Clean Development Mechanism and Sustainable Development

A discussion on the link between the CDM and Sustainable Development, an analysis of the current status of the CDM portfolio, and a multicriteria evaluation of the effects of additional incentives in order to foster broad local Sustainable Development dividends from the CDM projects

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Abstract

Exosomatic energy, although not an unconditional human requirement per se, is present in many aspects of Human Development. The introductory section of this study presents an analysis of the link between Energy and Development, highlighting common points of and contradictions between Climate and Development measures. It presents also a discussion about Sustainable Development and the potential role that the Clean Development Mechanism (CDM) could play in this regard.

The goal of the CDM, as defined under the Kyoto Protocol framework, is twofold. It must offset greenhouse gases emissions and it should contribute to local Sustainable Development. However, the effective contribution of the CDM projects currently in the pipeline to the latter objective can be questioned. The shortcomings of the CDM in terms of Sustainable Development may be summarised as follows. Firstly, the *quantity* of CDM seems insufficient in order to have a significant impact both in terms of Climate and Development policies. Secondly, the *quality* of the projects, including some already approved, is unsatisfactory from a local Sustainable Development point of view. Thirdly, the *distribution* of the CDM activities across potential host-countries is extremely unequal. This paper critically examines the CDM projects currently in the pipeline based on those three drawbacks.

Some institutions suggest alternative approaches with the aim of fostering broader local Sustainable Development dividends from CDM projects. Two alternatives are the Gold Standard and the Community Development Carbon Fund. The former rewards best-practice CDM projects in terms of Sustainable Development while the latter focuses on promoting CDM projects located in underprivileged communities.

In the present work, a multi-criteria assessment method is applied to analyse the influence of those additional incentives from a local Sustainable Development point of view. Projects benefiting from such additional incentives are compared with others that do not embody such incentives. The evaluation reveals that the CDM projects benefiting from those additional incentives perform relatively well in terms of local Sustainable Development. Interestingly, other CDM projects behave similarly well, or even better, both in terms of overall performance and in terms of balanced repartition amongst the different Sustainable Development criteria.

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Abbreviations and acronyms

ABD	Asian Development Bank
CBA	Cost-Benefit Analysis
CDCF	Community Development Carbon Fund
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH_4	Methane
CO_2	Carbon Dioxide
CO_2eq	Carbon Dioxide equivalent
COP	Conference Of the Parties
CSD	Commission on Sustainable Development
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DFID	Department For International Development (UK)
DOE	Designated Operational Entity
DNA	Designated National Authorities
EB	Executive Board
EIA	Environmental Impact Assessment
EIT	Economy In Transition
FAO	Food and Agricultural Organization (United Nations)
FIFA	Fédération Internationale de Football Association
FDI	Foreign Direct Investment
FGTB	Fédération Générale du Travail de Belgique (Belgian socialist trade union)
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gases
Gt	Gigaton (billion or 10^9 metric tons)
GTZ	Gesellschaft für Technische Zusammenarbeit
GWh	Gigawatt hour (billion or 10^9 watt hours)
GWP	Global Warming Potential
HDI	Human Development Index
HFC	Hydrofluorocarbon
HWWI	Hamburg Institute of International Economics (Hamburgisches Welt-Wirtschafts-Archiv)
IEA	International Energy Agency
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
IUCN	The World Conservation Union (former International Union for the Conservation of Nature and Natural Resources)
IRR	Internal Rate of Return
JI	Joint Implementation
Kt	Kiloton (thousand or 10^3 metric tons)

LDC	Least Developed Countries
LULUCF	Land Use, Land Use Change and Forestry
MATA-CDM	Multi-Attributive Assessment of CDM
MAUT	Multi-Attributive Utility Theory
MCA	Multi-Criteria Analysis
MDG	Millenium Development Goals
MOP	Meeting of the Parties
Mt	Megaton (million or 10^6 metric tons)
MW	Megawatt (million or 10^6 watts)
N_2O	Nitrous Oxide
NCCCC	National Coordination Committee on Climate Change (China)
NEF	New Economics Foundation
NGO	Non-Governmental Organisation
NO_x	Nitrogen Oxides
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OFEFP	Office Fédéral de l'Environnement, des Forêts et du Paysage
PDD	Project Design Document
PFC	Perfluorocarbon
REEEP	Renewable Energy & Energy Efficiency Partnership
ReNED	Research Network for Environment and Development
SF_6	Hexafluoride
SIDS	Small Island Developing States
SIF	Social Investment Funds (Moldova project)
SO_x	Sulphur Oxides
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate
WB	World Bank
WBCSD	World Business Council for Sustainable Development
WCED	World Commission on Environment and Development
WEHAB	Water, Energy, Health, Agriculture and Biodiversity
WRI	World Resources Institute
WWF	World Wide Fund for Nature (former World Wildlife Fund)

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Chapter 1: Introduction

1.1 Background

The Clean Development Mechanism (CDM) is the outcome of lengthy and delicate international negotiations. It represents a compromise between the aspirations of developing countries for Development on the one hand and the wish for industrialised countries to meet their emission target in an economically efficient way on the other.

The CDM has therefore two objectives, namely to off-set Greenhouse Gas (GHG) emissions produced in developed countries whilst promoting Sustainable Development in developing countries. Is the CDM able to hold the promise of that dual-objective? That doubt constitutes the core of this study.

