov 05	Econergy	DNV	large	biomass to electricity	bagasse	1	1	1				1			6.644	12,6	SP	3
17	206	Southeast Caete mills	Mar 06	Dec 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1	1	1				1			30.326	15,0	MG	3
18	201	Bioenergia Cogeradora	Mar 06	Nov 05	Ecoinvest	TÜV S	large	biomass to electricity	bagasse		1	1				1			2.084	24,0	SP	2
19	208	Campo Florido	Mar 06	Nov 05	Econergy	DNV	large	biomass to electricity	bagasse	1		1	1			1			10.175	24,0	MG	5
20	207	Alto Alegre	Mar 06	Nov 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1	1	1				1			9.674	26,8	SP	3
21	212	Iturama	Mar 06	Dec 05	Econergy	DNV	large	biomass to electricity	bagasse	1		1	1			1			12.841	11,0	MG	3
22	216	Cruz Alta	Mar 06	Oct 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			10.061	19,4	SP	5
23	200	Termoeletrica Santa A	Mar 06	Nov 05	Ecoinvest	DNV	large	biomass to electricity	bagasse		1	1				1			22.204	34,0	SP	2
24	202	Zillo Lorenzetti	Mar 06	Nov 05	Ecoinvest	DNV	large	biomass to electricity	bagasse		1	1				1			53.774	61,3	SP	2
25	190	Moema	Mar 06	Sep 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			13.139	8,0	SP	5
26	205	Equipav	Mar 06	Sep 05	Econergy	TÜV S	large	biomass to electricity	bagasse	1		1	1			1			31.821	44,5	SP	5
27	209	Central Energetica do F	Mar 06	Nov 05	Ecoinvest	DNV	large	biomass to electricity	bagasse		1	1				1			1.629	30,0	SP	2
28	211	Usinas Itamarati	Apr 06	Nov 05	Ecoinvest	DNV	large	biomass to electricity	bagasse		1	1	1			1			799	14,0	MGr	7
29	229	BT - Ferradura	Apr 06	Sep 05	Ecoinvest	TÜV S	small	small hydro power	run-of-river		1	1	1		1				23.496	9,2	RGS	7
30	168	BK Itacoatiara	May 06	Jun 05	Ecoinvest	TÜV S	small	biomass to electricity	forestry residues		1	1		1		1			14.537	9,0	Am	7
31	404	Irani	Jul 06	Jan 05	Ecosecurities	DNV	small	biomass to electricity	forestry residues				1		1			1	173.486	9,4	SC	6
32	477	Palestina	Aug 06	Oct 05	Ecoinvest	DNV	small	small hydro power	run-of-river		1	1			1				27.357	12,4	MG	2
33	486	Horizonte	Aug 06	Mar 06	Econergy	SGS	small	wind power		1	1				1			1	6.227	4,8	SC	1
34	485	Cucao	Aug 06	Jan 06	Econergy	SGS	small	biomass to electricity	bagasse	1	1				1	1			2.082	1,0	Pe	3
35	403	Inacio Martins	Aug 06	Jun 05	Ecosecurities	DNV	small	biomass to electricity	forestry resi	1			1		1			1	293.858	15,0	Pa	7

Barriers: a) = technological - b) = investment - c) = institutional - d) = economical - e) = infrastructural - f) = prevailing practice - g) = cultural - h) = investment analysis.

Part 2

Proj No.	ID	name	date of registry	date of subm. to DNA	developer	DOE	scale	technology	specification	barriers a)	b)	c)	d)	e)	f)	g)	h)	ssc-tool	reduc-tions t/a	MW installed	State	Score per project
36	480	Jaquari - Furnas do se	Sep 06	Oct 05	Ecoinvest	SGS	small	small hydro power	run-of-river		1	1			1				28.189	9,8	RGS	2
37	543	Nova Sinceridade - Bra	Sep 06	Oct 05	Ecoinvest	DNV	small	small hydro power	run-of-river		1	1			1				17.086	9,5	MG	2
38	114	Rickli	Sep 06	Mar 05	Ecosecurities	DNV	small	biomass to electricity	forestry residues				1		1			1	121.541	5,0	Pa	6
39	529	Bunge Guara	Sep 06	Dec 05	Ecoinvest	SGS	small	biomass to process heat	forestry res	1	1				1			1	14.101		SP	3
40	575	Agua Doce	Sep 06	Mar 06	Econergy	SGS	small	wind power		1	1		1	1				1	13.704	9,0	SC	0
41	520	Cachoeira Encoberta a	Oct 06	Nov 05	Ecoinvest	DNV	large	small hydro power	run-of-river		1	1		1					45.337	47,1	MG	1
42	519	Passo do Meio et al. - I	Oct 06	Nov 05	Ecoinvest	DNV	large	small hydro power	run-of-river		1	1		1					15.611	128,4	Pa/MG	1
43	668	Braco Norte IV	Nov 06	Jul 06	Clean Air	SGS	small	small hydro power	run-of-river								1		45.593	14,0	MGr	7
44	667	Braco Norte III	Nov 06	Aug 06	Clean Air	SGS	small	small hydro power	run-of-river								1		40.026	14,2	MGr	7
45	663	Santa Lucia II	Nov 06	Jul 06	Clean Air	SGS	small	small hydro power	run-of-river								1		23.151	7,6	MGr	7
46	401	Imbituva	Nov 06	Jun 05	Ecosecurities	DNV	small	biomass to electricity	forestry res	1			1		1			1	288.233	13,8	Pa	7
47	530	ARAPUtanga	Dec 06	Nov 05	Ecoinvest	TÜV S	large	small hydro power	run-of-river		1	1		1					106.924	74,0	MGr	1
48	489	Repowering SHP	Dec 06	Dec 05	Clean Air	SGS	large	small hydro power	existing dam				1						22.406	10,8	SP	0
49	627	Aquarius	Dec 06	May 06	MGM	DNV	small	small hydro power	run-of-river				1					1	13.436	4,2	MGS	0
50	603	Osorio	Dec 06	May 06	Econergy	DNV	large	wind power		1	1				1		1		148.325	150,0	RGS	9
51	693	Votorantim Pedra do C	Dec 06	Aug 06	Ecoinvest	DNV	large	hydro power	existing dam		1				1				59.485	160,0	Ba	1
52	860	Agropecuaria Salto do	Mar 07	Sep 06	Ecoinvest	SGS	small	small hydro power	run-of-river		1	1							11.744	8,2	SC	2
53	843	Petrobras	Mar 07	Nov 06	Petrobras	DNV	small	wind power		1			1		1			1	1.277	1,8	RGN	4
54	830	Rialma - Santa Edwige	Mar 07	May 06	Ecoinvest	BVQI	small	small hydro power	small dam		1	1		1					13.138	10,1	Go	6
55	831	Rialma - Santa Edwige	Apr 07	Apr 06	Ecoinvest	BVQI	small	small hydro power	small dam		1	1		1					16.513	12,1	Go	1
56	773	Ceran's Monte Claro	Apr 07	May 06	Ecoinvest	DNV	large	hydro power	small dam		1								121.721	139,0	RGS	5
57	968	Incomex	Apr 07	Mar 06	Ecosecurities	DNV	small	small hydro power	run-of-river		1				1			1	39.002	13,7	Ro	8
58	1062	Santa Terezinha - Tap	Jun 07	Apr 06	Ecoinvest	BVQI	large	biomass to electricity	bagasse		1	1			1				43.844	50,5	Pa	7
59	809	Garganta da Jararaca	Jul 07	Aug 06	Ecoinvest	SGS	large	small hydro power	small dam		1	1		1					50.293	29,3	MGr	1
60	891	Atiaia - Buriti	Jul 07	Jun 06	Ecoinvest	SGS	large	small hydro power	run-of-river		1	1		1					63.908	58,0	MGS	1
61	1089	GEEA	??? 07	Mar 07	Mitsubishi	DNV	small	biomass to electricity	rice husks	1	1				1			1	19.486		RGS	3
62	1146	Alto Benedito Novo	Aug 07	Sep 06	Ecosecurities	SGS	small	small hydro power	run-of-river	1	1				1	1		1	19.209	15,0	SC	2
63	1279	Fundao - Santa Clara	??? 07	Apr 07	Econergy	BVQI	large	hydro power	new large d	1		1				1	1		265.584	246,1	Pa	10
64	1235	Rio Grande do Sul	??? 07	Feb 07	Ecoinvest	SGS	large	small hydro power	run-of-river		1	1		1					25.000	26,5	RGS	1
total										31	37	43	27	10	20	29	5	13	2.975.834	2.104,2		262
share of total (%)										48,4	57,8	67,2	42,2	15,6	31,3	45,3	7,8	20,3				
mean value																			46.497	32,9		4,1