By not defining clearly the Sustainable Development criteria required for the CDM, the United Nations Framework Convention on Climate Change (UNFCCC) allows for certain flexibility for the host-country of a CDM project to adjust those criteria according to the national Development priorities. On the other side, much uncertainty and inconsistency could arise from such an uncoordinated approach.

The CDM is seen as of particular interest for developing countries. Indeed, their fear for environmental measures to hamper their Development would vanish if Climate and Development policies could converge. However, as to whether Climate and Development objectives are compatible or in contradiction represents the source of many debates.

Facilitating the access to clean and affordable energy services can represent an attractive instrument for Sustainable Development in underprivileged communities. Energy[1], despite not representing a fundamental human requirement in itself, contributes to fulfil many crucial needs, such as cooking and heating for instance. A CDM related to Energy seems therefore of particular interest, as will be exposed in the next chapter, to explore the double goal

[1] For the clarity and fluidity of the text, the general term Energy is used but specifically refers to *exosomatic* Energy throughout this paper.

mentioned above. Based on this assumption, the study will focus on energy-related projects principally.

According to the literature, some CDM projects seem to under perform in terms of Sustainable Development. This claim gives rise to a series of measures which aim at promoting CDM activities with broader Sustainable Development dividends. The effects of such additional incentives is analysed and discussed in this paper.

1.2 Objectives and research questions

This research work provides some insights about the status of the CDM as a compromise between the Sustainable Development claim and the cost-efficient greenhouse gas emission off-set. The objective is threefold:

- Firstly, to provide an overview and an understanding of the CDM and its current debate from a Sustainable Development point of view predominantly.
- Secondly, to analyse the current CDM portfolio.
- And finally, to perform a multi-criteria evaluation applying the MATA-CDM methodology on selected CDM projects in order to explore the influence of additional incentives to foster higher Sustainable Development benefits from such activities in the host-country.

Those objectives can be divided into the following research questions:

- How did the CDM emerge in the international agenda?
- What is the role of the CDM in Sustainable Development?
- To which extent does Energy influence Human Development?
- What are the main tendencies of the CDM projects currently in the pipeline (at validation stage or further) from a Sustainable Development point of view?
- To which extent have additional incentives to foster broader Sustainable Development

dividends an influence on the outcome of a CDM activity?

1.3 Research methods

The first section will be based on an extensive literature review to allow for a clear and up-to-date understanding of the CDM concept, including insights on its potential influence on local Sustainable Development. Also, this part aims at analysing the link between Energy and Human Development.

Three aspects compose the analysis of the CDM projects currently in the pipeline. The quantity of Certified Emission Reduction (CER) will be examined. The different types of project activities will be analysed in depth. And finally, the distribution of the CDM activities over the potential host-country will be investigated.

Ultimately, a multi-criteria evaluation will be performed on different CDM projects in order to assess and discuss the effects of additional incentives for Sustainable Development dividends. Projects benefiting from such additional incentives will be evaluated alongside with projects that don't involve such incentives.

1.4 Structure

Following the introduction, this study is organised in two main parts. The first part represents a theoretical approach of the issue, while the second displays an empirical view.

Chapter 2 presents the literature review and brings the theoretical foundation of the study. The chapter 3 analyses the CDM portfolio in a critical manner and from a Sustainable Development point of view. Some additional incentives designed with the aim of dealing with some of the shortcomings discussed in the previous chapter are presented in chapter 4. Chapter 5 introduces the multi-criteria methodology applied for the appraisal of the CDM activities. In chapter 6, the project evaluations take place. Chapter 7 allows for a discussion of the results and lastly, conclusions are drawn in chapter 8.

Chapter 2: Literature Review and Theoretical Framework

Through an extensive analysis of the international literature this chapter places the research in its contemporary context. The review examines the context in which this study finds itself, starting by exposing some of the relevant findings in regards to Climate Change and moving towards the Climate negotiations and the Clean Development Mechanism (CDM). The related concepts of Sustainability and Sustainable Development are discussed as is the role played by the CDM in that respect. Finally, the critical role of Energy in regards to Development is investigated.

The goal of this section is to present an overview of the international debates in relation to this research. Reference to the various literatures, and an analysis of those various points of view, serves to explore the past and current discussions triggered by the different topics. Various resources have been accessed for the literature review. These include traditional sources such as text books as well as published and printed referred journals. However, a reference to traditional literature only could be viewed not to serve this research field adequately as the discussions are immediate, contemporary and urgent. Quite appropriately, the literature review will refer to the growing fields of the accessible, dynamic and prolific sources found through the internet. This includes a variety of electronic materials, articles from on-line refereed journals, un-refereed papers, as well as email-lists information and personal contacts. The field of the CDM being recent and often contentious, the access to the immediate public literature is vital in determining where the debate is headed. However, it must be acknowledged that the abundant documentation available on the internet is not of equal quality. It is important for a researcher to acknowledge sources and credibility. Peer-reviewed sources, as well as the reputation of the author and/or institution, are regarded as one of the most accurate indications of the reliability and integrity of a piece of literature. This section of the research clearly acknowledges all sources, and indicates where arguments may have a certain validity, or where they might be regarded as interesting but not necessarily from reliable or accredited authors.