Barriers: a) = technological - b) = investment - c) = institutional - d) = economical - e) = infrastructural - f) = prevailing practice - g) = cultural - h) = investment analysis.

Part 3

Proj. No.	ID	name	date of registry	date of subm. to DNA	developer	DOE	scale	technology	specification	barriers a)	b)	c)	d)	e)	f)	g)	h)	ssc-tool	reduc-tions t/a	MW installed	State	Score per projed
LoA																						
65		Sacre 2		Feb 07	Ecoinvest	TÜV-S	large	small hydro power	new dam			1	1						64.000	30,0	MGr	6
66		Paraiso		Jan 07	Energias do Br	BVQI	large	small hydro power	run-of-river		1	1							31.000	21,6	MGS	1
67		Sao Joao		Dec 06	Ecologica Ass	SGS	large	small hydro power	run-of-river	1	1	1			1		1		47.000	25,0	ES	10
68		Rosa dos Ventos		Dec 06	Ecologica Ass	TÜV-N	small	wind energy											16.000	13,7	Ce	0
69		Martinuv Espigao		Oct 06	Ecosecurities	DNV	small	hydro	run-of-river		1				1			1	16.000	2,4	Ro	4
70		UHE Mascarenhas		Dec 06	Ecologica Ass	SGS	large	hydro	existing dam		1	1	1				1		73.000	49,5	ES	10
71		Usina Sao Francisco		Apr 06	Ecoinvest	SGS	large	biomass	bagasse								1		34.000	80,0	Go	7
72		CAAL		Jul 06	PTZ	SGS	small	biomass	rice husk		1							1	51.000	3,8	RGS	5
73		JOSAPAR Pelotas		Aug 06	PTZ	SGS	small	biomass	rice husk		1							1	20.000	8,0	RGS	5
Approved with corrections																						
74		Salto Santo Antonio		May 07	carbotrader	DNV	small	small hydro power	new dam	1					1			1	8.500	6,7	SC	4
75		Saldanha		May 07	Ecosecurities	DNV	small	small hydro power	run-of-river		1		1		1			1	28.000	4,8	Ro	6
76		Primavera		May 07	Ecosecurities	SGS	large	small hydro power	new dam								1		94.000	18,2	Ro	7
77		URBANO Sinop		Aug 06	PTZ	SGS	small	biomass	rice husk		1							1	21.000	3,0	MGr	5
78		JOSAPAR Itaqui		Aug 06	PTZ	SGS	small	biomass	rice husk		1							1	51.000	6,0	RGS	5
79		CAMIL Camaqua		Jul 06	PTZ	SGS	small	biomass	rice husk		1							1	29.000	3,5	RGS	5
80		Mandu		May 06	Econergy	SGS	large	biomass	bagasse		1	1				1			26.000	30,2	SP	3
81		Agua bonita		May 06	Econergy	SGS	large	biomass	bagasse			1	1			1			20.000	15,8	SP	3
Under Revision by DNA																						
82		Faxinal dos Guedes		Aug 07	MGM	SGS	small	small hydro power	run-of-river						1			1	5.700	4,0	SC	3
83		Cristalino		Aug 07	MGM	SGS	small	small hydro power	run-of-river						1			1	6.300	4,0	Pa	3
84		Usina Interlagos		Jun 07	Ecoinvest	TÜV-S	large	biomass			1	1				1	1		55.000	40,0	SP	9
85		Salto		Jun 07	Ecoinvest	SGS	large	small hydro power	run-of-river		1			1					31.000	19,0	MGr	6
86		Baruito		May 07	Ecosecurities	SGS	large	hydro	new dam								1		34.000	18,0	MGr	7
87		Icarai		Apr 07	Ecologia Asse	TÜV-N	large	wind energy		1	1						1		214.000	207,0	Ce	9
88		NOBRECEL		Aug 06	Ecosecurities	DNV	large	biomass							1		1		125.000	8,8	SP	8
89		Nova America Maracai		Aug 06	Econergy	TÜV-S	large	biomass	bagasse			1				1			43.000	51,0	SP	4
90		Ruette		Aug 06	Econergy	TÜV-S	large	biomass	bagasse			1				1			28.000	21,0	SP	4
91		Pioneiros		Aug 06	Econergy	SGS	large	biomass	bagasse			1				1			39.000	22,0	SP	4
92		Goiasa		Jul 06	Econergy	DNV	large	biomass	bagasse			1				1			33.000	42,5	Go	4
93		Giasa II		Aug 06	Ecoinvest	DNV	large	biomass	bagasse		1	1				1			5.500	15,1	Par	2
Submitted to DNA																						
94		Faxinal II		Sep 07	MGM	SGS	small	small hydro	run-of-river	1		1		1	1			1	53.000	10,0	MGr	6
95		ARS		Sep 07	MGM	SGS	small	small hydro	run-of-river		1			1	1			1	12.000	5,8	MGr	4
96		Castro Alves CERAN		Sep 07	CERAN	SGS	large	hydro	new dam								1		315.000	130,0	RGS	7
total										4	16	13	4	3	9	8	9	12	1.631.000	920,4		166
share of total (%)										12,5	50,0	40,6	12,5	9,4	28,1	25,0	28,1	37,5				
mean value																			50.969	28,8		5

Barriers: a) = technological - b) = investment - c) = institutional - d) = economical - e) = infrastructural - f) = prevailing practice - g) = cultural - h) = investment analysis.

Appendix B: Overview over CDM project types

Types and numbers of CDM projects* either under validation, in the registration process or already registered by greenhouse gas**

Types of CDM projects	Specification	Number
CO_2-Abatement (Carbon Dioxide – Global Warming Potential 1)		
Renewable Energies	hydro power	654
	wind energy	323
	biomass to energy	460
	geothermal, solar, tidal	22
Energy Efficiency	industry	391
	households	7
Fuel Switch	from one fossile fuel to another	84
Cement blending	replacement of lime	28
Capture of fugitive emissions	methane recovery from oil wells, pipelines etc	20
Aforestation / Reforestation		12
Transport	more efficient transport, e.g. rapid bus transport	7
CH_4-Abatement (Methane – GWP 21)		
Agriculture	Manure (methane flaring)	187
	Biogas (power generation)	136
Landfill gas capture	Methane flaring, power generation or compostation	203
Coal mine methane capture		42
N_2O-Abatement (Nitrous Oxide – GWP 310)		
Catalytic destruction or decomposition at the production of adipic acid or nitric acid		43
HFC-Abatement (Hydrofluorocarbons – GWP 11700)		
Capture and incineration or substitution of HFC 23		19
PFC-Abatement (Perfluorocarbon – GWP 6500-9200)		
Anode effect mitigation at aluminium smelting		2
SF6-Abatement (Sulphurhexafluoride – GWP 23900)		
Avoidance of SF_6 release from insulations of electric utilities		-

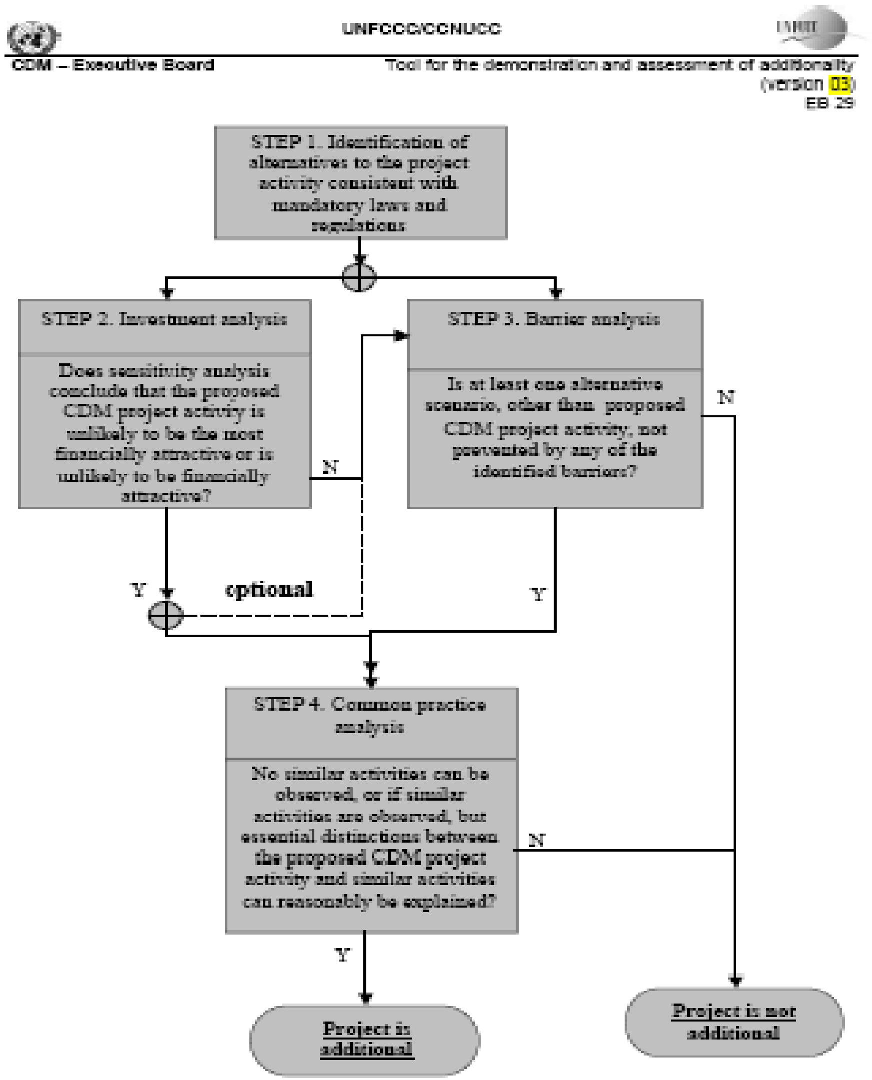
* Source: CDM pipeline of UNEP/RISØE as of November 2007
** Note that in some cases the classification is not 100% clear, as for example some Biomass to Energy projects have a methane reduction component, while some of the Bio*gas* to Energy projects do replace CO2-emissions as well.

Appendix C: Overview over baseline methodologies for small-scale projects

Energy generation	Energy efficiency	Others
AMS-I.A. Electricity generation by the user	**AMS-II.A**. Supply side energy efficiency improvements – Transmission and distribution	**AMS-III.A.** Agriculture
AMS-I.B. Mechanical energy generation for the user	**AMS-II.B.** Supply side energy efficiency improvements – generation	**AMS-III.B.** Switching fossile fuels
AMS-I.C. Thermal energy for the user	**AMS-II.C.** Demand side energy efficiency	**AMS-III.C.** Low GHG emitting vehicles
AMS-I.D. Grid connected renewable energy generation	**AMS-II.D.** Energy efficiency and fuel switching measures for industrial facilities	**AMS-III.D.** Methane recovery in agricultural activities
	AMS-II.E. Energy efficiency and fuel switching measures for buildings	**AMS-III.E./ F.** Avoidance of methane from biomass decay
	AMS-II.F. Energy efficiency and fuel switching measures for agricultural facilities	**AMS-III.G. / H.** Landfill methane recovery from landfills and wastewater
		AMS-III.I. – R. (Others)

Source: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

Appendix D: The consolidated additionality tool for large-scale projects (flow chart)



Appendix E: Overview of interviewed persons

The group of project owners received the questionnaire in Portuguese as displayed below in Appendix F. The 59 responsible representatives were contacted by E-Mail according to their adresses as stated in the PDDs. Out of 59 E-Mail contacts as stated in the official UN PDDs, 15 (25%) returned as *not deliverable*. From the remaining 44, 6 (14%) replied.