Other excellent opportunities to retrieve the latest positions of the stakeholders and world experts in their respective areas include an active participation in the conference *Climate or*

Development? in Hamburg[2] and *Expo CO_2* in Barcelona[3] as well as a role of attentive observer of several conferences, such as *The Clean Development Mechanism – Linkages to Poverty Reduction and Sustainability* in Copenhagen[4], the *Eleventh session of the Conference of the Parties to the Climate Change Convention (COP 11) and the first Meeting of the Parties (MOP 1) to the Kyoto Protocol* in Montréal[5] and the *Fourteenth Session of the Commission on Sustainable Development (CSD-14)* in New York[6] together with their many Side-Events. Such personal involvement in, and reference to, the literatures and research of international conferences considerably contributes to the foundation of this study.

2.1 Climate Change

Climate Change, alongside with biodiversity loss, is often described as being the major contemporary environmental challenge humankind is facing nowadays (UNFCCC 2002a, Ramos Martin 2001, Watkiss et al. 2005). Obviously the Earth is in a state of constant change and evolution, and the Earth's climate has always varied naturally. However, according to the vast quantity of international literature commenting on these matters, the majority of scientists are now convinced that the current trend is distinct, especially in terms of the rate at which the change is happening, with the previous decade being the warmest globally (IPCC 2001a) in recent times. Observations and measurements show a global average temperature increase, snow and ice covers decrease, global average sea level rise, change in precipitation patterns, as well as an increase of the intensity and frequency of extreme weather events (IPCC 2001a, Greenpeace 2005). All these changes are measured as occurring over a relatively short period of time.

[2] Hamburg Institute of International Economics, 28-29 October 2005. More information available at: <http://www.hwwa.de/index.htm>, viewed 8 November 2005.
[3] Fundació forum ambiental, 4-5 May 2006. More information available at: <http://www.expoco2.org/>, viewed 27 May 2006.
[4] Research Network for Environment and Development, 27 October 2005. More information available at: <http://www.rened.dk/static.asp?page=CDM_2005>, viewed 8 November 2005.
[5] United Nations Framework Convention on Climate Change, 28 November - 9 December 2005. More information available at: <http://unfccc.int/meetings/cop_11/items/3394.php>, viewed 8 November 2005.
[6] United Nations Commission on Sustainable Development, 1-12 May 2006. More information available at: <http://www.un.org/esa/sustdev/csd/csd14/themes.htm>, viewed 27 May 2003.

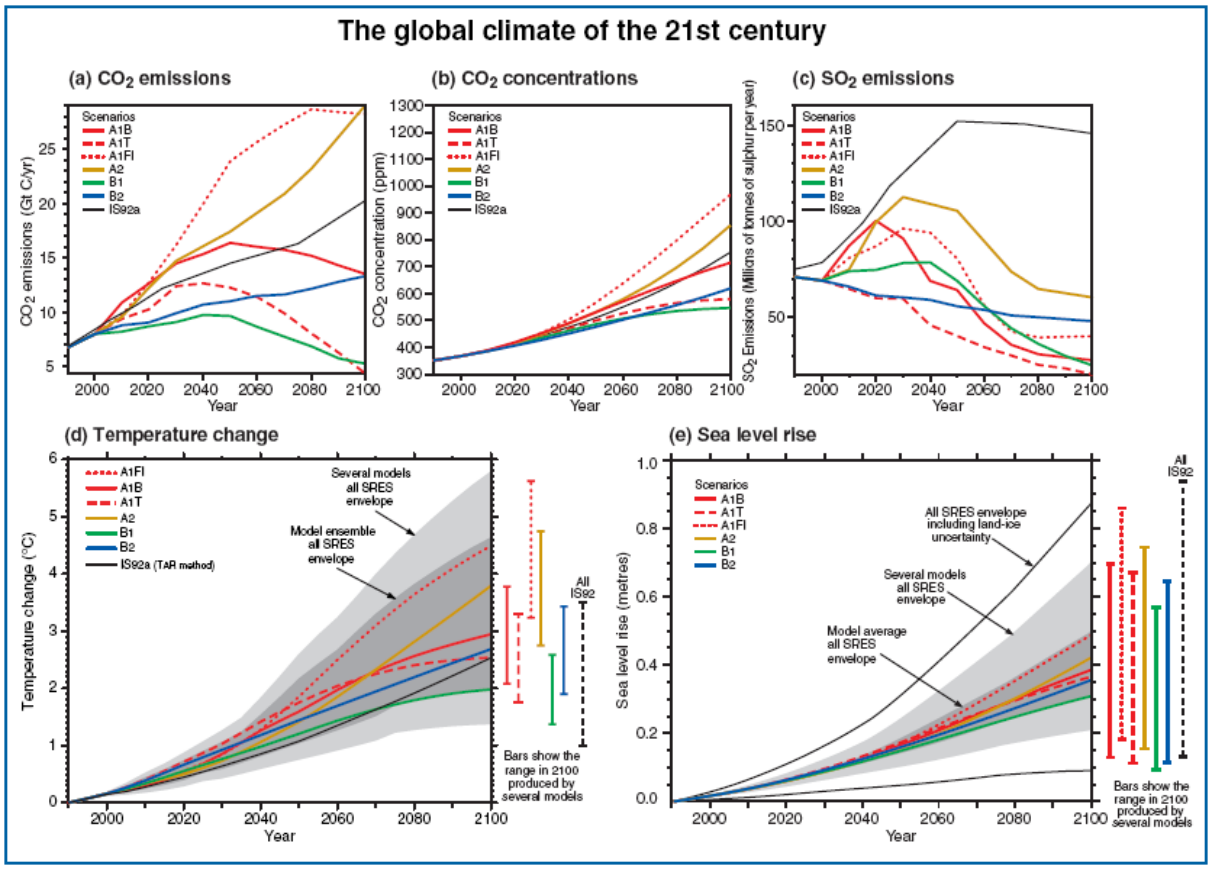

Figure 1: Projected evolution of global climatic parameters according to different emission scenarios.
Source: IPCC 2001a.