Personal interviews with project developers were held in Brazil with Pablo Fernandez (Ecosecurities), David Freire da Costa (Econergy) and Ricardo Besen and Jenny Komatsu (Ecoinvest). Adriaan Korthuis (Climate Focus) was interviewed in Rotterdam.

Among DOEs, Fabian Gonçalves (SGS) was interviewed personally in São Paulo, Siddharth Yadav (SGS) in Camberley, Irma Lubrecht (SGS) in Amsterdam, Martin Saalmann (TÜV Nord) in Essen and Werner Betzenbichler (TÜV SÜD) in Munich. Sergio Carvalho (BV Cert) responded to the questionnaire by E-Mail. DNV do Brasil refused taking part in the interview.

On the behalf of DNAs, Branca Bastos Americano (CIMGC) was interviewed in Rio de Janeiro, Lex de Jonge (VROM) in Den Haag and Karsten Karschunke and Malin Ahlberg (UBA/DEHSt) in Berlin.

As for environmantal NGOs, strong positive feedback came from the WWF. Kirsty Clough and Juliette de Grandpré were interviewed personally in Godalming (UK) and Berlin. André Tavares responded by E-Mail on the behalf of WWF do Brasil. Mark Kenber, who is now policy director with the Climate Group but who, during his time at the WWF, gave strong impetus to the development of the CDM gold standard, was interviewed personally in London. Though persistently contacted, neither Greenpeace do Brasil, nor fboms (see above), nor FoE were interested in sharing their views with the author.

Alexandre D'Avignon e Claudia do Valle Costa of the Centro Clima at the Federal University of Rio de Janeiro were interviewed personally in Rio; Kamyla Borges da Cunha of the mechanical engineering faculty of the State University of Campinas replied by E-Mail.
Deep insights into the Brazilian wind energy sector I owe to Afonso Pacheco of the DEWI do Brasil in São José dos Campos, Brazil.

I feel deeply grateful to all my interview partners for helping me to develop a better understanding and deeper insight of the complex topic: thank you!

Appendix F: Interview questionnaire

PART ONE – RENEWABLE ENERGIES

Question 1: The support for a worldwide diffusion of renewable energy technologies is of utmost importance for the mitigation of climate change, not to mention the contribution to energy justice and sustainable development. In your eyes, is the CDM a suitable tool for a substantial push of renewable energies in the developing world? Where would you see room for improvement?

Question 2: There is a perception that the implementation of CDM projects in Brazil has slowed down lately. Do you agree with this? If yes, why do you believe this is so?

Question 3: Where do you see untapped potentials, what is the future for renewable energy projects in Brazil *under* the CDM?

Question 4: What can you say generally about the renewable energy CDM projects in Brazil, with respect to their performance? Do they function as expected? Do they reduce emissions as expected?

PART TWO – ADDITIONALITY

Question 5: Additionality is one of the key eligibility criteria of CDM projects. The concept of additionality however is not precisely defined in the UN documentation and various views on the meaning of this criterion exist. How would you define additionality?

Like this...

A CDM project activity is additional if GHG emissions are reduced below those that would have occured in the absence of the registered project. If the proposed project is *not* implemented, a less GHG friendly activity would have been continued or initiated instead.

...or more like this:

Without the ability to register under the CDM the proposed project activity would be unlikely to occur. A CDM project is additional if it does not belong to the baseline, that is, if it would not have been carried out *anyway*.

Question 6: According to your point of view, why is additionality important, why should non-additional projects have to be avoided?

Question 7: The way (strictness/looseness) the additionality check is applied might have an impact on the distribution of project types and sizes. Would you agree with this? Could you give any examples for the impact on specific sizes or technologies, be it positive or negative?

PART THREE – THE BARRIER TEST

Question 8: The barrier test is one of the main pillars of the „tool for the demonstration and the assessment of additionality“, which was designed to operationalize the additionality check. How do you judge the suitability and the appropriateness of the barrier test for the determination of additionality? Does the additionality test have the capacity to uncover non-additional projects?

Question 9: A challenging evaluation problem surely is how to distinguish between ordinary business risks, any entrepreneur faces, and the prohibitive barriers, that can only be overcome by the means of CDM registration. Where would you draw this „thin red line“?

Question 10: Barriers to a potential CDM project must be apt to prevent the project, i.e. the barrier must be of prohibitive nature. Would you agree to the perception that sometimes artificial barriers are created and existing barriers are exaggerated? Have you maybe got any examples?

Question 11: The additionality tool suggests possible barriers that have the potential of credibly preventing the implementation of a certain project, such as investment barriers, technological barriers and barriers due to prevailing practice. In reality however, a multitude of different barrier concepts is used in a rather inconsistent way. How would you – in a few words – define the following barrier:

technological barriers
institutional barriers
cultural barriers
prevailing practice barriers
financial barriers
economical barriers
investment barriers, as opposed to the investment test pursuant to Step 2

Question 12: In PDDs of Brazilian renewable energy projects one frequently finds a ‚financial analysis type of argumentation' as investment barrier, sometimes without sensitivity analysis as this is not required in step 3. How would you judge the following reasoning (exemplary figures):

- IRR without CERs: 10%
- IRR with CERs: 12%
- Benchmarks (interest in the case of loans or alternative use of equity): 15% or 20%

In the validation, looking at the IRR calculations, do you also check whether tax alleviations are duly taken into account?

Question 13: About what percentage of submitted PDDs for validation is rejected by your organisation? Is lacking additionality the dominant reason? Without necessarily naming any particular project proponents, could you please give examples for non-additional projects or common insufficient additionality argumentation?

PART FOUR – THE PROJECT DEVELOPERS

Question 14: Crucial for the success of the CDM is the attitude of the investors and the project developers, as well as their willingness to accept the existing complex regulation and cumbersome procedures. How do you feel that the respective industry is dealing with this matter at the moment and what are the current tendencies with the decision makers?

Question 15: Generating carbon credits has become a considerable business throughout the last years. Have you got the feeling that the involved industries play fair or would you agree with the perception that substantial pressure is exerted, also unto DOEs?

Question 16: Environmentalists sometimes argue that project developers (PDs) with critical projects approach one DOE after another until one finally agrees to validate a project. How would you comment on this perception?

Analyzing the Brazilian CDM projects, the PDs do not seem to have a clear inclination to one particular DOE. What do you believe are the criteria for PDs to choose a DOE for a certain project? How do they go about, what is the procedure?

PART FIVE – THE CDM EXECUTIVE BOARD

Question 17: The ruling of the EB, especially with respect to review requests and rejections, is of major significance for the project implementation. Do you consider the EB decisions comprehensible and justified? Why, do you think, is it that mostly the three necessary review requests are identical? Why are the reasons so short?

Question 18: Could you see a change in the way that the EB looks at additionality over the last three years? Has this manifested in a changing registration/rejection/review – practice?
Given a certain „development“, a „trend“ of EB decisions on rejections or reviews: are these decisions consistent, that is, are similar projects treated similiarily?

Thank you so much for your time and attention!

Questionnaire for project owners:

Pelo ponto de vista da sua empresa valeu a pena, proceder a aplicação para se registrar como um projeto MDL?

Quais eram os obstáculos no processo do registro?

Estão contentes com o processo do registro? Há critica?

E com o processo da validação pelas DOEs? Há critica?

E com o desenvolvimento e com os serviços dos ‚project developers'? Há critica?

Já vos foram emitidos creditos? Caso que sim, a quatidade correspondeu com as vossas expectativas? Caso que não, quais são as razões para isto?

Os beneficios esperados pelo MDL foi o factor critical, quer dizer decisivo, para a realização do projeto? Ou terá sido realizado de qualquer maneira?

Os vencimentos pelos creditos contribuem substancialmente para a T.I.R. do projeto?

Quais são os outros beneficios do MDL, que ajudaram a realizar o projeto?

A vossa empresa pretende desenvolver mais projetos dentro do MDL?

Qual e a sua opinião sobre o PROINFA?

E sobre a interacção entre o PROINFA e o MDL?

Como é que vocês veem o futuro das energias renovaveis dentro do MDL no Brasil (quais serão as technologias prometedoras etc)?
Quais são os problemas específicas das energias renovaveis dentro do MDL no Brasil?

Existe uma expectativa realística do desenvolvimento de projetos de energias renovaveis, fora do MDL? E fora do PROINFA? E independente dos dois?

No vosso ponto de vista, o MDL já contribuiu substancialmente a divulgação das energias renovaveis no Brasil? Caso que sim, mais no nível económico ou mais na consciencia dos ‚stakeholders' (nas empresas, no sector financeiro, na administração etc)?
Muito obrigado pela sua ajuda !!!

Appendix G: Comprehensive summary of interviews

Viewpoints of Brazilian CDM stakeholders

The following standpoints are summarised from personal interviews with representatives of different stakeholder groups, conducted by the author in September and October 2007, with exception of the "project owners" that were interviewed by E-Mail. For a list of interviewed persons and the questionnaires, see Appenices E and F above. Following the logic of the project cycle, the presentation starts with the project owners.

The project owners

All project owners, that is, representatives of companies that responded to the survey by E-Mail, consider it worth-while that their company is active in the CDM. They unanimously share the view that the CDM contributes substantially to the diffusion of renewable energies in Brazil and that this happens not only on an economical level but also contributes to consciousness-building. All stated that the CDM earnings contribute positively to the IRR of the project, the extent ranging from "little" to "15%". Three-fourths of the project owners already have CERs issued. Moreover, most stated that there were positive image effects through the demonstration of "a socio-environmental attitude", as put by one of the participant.

When asked whether the expected CDM benefits were considered a critical, or rather a decisive factor in the decision to go ahead with the project, more than half of the respondents said that the project would have been implemented anyway, while the rest described the CDM incentive as *important* in the investment decision. One respondent claimed the project had to be viable on its own as only marginal income streams from carbon finance were expected.

The major obstacles in the registration process were identified to be the slowness of the DNA and the UN, bureaucracy, uncertainty and a lack of guidance. At the same time, three-fourths of the respondents described the registraion process as satisfactory. Most were content with the validation performance of the DOEs, although one participant complained about the small number of DOEs in the country which, according to his words, leads to delays in the project implementation. With respect to the perceived performance of the project developers, two-thirds of the respondents expressed satisfaction, while one-third at least had "some critique". One respondent complained about the “copy-and-paste”-mentality of some project developers and suggested they should look into the projects more individually, thereby leading to higher quality.

The renewable energy promotion tool PROINFA, is viewed very diversely by the project owners. Typical statements were: “irrelevant”, “needs improvement” or “important, contributed substantially to renewable energy diffusion”. The surveyed companies do not participate in the PROINFA and the majority of the respondents abstained from comments on the interaction with the CDM. One stated however, that in his eyes it is unfair that Eletrobrás seizes the generated carbon credits. When asked whether according to their point of view, renewable energy projects had a chance to be established economically without either the CDM or PROINFA, 50% responded negatively, while the other half agreed.

The biggest problems of renewable energies in Brazil are identified as: low remuneration, exaggerated environmental standards (including unjustified critiques by environmentalists), bureaucracy (causing delays and costs), financing difficulties and lack of guidance in baseline development by the government.

When asked whether their company envisages further CDM projects in the future, all respondents unanimously agreed. The future of renewable energies within the CDM in Brazil is seen in sugar cane biomass (including the energetic use of sugar cane *straw*), small hydro-power and biofuels. Only one responent named wind energy.

The project developers

All of the interviewed project developers agree that the CDM is contributing to the promotion of renewable energies in Brazil, not only as an economic incentive but also in creating awareness, considered to be an even more important element. According to their view however, this positive effect is limited by a number of serious obstacles, among these are: uncertainty, exorbitant bureaucracy and delays.

Several contradictory and hampering properties of the current setup were more concretely identified. One property is the closing time window of the CDM, due to the uncertainty regarding the post 2012situation. Given the extensive registration span, only a few years are left, which is problematic for renewable energy projects with operation spans of 20 – 30 years.

Another problem identified, is the high risk of the registration process. As a consequent application of additionality means that a project only becomes viable by the means of the CDM and at the same time substantial investments have to be made years before it ever becomes clear whether the project will be registered or not, project owners and developers run a high risk of economical losses.

The balancing act in order to convince financiers of the viability of a project and to simultaneously demonstrate the additionality through stating that the project would not be likely to come into existence, is seen as an absurd difficulty.

As a further obstacle, an excessive complexity of methodologies is identified. Obsolete and redundant requirements of proofs are impeding a dynamic development of projects.

The extremely low grid emission factors are devastating for the development of renewable energy CDM projects in Brazil, especially in the North and North-East of the country. This is a situation which is worsening rather than improving. Here the industry feels abandoned by the government.

Consequently, more clarity about the post 2012 perspectives of the carbon market is considered crucial. Apart from this, project implementation could be improved substantially by speeding up the registration process, while at the same time reducing the respective risks. A simplification of methodologies would also be welcome. Specific project types (e.g. renewable energies) should be considered additional *per se*. Last but not least, something should to be done urgently with respect to the grid emission factors.

Project developers have perceived a substantial shift in the registration practice of the CDM executive board, from 2005 to 2006 (which is attributed to the creation of the RIT), and again from 2006 to 2007 (when the UNFCCC secretariat started to review the submitted projects). Especially the way the EB communicates its rulings on projects, that is, either review requests or actual rejections, is seen very critical. The facts that no more than two lines are used to express doubts or concerns, that these comments are so vague and not pointed at a specific aspect of the PDD and that the review requests are mostly identical and anonymous, are considered "*really questionable*". "*Who guarantees that really three EB members had had doubts, why don't they say what is wrong, instead of stating 'it is wrong'? When I have written five pages on additionality, which is the part you do not like?*". Since EB rulings remain anonymous and the personnel responsible for these cannot be contacted, no clarifications could be made.