The difficulties and uncertainties of modelling an extremely complex system, such as the Earth's climate, lead to a wide range of estimates and strongly depend on different hypotheses and models used. Nevertheless, the Intergovernmental Panel on Climate Change (IPCC 2001a) predicts an increase of the mean surface temperature of 1.4 to 5.8 °C over the next 100 years (see Figure 1). An important driver of this rapid global climate change is believed to be the particularly high concentration of Greenhouse Gases (GHG) in the atmosphere (UNFCCC 2005a), which is influenced by human activity.

> *There is new and strong evidence that most of the warming observed over the last 50 years is attributable to human activities.* (IPCC 2001a, p. 10)

Preoccupations for anthropogenic Climate Change emerged on the political agenda in the mid-1980s. Indeed, the scientific evidence of human interference with the climate system started to raise public concern (UNFCCC 2005a). The consequences of a global average temperature rise of a few degrees are numerous, diverse and alarming. The projected changes in the climate patterns could alter ecosystems which are fundamental to humankind and,

amongst other effects, disrupt agricultural production, water cycles and resources. Such potentially disastrous effects underline the fact that the stakes are high (IPCC 2001b).

The Climate Change negotiations

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 order to provide policy makers with authoritative scientific information. The United Nations General Assembly responded to the call of the IPCC to reduce human-induced Greenhouse Gases released into the atmosphere by launching formal negotiations on a framework convention on Climate Change. Those negotiations resulted in the completion of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. This agreement provides the foundation for intergovernmental efforts to address this issue. The Convention splits countries in two groups according to their historical contribution to anthropogenic Climate Change. The so-called Annex 1 Parties include the industrialised countries plus countries with Economies In Transition (EIT), such as the Russian Federation, the Baltic States, and several Central and Eastern European States. The non-Annex 1 Parties are composed primarily of developing countries[7]. Also, the Convention recognises the particular vulnerability to Climate Change and other special circumstances of 48 countries defined as the group of Least Developed Countries[8] (LDC) by the United Nations.

The Convention set up a few basic principles which are of importance to this research: 1) It highlighted that the climate system should be protected on a basis of equity, and according to *common but differentiated responsibilities* and respective capabilities; 2) It acknowledged the specific needs and the special circumstances of *developing countries*, underlining their particular vulnerability; 3) It recognised the *precautionary principle*; 4) It emphasised the need for *sustainable development*. (UN 1992, art. 3)

Also, the Convention stated the aim of developed countries to return, *individually or jointly*, to their 1990 levels of anthropogenic greenhouse gases emissions (UN 1992, art. 4, 2b). This can be interpreted as the first sign for allowing Annex 1 countries flexibility in the way of

[7] For up-to-date lists of Annex I and non-Annex I countries, see <http://unfccc.int/parties_and_observers/parties/items/2352.php>, viewed 13 September 2005.
[8] List available at: <http://unfccc.int/files/cooperation_and_support/ldc/application/pdf/ldcbyregion.pdf>, viewed 25 November 2005.

achieving their emissions reduction targets, opening the door to multinational partnerships, including North-South[9] cooperation.

Mitigation and Adaptation

The strategy arising from international negotiations is twofold. On the one hand, *Mitigation* efforts will be deployed in order to moderate the anthropogenic contribution to the increasing atmospheric Greenhouse Gases concentration. On the other hand, *Adaptation* schemes will aim at easing the consequences of Climate Change.

According to the models and even assuming the most optimistic emission scenarios[10] implying drastic and rapid reductions, the atmospheric CO_2 concentration is likely to increase for decades until reaching stabilisation (IPCC 2001a). This demonstrates that *Mitigation* measures are crucial, but must be accompanied by effective *Adaptation* actions (DEFRA 2006).

It is widely recognised that poor developing countries are especially vulnerable, although not exclusively, to the negative effects of Climate Change and dispose of less capacity to adapt (IPCC 2001b, Parry et al. 2005). Geographically, several of those countries have low-lying coastlines subject to floods, are exposed to tropical storms or salt water intrusion, generally dispose of limited resources, and can be relatively isolated (UNFCCC 2005a, UNFCCC 2005c). The Small Island Developing States (SIDS), whose very existence is at stake, is a prime example of such extreme vulnerability. Many of the poor countries are mainly relying on local subsistence agriculture which is essentially dependent on rainfall. Climate Change can be seen as having obvious, immediate and possibly devastating effects in those countries.

The urgency of mitigating the anthropogenic contribution to Climate Change is repetitively underlined in the literature (DEFRA 2006, UNFCCC 2005a). The Kyoto Protocol is a product of such efforts at international level.

[9] North and South through the whole document refer as political poles, rather than geographical.
[10] For more details, see IPCC special report on Emissions Scenarios, available at <http://www.ipcc.ch/pub/reports.htm#sprep>, viewed 16 September 2005.