A further critical aspect, is the perceived inconsistency of the ruling on projects. Often among identical projects some would get accepted and some would get rejected. This perceived inconsistency is attributed to the differing background of the RIT members and to the fact that they very seldom meet ("*they do not work together – consistency would be surprising*"). It is further attributed to constant changes of staff, parts of which seem to be insufficiently qualified and prepared for the assessment of the projects. In addition, rules would be changed constantly, without justification and the reasoning of decisions is decribed as not comprehensible.

Regarding the perception of additionality, it is generally accepted that the concept has its right and significance, being part of the "rules of the game". Additionality is seen as a consequence of a mistake that was made earlier: the separation in a world with and without emission targets. Because, unlike emissions trading, a certified emission reduction is *not* subtracted from the account of one country when being transferred to another. It has to be checked "three times" that the emission reduction hadn't taken place anyway, in order to guarantee compliance with the Kyoto targets.

Consequently, additionality has to be demonstrated and checked. According to the general opinion among the project developers, if a project is not common practice it can be considered additional, even if it gives some return. If there is at least one barrier in relation to the baseline, the project would be additional. The barrier test is therefore seen as a suitable tool to demonstrate additionality. The different barrier *types* however, are judged differently with respect to their capacity to prove the existence of significant barriers: the technological barrier is considered still important by one respondent, while most of the others would slowly lose grounds. An IRR comparison by means of the financial analysis is seen as gaining importance.

As to the discrimination between non-prohibitive and prohibitive barriers, it is considered "easy to imagine extreme examples to either side". "Moving to the centre however, it gets more and more difficult to really differentiate and generalise: what is too risky for one might be alright for another, what is a reasonable margin for one might be undisputable for another". With respect to the impact of expected CDM gains in the investment decision, for example in bagasse cogeneration projects; energy contributes only 5% to the IRR of the enterprise and CERs income even less. It is an *extra* incentive, a symbolic value, which means that some entrepreneurs would go ahead without the CDM and some wouldn't.

Brazilian project developers conceive a variety of promising activities and technologies which can play a future role in the CDM: rural electricity generation based on renewable sources such as PV or small wind turbines is seen as an interesting perspective under a programmatic CDM. But also the potential of energy generation from captured methane at swine farms or the energetic uses of waste incineration or pyrolysis are seen as untapped.

Designated Operational Entities

Also representatives of the DOEs active in Brazil, agree that the CDM provides for a certain push for renewable energy diffusion. The extent to which this is achieved however is judged rather critically. The scale and speed is seen as too small for having a real impact on the global energy matrix; too small even for maintaining the current share. Renewable energy projects in the CDM would typically be small projects because large ones automatically face additionality problems. However, energy demand in developing countries would rise much faster than what small projects could contribute. Cuts in red tape and positive lists or benchmarks could help to alleviate these restrictions which in return, would open loopholes for non-additional projects.

When asked about an apparent slow-down in the Brazilian CDM development, DOE representatives pointed at the extensive approval process through the Brazilian DNA, compared with other countries such as India. Nevertheless, it must not be overseen that the CDM development nowadays rather reflects the countries natural potential, whereas the initial rush was a result of the catch-up-inclusion of all the “early projects”; a development that hadn’t taken place in China. After all, comparing any country’s CDM development with the one of India and China, the sheer size of these countries must never be far from sight.

As to the future of renewable energies in Brazilian CDM, respondents were not all too optimistic because of the extremely low emission factor. Biomass cogeneration in the industrial sector, as well as the programmatic CDM, are considered promising.

With respect to the “functionig” of the operating projects, it is said that many stay far behind their expectations, not only in Brazil however, which is mostly due to monitoring problems.

DOEs clearly feel inclined to a reading of the additionality concept, which aims at projects that wouldn't have come about anyway. This prevailing interpretation is regarded as meaningful for the avoidance of windfall profits and price deterioration due to credit inflation. An unlimited inclusion of typical non-additional projects would lead to a crowding out of new, state-of-the-art technologies, which would contradict the desired technology transfer. All in all, the integrity and credibility of the system are at stake.

At the same time the restricting consequences for a "global energy shift" of this approach are acknowledged. In fact, many projects are submitted to the DOEs where it is clear that they were meant to be carried out anyway and that the CDM had been added as "the icing" by consultancies. In the past, there has definitely been some non-additional projects which "have slipped through". According to the suggestion of one respondent, non-additional projects should, instead of being "avoided", be carried out in the voluntary carbon market.

The suitability of the barrier test for additionality determination is viewed inconsistently. Some respondents consider the barrier analysis as adequate, credible and a "simple and elegant" method for additionality demonstration (especially when backed by the common practice analysis). Others prefer the financial analysis pursuant to Step 2, as this could be used as an undisputable tool, being clearly quantifiable and substantiated by documentation. But also qualitative barriers shall not be disqualified *per se*. Cultural barriers ("*we have done it like this the last hundred years…*") for example, definitely would exist and be responsible for inertia, where the incentives of the CDM could provide the decisive "push". Also financial barriers, such as no access to funding, would be a realistic obstacle. With respect to this however, the situation in Brazil is considered as having improved a lot lately, which decreases the importance of this barrier. The existence of a common practice barrier would be evidenced by the small share of renewables (except for large hydro) in the Brazilian energy matrix and by the fossil based extension in the recent path. "*With small hydro for instance, you have to build a lot of plants for little energy*".

DOEs do share the perception that barriers are sometimes exaggerated and that artificial barriers are created. Consequently, it is considered important that PDDs demonstrate in a credible way, that the potential CDM registration had played a critical role in the decision process of the project proponent. By including feasibility studies or board meeting notes, it can be shown that barriers had been considered right from the start and had not been "invented" along the way. Close to all PDDs would change during the validation process, in which DOEs try to identify and erradicate exagerations and artificialities.

Confronted with findings from a PDD analysis by the author, where frequently a project IRR is presented first without CER income, then with CER income (which is higher) and finally a benchmark that is even higher than both IRRs, DOE representatives stated that in such cases it should be questioned in the validation what the true motivation for going ahead with the project is. On the one hand, it is clear that an entrepreneur considers many aspects in an investment decision. Text-book business-administration wisdom at this point, would only compare the IRR with the benchmark. Some aspects however, could not or only with great difficulties be monetised, but would definitely play a role. So it certainly would be conceivable that a project with an IRR with CERs lower than the benchmark (interest on loans or alternative investment options) may be implemented. On the other hand, it would have to be questioned in such cases, whether the respective project wouldn't have been kicked off anyway, irrespective of any benchmark.

All in all, 5 – 10% of the projects in the case of one DOE and 3 – 4% in the case of another, do not pass the validation process. Additionality is the dominant reason. Of the ones that pass, close to 95% live through substantial changes during the process, which takes at least half a year. It often happens that during the validation, methodologies or templates change ("*and you have to change with them*"). This may prolong the process until one year. "*And if then things go wrong and one misses a DNA meeting, it sometimes happens that again rules change or a methodology expires*".

When asked to comment the perception of environmental NGOs about situations where some project developers play DOEs off against one another, most respondents explicitly agreed. This would happen with respect to prices ("*race to the bottom*"), but also with respect to strictness. However, it could only happen *before* the actual validation process because once the public stakeholder comment period begins, for which the DOE publishes the PDD on the UNFCCC website, changing to another DOE is not possible (which of course does not prevent the threat of not getting any other projects at a later date). This sort of gaming would be likely to come to an end however, because with the actual multi-stage scrutiny by the EB (to which all DOEs are committed to deliver quality to), a questionable project that might have passed the critical eye of a DOE will then be caught in a review request. This is seen as something nobody wants and it "should be understood by project developers by now". Commenting on the alleged conflict-of-interest situation between project developers and DOEs, one respondent stated "We are large and internationally operating companies with so many business segments among which CDM validation is only one sideline. There is so much work and we would never put our credibility at stake by giving in to a particular project developer".

Different views exist with respect to the criteria upon which project developers base their choice for a particular DOE. "*Price, price and speed, but mostly price*" one respondent replied. Another differentiated: "*Unilateral projects: only price. In bilateral projects quality, record, experience with the host country play a stronger role*". Sometimes long-time established relations between companies and certification bodies can outweigh criteria such as price.

What is considered very critical is the "copy-and-paste" mentality of some project developers. Every project would be unique and additionality argumentation, that is barriers would have to be "personalised". Very general and unsubstantiated statements that refer to the whole sector or country could not be approved.

Concerning the registration practice of the CDM executive board, there is a consensus among the DOE representatives that against the backdrop of the CDM being a new and still evolving ("maturing") mechanism, the UN staff does a good job in navigating the CDM. After all – it is a learning-by-doing process ("*everything was new to everyone*"). And without any doubt a tightening of the project scrutiny by the EB can clearly be perceived.

There is however, substantial critique as to the communication concerning clarifications, review requests and rejections. Sometimes requests would be unnecessary – "the answer was in the PDD!". Often instead of a simple clarification request by e-mail, a request for review would immediately be issued. One could clearly notice the changes of RIT members, as questions that had long been clarified are asked all over. Besides, requests would often be incomprehensible and vague. The work of the RIT is criticised as inconsistent: "*it should be better coordinated!*". The outcome was a perceived inconsistency in additionality appreciation on the part of the board. Sometimes out of a set of identical projects some were registered and some weren't.

From a DOEs perspective, the ever stricter review regime is ambiguous: on the one hand it is considered important and positive as it alleviates the pressure on the DOEs by interested stakeholder groups and it deviates the responsibility to the UN regulatory framework. A consequent review regime would prevent a "quality race to the bottom" among DOEs under the pressure of their clients. If on the other hand, one really does get caught in a review, it is a really straining procedure and can be seen as a real nuisance if not justified.

An improvement of communication between the EB and the DOEs as well as among the DOEs is generally considered extremely important, and steps in this direction are on the way.

Designated National Authorities

According to the Brazilian DNA, the CDM did contribute to the "structuring" of renewable energy projects in the consciousness of the people. Programmatic CDM, for example in the field of solar thermal appliances for water heating as well as the important task of reforestation, are identified as promising areas of future development.

Strict application of additionality is considered important due to the linkage with the carbon intensive sectors of industrialised countries. Although clearly *all* renewable energy projects including non-additional ones, yield tremendous benefits, "*positive externalities*", different support tools that are not linked to carbon credits have to be used in addition to the CDM. The commission (see above, CIMGC) carefully checks the additionality of projects on the basis of the PDDs and the validation reports and thereby tries to provide an "*equal playing field*" for project proponents.

It is acknowledged that to some extent, non-additional projects had slipped through in the past, although the percentage is considered much lower than in other countries. A current problem would be the continuous submission of prompt start projects, a phenomenon which should have been over by the beginning of 2007. Through a loophole in the UN documentation however, projects that were partly operating for years could still ask for registration, only not for retroactive crediting. These projects would be clearly non-additional: "*why haven't they asked for registration before?*". As for the Brazilian DNA, such free-riding tries to be avoided.

The current situation under the ACM0002 methodology causes extremely low emission factors, especially in the North-East. For example, wind energy projects would *have to be* non-additional, because of the minute contribution of carbon finance, despite excellent conditions and their positive contribution for the mitigation of climate change. The emission factors that were determined by both the Ministry of Science and

Technology and the Ministry of Mines and Energy, based on official ONS data, are published on the website. These factors are not official ("*in terms of final*") and have been submitted to the Meth Panel. Reactions in the country were strong, because in some areas the emission factors decreased considerably, as for example in the South-East, due to the separation from the carbon intensive southern subsystem. Although it is claimed that no substantial transmission constraints exist (see above: project boundary), the truth is that no actual transmission takes place between these systems. On the whole, the methodology ACM0002 is considered not very appropriate for a country like Brazil with lots of hydro.

Variations with respect to the quality of performance, is perceived with DOEs. The communication of the work could be improved. DOEs would often raise important questions (CARs – corrective action requests) and then would just conclude them to be "*solved*", in an irreproducible way.

The barrier test is seen as extremely subjective and non-scientific. The barrier demonstration in the PDDs often was very "pattern-like". The DNA would increasingly ask for documentation and proofs. The barrier test could be very useful if people wanted to answer correctly – and not just argue for whatever they believe will be accepted. This "mal-faisance" would limit considerably the capacity of the barrier test to uncover non-additional projects – "*DOEs should do more to stop this*".

Changing EB performance and tightening of project scrutiny, is perceived as positive by the Brazilian DNA. At the same time inconsistencies are acknowledged, which is attributed to the structural architecture. Although the RIT would try to better synchronize its work, everyone works alone on certain aspects (in contrast for example to the Brazilian DNA) and sometimes the connection and the overall rationale is lost.

Unlike the Brazilian DNA, the DNA of the Netherlands does not go into a detailed additionality check. Following an official legal process on the issuance of LoAs, the credibility of the project, the status of the company, a declaraion of compliance with the UNFCCC regulation by the project proponents, and, in the case of hydro-power, the compliance with the guidelines of the World Commission on Dams are checked. The Dutch DNA wants to support the CDM as a system, so when it is approached by a project proponent for the Annex-I-LoA and the above aspects are alright, the approval is given. The detailed project scrutiny, for example with respect to additionality, is left to other bodies. In the cases of projects in which the Netherlands are involved through their purchase programmes, every aspect of the project is known anyway.