The Kyoto Protocol

Within the framework of the Climate Change Convention, governments acknowledged the fact that the issue of Climate Change deserved stronger and more detailed commitments, especially on the part of the industrialised countries. After long and intense negotiations, the *Kyoto Protocol* was adopted during the third Conference of the Parties (COP) in Japan, 11 December 1997. The open items of the Protocol's implementation were discussed in subsequent meetings and figure in, most importantly, the Bonn Declaration and the Marrakesh Accords (UNFCCC 2005a).[11]

For the Protocol to enter into force, a minimum of 55 Parties needed to ratify it, including enough Annex 1 countries so as to cover at least 55% of that group's carbon dioxide emissions in 1990 (UNFCCC 1997, art. 25, 1). The Kyoto Protocol entered into force 16 February 2005, after the Russian Federation's ratification (UNFCCC 2005a), and currently represents one of the most internationally supported treaties in history (AETF 2005) with 162 states having ratified it, representing 61.6 % of the total anthropogenic GHG emissions[12].

The Kyoto protocol creates a legally binding set of obligations for 38 industrialised countries, and 11 countries of Central and Eastern Europe, in order to reduce their emissions of Greenhouse Gases to an average of 5.2% below their 1990 levels over the commitment period 2008-2012. Some media describe this international agreement as representing the most ambitious attempt to tackle an environmental issue in history (Pomeroy 2005).

The Protocol lists 6 Greenhouse Gases, namely Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulphur Hexafluoride (SF_6). Those gases, which each have a different potential greenhouse effect, are aggregated together with the Global Warming Potential (GWP) factor[13] in order be comparable in a common unit, the Carbon Dioxide equivalent (CO_2eq).

Excluding the countries with Economies In Transition, out of the group of Annex 1 Parties, only few industrialised countries have ratified the UNFCCC but *not* the Kyoto Protocol to

[11] For more details on the Climate Change Convention Process, see UNFCCC 2002a.
[12] Data source: UNFCCC, status as of 28 February 2006, <http://unfccc.int/essential_background/kyoto_protocol/status_of_ratification/items/2613.php>, viewed 7 March 2006.
[13] GWP factors available at: <http://ghg.unfccc.int/gwp.html>, viewed 23 November 2005.

date, some of them having officially announced their intention not to do so in the future (UNFCCC 2005a). In order of importance in terms of total Greenhouse Gases emissions[14], these countries are the USA, Australia, Turkey and Monaco. Their main arguments repose on the fact that legally binding emissions reduction would undermine domestic economic performances and therefore prejudice national interests[15].

The Kyoto Protocol establishes three cooperative mechanisms to allow for Annex 1 Parties to reduce their costs of meeting the targets by trading emission certificates or undertaking corrective actions abroad rather than domestically. These are: *International Emissions Trading*, *Joint Implementation* and *Clean Development Mechanism*. Because Greenhouse Gases are spread out in the atmosphere around the globe, the geographical location of the emissions, or the emission cuts, doesn't significantly matter from an emission concentration point of view. Therefore, the effects of measures, wherever undertaken, are equally valuable from a mitigation of anthropogenic Climate Change point of view. This study focuses only on the third flexible mechanism, the CDM.

The Clean Development Mechanism

The CDM was created as a means of assisting governments and private businesses to reach their GHG reduction targets in a cost-effective manner, while contributing to the Sustainable Development priorities of developing countries, as stated in the article 12 of the Kyoto Protocol. The dual-objective of the CDM reflects the compromise of the negotiations with the industrialised countries looking for flexible options in order to meet to emission target, while at the same time developing countries being preoccupied by Climate Change policies which might be viewed as impeding their Development path. The CDM originally raised high expectations, especially in the developing countries, for its potential of delivering sustainable benefits triggered by foreign investments, technology transfer, and for its possible contribution to poverty alleviation (Olsen 2005).

[14] Source : UNFCCC, Information on national greenhouse gas inventory data from Parties included in Annex 1 to the Convention for the period 1990-2002, including the status of reporting, FCCC/CP/2004/5, 14 October 2004, available at: <http://unfccc.int/resource/docs/cop10/05.pdf>, viewed 9 November 2005.
[15] For more information on national strategies and arguments in regards to Climate Change, see respective official national communication reports to the UNFCCC available at <http://unfccc.int/parties_and_observers/parties/items/2352.php>, viewed 15 September 2005.

Apart from the requirement for Annex 1 countries to assist non-Annex 1 parties in promoting Sustainable Development, CDM projects of course are required to have 'real, measurable and long-term benefits related to the mitigation of Climate Change', and be based on emission reductions that are 'additional to any that would have occurred in the absence of certified CDM project activities' (UNFCCC 1997, p. 12).

The CDM project cycle

Each CDM project has to go through a process which is composed of different stages in order to be allowed by the Executive Board (EB), the supervising body of the CDM, to issue Certified Emission Reductions[16].

- Validation: A Project Proponent, such as a company or a local Non-Governmental Organisation (NGO), develops and implements a CDM project. It must be associated with a Designated Operational Entity (DOE), an institution accredited by the EB, which evaluates the Project Design Document (PDD) against the CDM requirements. The PDD basically represents a check-list in which the design and the methodology used for the project are exposed, and is the reference for the project evaluation. This document must be made available for public comments during a period of 30 days. The validation process includes as well, the verification that the host-country accepts the project by acknowledging its contribution to Sustainable Development.

- Registration: Based on the recommendations of the DOE, the Executive Board formally accepts the project or requests a review.

- Verification: The emission reductions that occur because of the CDM must be periodically monitored by the DOE.

- Certification: The final stage represents the issuance of the CERs by the DOE, which must be confirmed by the EB. Those certificates can then be placed on the market.

[16] For more information about the CDM project cycle, see: <http://cdm.unfccc.int/Projects>, viewed 21 December 2005.

The issue of Additionality

According to the official definition, 'a CDM project activity 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' (UNFCCC 2002b, p. 36). Although the concept might seem straightforward, the practical application can be biased. The hypothetical scenario of what would have happen with the absence of the CDM project is characterised by a relatively high degree of uncertainty (Sutter 2003).

The issue of *Additionality* often represents the target of critiques. Because the CDM does not reduce GHG emissions but only offsets them, if the *Additionality* of a project is questionable, there is the risk for CERs to be issued without actually being compensated. Although this notion is important, a more elaborated debate goes beyond the scope of this investigation[17].

Even if *Additionality* is legitimate, the CDM is at best Climate-neutral. Therefore, its contribution to the other objective, Sustainable Development, is fundamental (Sterk et al. 2005).

2.2 Sustainability, Sustainable Development and the CDM

There was a clear shift a few decades ago in the environmentalist movements. The idea that environmental Conservation is *not* the opposite of Development (IUCN 1991) had been first brought up in the early 1980s, acknowledging that the consequence of poverty and misery can be a burden to the Environment. The need for people to enjoy a life of dignity, combined with Conservation arguments, gave birth to the concept of Sustainable Development.

Sustainability

In order to evaluate Sustainability, it is appropriate to start by discussing the different views and definitions of the concept. There is no single definition of Sustainability. Its meaning is strongly dependent on one's approach to environmental management. Also, its interpretation varies depending on different assumptions in regards to Human nature, Society at large as well as the interaction between Society and Nature (Özkaynak et al. 2004), which in turn

[17] For more information on the debate regarding *Additionality*, see Sutter 2003 and Greiner et al. 2003.

deeply influence its operationalisation. The polyvalence of Sustainability varies in relation to different social groups and practices, their particular beliefs, values or interests (Tàbara 2002). Despite the absence of a unanimously recognised definition, the notion is far from being futile.

One could argue that Sustainability is a relatively hypothetical state compared to the current way-of-life, especially in the western world. The concept of Sustainability can be interpreted as representing an objective rather than qualifying a state. Also, it helps identifying the trend by evaluating if a socio-economic system is getting closer to or moving away from an ideal.

The World Conservation Union (IUCN 1991) sees three main conditions for Society to claim Sustainability. Firstly, it must preserve the essential ecological processes that maintain life and biodiversity. Secondly, it has to guarantee the sustainable use of renewable resources and minimise the use of non-renewable ones. Thirdly, its activities are required to remain within the carrying ecological capacity. The slight weakness of this argumentation that can be pointed out, from the operationalisation point of view, is that the concept of *carrying capacity* remains difficult to reliably quantify because of its dynamic characteristic (Meadows et al. on 1992) on one hand, and on the other because it strongly depends on assumptions in regards to social metabolism (Martínez-Alier 1999). The ecosystems are complex, with innumerable interactions between them. This interdependency, amongst other factors, together with our limited knowledge don't allow for a clear estimation of the anthropogenic burden an ecosystem could handle. As well, *minimising* the use of non-renewable resources is a rather fuzzy target.

Research on the Earth ecosystems' history provides numerous examples of changes, progressive or sudden, that occurred naturally. Sea level variation, global average temperature change, biodiversity modifications are all illustrations that natural systems are dynamic and self-evolving. Therefore, Sustainability is anything but a static concept, as long-term equilibriums, whether with or without anthropogenic interaction, have never existed.

Sustainable Development

There are several attempts to define Sustainable Development. The classical one, from the World Commission on Environment and Development (WCED), is as follows:

Sustainable development implies meeting the needs of the present generations

> *without compromising the ability of the future generations to meet their own.* (WCED 1987)[18]

This concept receives a wide acceptance within the international community, although it is also relatively often criticised for its vagueness (Kates et al. 2005). For example, what are the so-called *needs* referred to in the "Brundtland's definition"? While some basic life requirements, like food and shelter, clearly fall under that category, others are disputable and socially constructed. The average occidental wealthy family would argue that having a second car represents a need for them. Beside the debate on whether something is a need or a luxury, there is as well the more subtle debate between the universal and objective needs and the culturally shaped ones (Preston 1996). The former represents a set of minimum physiological requirements whilst the latter implies a material and cultural minima. A list of needs is unlikely to be identical in different cultural contexts. As well, it would be mistaken to take for granted the fact that the needs of future generations will be equivalent to the ones of the present generation. Moreover, future generations have no agents and therefore no means of defending their preferences (Padilla 2002). Therefore, advocating future needs represents a challenge for current populations.

Luke (2005) questions the rhetoric of Sustainable Development, describing it as ideologically constructed in contemporary global Society, and arguing that other strong interests, mainly economic, prevail in our 'unsustainably non-developmental material culture' (Luke 2005, p. 236).

There is a clash in the interpretation of the notion of *Sustainable Development* between two fundamental positions. Both Environmental Economists and Ecological Economists advocate the preservation of natural capital. However, for the operationalisation, the former apply an economic value to that stock while the latter refer to it in its respective physical terms (Özkaynak et al. 2004).