The German DNA has a clear legal obligation to check the additionality of the projects. It primarily bases its assessment on the DOE validation reports and the original PDD, taking a look at the plausibilty and coherence of the argumentation. Although no project-by-project data collection is carried out, DOE mistakes and reasons for rejection are carefully monitored.

It is acknowledged that the additionality tool is a comparatively new instrument that is continuously maturing. Much consideration will be given to the approaching beginning of project scrutiny for the *second* crediting period, because it is expected that in this process, many projects may be re-evaluated.

Like their Dutch colleagues, the German DNA feels inclined to a strict interpretation of additionality, although the wording of the respective legal act (the ProMechG) is as vague as the MA. There is consensus however, in that non-additional projects lead the system *ad absurdum*.

The ever stricter registration practice of the EB is attributed to an increase in staff, to a continuous learning-by-doing process, to improved tools and to (political) changes in the composition of the EB. “The way the whole system is structured now, a much more stringent practice can be expected”, especially with respect to the upcoming “feedback-round”. Findings of the re-evaluation for the second crediting period will have an impact on the assessment of new projects.

Other stakeholders

Environmental NGOs

As the other stakeholder groups, representatives of environmental NGOs do acknowledge a positive contribution of the CDM for the diffusion of renewable energies, as well as a positive impact on the understanding of renewables throughout parts of the developing world. But also from an NGO perspective, the extent to which this is achieved is regarded in a rather pessimistic way: “*is it able to substantially contribute to this goal? Unfortunately, no*.”. Additionality, the global warming potentials and the cost structures would favour industrial gas abatement and methane, leaving renewable energies behind.

And although the bulk of “low hanging fruits”, like HFC would soon be exploited, the current set-up is still considered as limiting rather than promoting, due to project-by-project bureaucracy and transaction costs.

Sectoral approaches, positive lists and the upcoming programmatic CDM are all considered as interesting improvement options. Nevertheless, it would be wrong to rely on the CDM alone for providing the necessary push for renewables. National policies and a favourable regulatory framework would have to be created within the developing countries (feed-in tariffs, mandatory implementation, subsidies etc), with the help of industrialised countries.

A strict application of additionality would be crucial under the current set-up. An inclusion of non-additional projects would only create windfall profits for some of the project owners/developers. Although more projects would be implemented under a looser additionality regime, this would lead to extra emission in industrialised countries and therefore damage the credibility of the whole climate protection regime as we have it now. Another important point in this respect, is the fact that it is not the degree of additionality which is the most decisive or restricting parameter for the implementation of renewable energy projects, but rather the excessive costs resulting from the ‘project cycle’.

The performance of the EB is judged positively as getting more and more pragmatic (“*Yes, they do a good job in navigating the CDM*” / “*They are ‘holding the line’ environmentally*”). Under-resourcing is considered to be the reason for inconsistencies in the past.

With respect to the barrier test and its suitability for the additionality check, no clear or unambiguous judgement can be given. In Brazil, the interest rates with which the project IRR is compared to, are extremely high. Many return rates fall beneath this hurdle, which would indicate the additionality of this project. It can however be widely perceived in the country that projects *do* survive with returns much lower than the interest rates.

The fact that the current CDM implementation is hardly critically followed by the international NGO community (exception: WWF) can be explained by two main reasons: first, the sheer mass of projects makes it literally impossible to follow all the projects in detail given the resourcing and staff. Second, many NGOs had fought against the CDM from the beginning, but now that it is there they rather concentrate on post 2012 developments. There is evidence however, that a "CDM-watch" might be re-established.

Science

Views of the Brazilian scientific community on the CDM in the country and its impact on renewable energy diffusion and additionality differ substantially in some respects.

Again on a general level, a positive impact on renewable energy promotion is acknowledged. One respondent however sees this goal sacrificed on the altar of cost-effectivity, due to the design as market mechanism. Projects with outspoken socio-environmental benefits like rural photovoltaics had no chance due to the unfavourable ratio between costs and certified emission reductions. On the other hand projects with extremely questionable additionality, like sugar cane cogeneration or SHP were prospering. In the first case, due to the very logic of the industrial process, cogeneration of the waste bagasse would be a logical step in the project's optimisation and would at the same time be a good "marketing tool". Barriers such as uncertainties resulting from electricity prices would frequently remain vague (not quantified) and unsubstantiated in the PDDs. In the latter case, projects would either result directly from governmental expansion plans or serve the auto-supply of big industrial complexes. Frequently alleged barriers would be exaggerated by the project proponents in order to prove additionality.

A more appropriate way for the promotion of renewable energies is seen in effective policies. The linking of renewable energy promotion in developing countries with (rising) emissions in industrialised countries would be a "des-incentive" for the establishment of sustainable projects. *Within* the CDM, the programmatic CDM might contribute better to the goal mentioned above.

A completely different view on the additionality of Brazilian renewable energy projects is held by two other representatives of the countries scientific community: "*barriers against the implementation of individual small*[108] *renewable energy pojects do exist and they are substantial, robust and credible*". Since, contrasting the predominant large hydro electricity, these technologies haven't had a chance to develop economies of scale, they face a distinct disadvantage and cannot compete economically. Investment barriers,

[108] Small, as opposed to for instance large hydro, not in the sense of small scale CDM activity.

interpreted as difficult project financing, are still considered to be existing and credible obstacles, due to the continuation of high interest rates in the country.

Even apart from all economic rationale, many other aspects have to be taken into account to appreciate the behaviour of decision makers in Brazil. Regulatory complexity for example, is described as overwhelming ("*não é brincadeira - this is not funny*"). This is something which is believed to be probably different in many industrialised countries. Another difficulty would arise from the fact that (outside the PROINFA) there was no incentive for the local utilities (concessionaires) to accept possible energy producers who were consumers beforehand.

Although most of these barriers for themselves would not necessarily prevent a project implementation, they would create in sum an atmosphere that makes investment decisions extremely unlikely for these kinds of projects. This is where the CDM could definitely make a difference.

Bagasse based cogeneration and SHP would, according to these respondents, remain the most promising technologies among the renewables within the CDM. Rice husk and wood residue projects would not reach a sufficient scale. Wind energy, due to a lack of competition, hadn't been able to develop economies of scale and remains on the margin of competitiveness. PV would be absolutely chanceless except in locations with a certain distance to the next grid.

With respect to the underlying problem of additionality that ties the promotion of GHG friendly technologies to Annex I emissions, a system that is more based on technology *transfer* would be welcome in the long run.

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Climate protection activities must, according to the Kyoto Protocol, satisfy the criterion of "Additionality", in order to be recognised as Clean Development Mechanism (CDM) Projects. But what does "Additionality" really mean? How can this criterion be put into operational practice? How can one determine whether or not a project would have been carried out without the support of the CDM incentives? The author addresses these and other thought-provoking questions, with particular focus on the application of the barrier test in Brazilian CDM projects pertaining to the Renewable Energy Sector.

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