In spite of the divergent interpretation and critiques, the concept of Sustainable Development can't be characterised as being completely relative. There is a convergence on three key goals. Firstly, 'human beings should be able to enjoy a decent life'; secondly, 'humanity should become capable of respecting the finiteness of the biosphere'; and thirdly,

[18] More popularly known as the Brundtland Report, named after the Chairperson of the Commission.

'neither the aspiration for the good life nor the recognition of the global biophysical limits should preclude the search for greater justice in the world' (Sachs 1999 quoted in ADB 2000, p. 92, Sneddon et al. (article in press)).

As well, there seems to be a consensus in the literature for seeing Sustainable Development as multidimensional dynamic process (Newman 2005, Martens 2006, Giampietro et al. 2006), including at least *Social*, *Environmental* and *Economic* aspects (Olsen 2005, Martens 2006).

Climate Change and Sustainable Development

The aspiration for socio-economic Development is undeniable, most especially for parts of the world which are most impoverished. However, Development paths over the last couple of centuries clearly demonstrated strong unsustainable characters, with adverse effects on the Climate in particular. It is therefore of utmost importance to elaborate a different pattern of Development, preserving environmental assets. The challenge is thus to work out conditions in which both developing and developed countries can enjoy a decent life at a minimum environmental cost (UNFCCC 2004).

Climate Change and Development policies have traditionally been treated separately (WRI 2005). However, it is not about a choice between Development and the Environment, in the sense that Human Development doesn't have to come at the expense of the Environment (Humphrey Institute 2004). Without neglecting the fact that sometimes Development and Climate Change mitigation have conflicting arguments as will be developed further, the international literature argues that there exist many options with which the aspiration of the poor is compatible with an easing of the anthropogenic environmental pressure in general, and of the human influence on the Climate system in particular (WRI 2005). Investments in Climate related fields are seen as central to growth and poverty reduction (WB 2005a).

The role of the CDM in relation to Sustainable Development

As already mentioned, the Clean Development Mechanisms represent an opportunity for Sustainable Development in developing countries, facilitated by the need of industrialised countries to meet their GHG emission targets. However, the link between such undertakings and Sustainable Development is not straightforward. Indeed, different factors, as it will be discussed below, could undermine the valuable objective of the CDM to promote Sustainable

economic, social and environmental Development in the host-country.

The Clean Development Mechanism projects appear to be of particular interest to the developing countries as they represent an opportunity for foreign investments while aiming at local Sustainable Development, a particular focus that does not always represent the ultimate goal of other forms of Foreign Direct Investments (FDI). CDMs have, beside their Climate Change related benefits, the potential of contributing to technological evolution, economic growth through foreign investment and poverty alleviation as well as environmental and human health improvements in the host-country (Cosbey et al. 2005). This kind of foreign investment is unique in the sense that only low- or no-GHG emissions activities (Ellis et al. 2004) are targeted, allowing for "leapfrogging" the dirty Development path that characterised the industrialisation of most countries. The UNFCCC secretariat officially supports such undertakings by facilitating information and coordination in order to create environments favourable to technology transfer and thus provides capacity building (UNFCCC 2005a) in developing countries.

The international literature reviewed in this section of the research illustrates clearly that there is a trade-off between the two objectives of the CDM, namely that the market seems to favour the cost-effectiveness of the emission reduction over the Sustainable Development dividends (Olsen 2005). This argument will be further developed in the following chapter. However, at this stage of the literature analysis, researchers and commentators argue that energy-related projects appear to provide the most appropriate broad Sustainable Development dividends (Sterk et al. 2005).

2.3 The role of Energy for Human Development

Energy does not directly represent a vital human requirement as such. However, Energy is regarded by researchers, local actors, and presenters at international conferences as observed during the recent Session of the Commission on Sustainable Development for instance, as being central to any discussion on Sustainable Development. There is a clear causational effect of energy services on all of the *three pillars* of Sustainable Development: economic, social and environmental (Najam et al. 2003, Cavallaro 2005, UNDP 2000). Simply, in terms of the economic facet of Sustainable Development, Energy clearly plays an important role in business development. In regards to the environmental aspects, conventional energy carriers,

for example, are major sources of environmental stress at global as well as at local levels. Therefore, a switch towards cleaner technologies can represent a partial relief of direct environmental contaminations. And finally, in terms of the social dimension, Energy is a prerequisite for the fulfilment of many basic human needs and services (Najam et al. 2003).

The relevance of the availability of energy services

The lack of broad access to energy services in some developing countries represents a major barrier to local Sustainable Development (DFID 2002). It is argued that there is an absolute minimum amount of energy necessary for basic human survival. More specifically, in his Commissioned Paper for the Millennium Project, Modi (2004) argues that, given climatic and other variations, there is quantifiable minimum amount of energy necessary to avoid seriously compromising human survival. Beside the energy required to sustain basic life, like to cook food or stay warm (Goldemberg et al. 1995), Humans need more energy to allow for education, health care, social enhancement, access to safe water for example, as well as to provide means of being productive.

Within underprivileged communities, an important part of the time and physical energy is spent on basic subsistence activities. This clearly enhances the marginalisation of such poor populations and limits their ability to improve their living conditions. Energy is strongly linked to many basic requirements necessary to Human Development (IISD 2004). For example, energy services enhance the improvement of women's position in households and Society in general, somewhat relieving them from some of the physically demanding tasks of day-to-day existence. Similarly, in many underprivileged communities children are sometimes withdrawn from school to collect and transport firewood or fetch water.

Energy offers the possibility of pumping, boiling, disinfecting, purifying, storing and distributing water (IEA 2002). It helps providing drinking water, water for domestic use and for irrigation. The lack of sanitation in many rural areas of developing countries is often related to the difficulty of getting clean water.

Healthcare improves and is made more convenient by access to reliable energy services, for example, by allowing for the refrigeration of medication. Various forms of Energy have a direct influence in reducing maternal mortality, combating diseases and avoiding physiological traumatisms caused by having to carry heavy loads for long distances (IEA

2002). As well, the use of traditional fuels for cooking and heating can have serious impacts on people's health. Indoor pollution caused by cooking fires affects mainly women and children as they are the most exposed to the toxic fumes (DFID 2002).

A more reliable access to energy services promotes agricultural development (IISD 2004), allowing for better storage, crop processing as well as transport to the market. It can increase the productivity and thus reduce the need of land expansion, therefore diminishing the pressure on the ecosystem. Particularly, modern biomass power technologies hold the promise of displacing existing diesel generation while creating economic opportunities for rural communities (Juergens 2005).

The lack of fuel alternatives for cooking purposes can lead to disastrous environmental impacts in the case of scarcity of supply. If the natural production of the forest is overcome by the consumption of timber for cooking and heating purposes, the natural capital is rapidly depleted. The consequences are various: there are greater distances to be travelled to collect fuel, the associated services provided by the forest such as the provision of food diminish or disappear. This effect is amplified by the fact that, quite obviously, this consumption is vital to sustained living and therefore can not be reduced. In most, if not all, desperate developing country situations fuel alternatives are either not available or not affordable (IISD 2004).

Energy alone will not reduce poverty (DFID 2002). However, it is agreed that an access to clean and affordable energy services is an essential element for human emancipation (CSD 2001).

Energy and the Millennium Development Goals (MDG)

The Millennium Development Goals set up by the United Nations in 2000 provide key targets to address the most pressing development needs[19], and summarise the current main objectives of the Development community. Even though not one of the goals is energy-specific, Energy may contribute, directly or indirectly, to the fulfilment of those goals (Ray 2005). The importance of Energy in meeting the target of halving poverty by 2015 was reflected in a key decision at the Ninth Session of the Commission on Sustainable

[19] For details, see *United Nations Millennium Declaration*, A/RES/55/2, General Assembly, Fifty-fifth session, 18 September 2000, <http://www.un.org/millennium/declaration/ares552e.pdf>, viewed 20 October 2005.

Development (CSD), underlining the urgent need of extending greatly the availability of energy services for the poor, especially in rural areas.

> *To implement the goal accepted by the international community to halve the proportion of people living on less than one dollar per day by 2015, access to affordable energy services is a prerequisite.* (CSD 2001, p. 9)

Energy access inequality

Inequalities in energy provision and quality often represent a source of social injustice and morality issues (UNDP 2005a). Nearly one third of the world's population has no access to electricity, another third has poor access only and about 2 billion people rely on traditional fuels, such as wood, dung and agricultural residues, to meet their daily heating and cooking needs (WEHAB 2002).

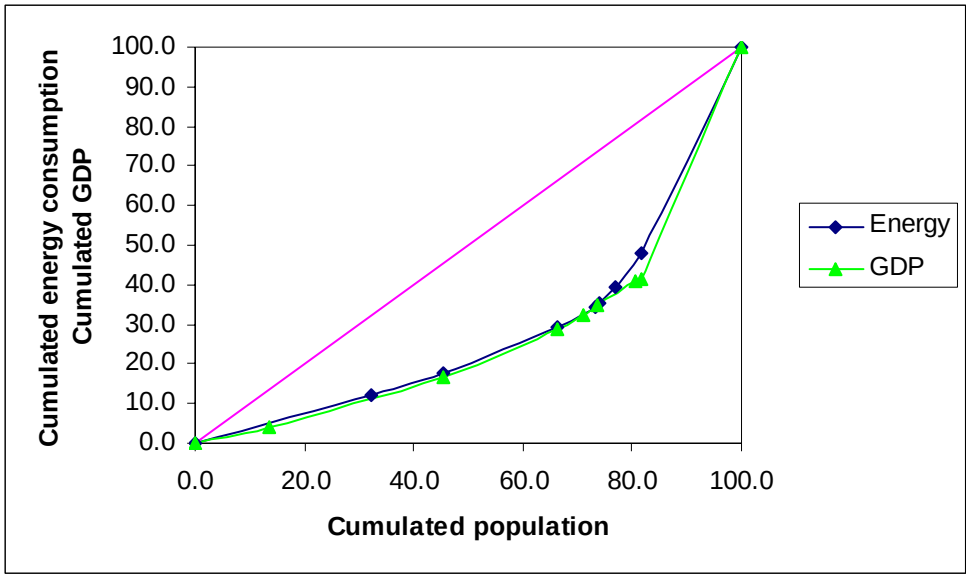

Figure 2: Lorenz curve of energy consumption compared to Gross Domestic Product (GDP).
Source: Own compilation of data from IEA 2004.

The inequality in energy consumption in the world is manifest. As shown in Figure 2, the disparity in the distribution of energy consumption throughout the world population is as prominent as the inequality of wealth distribution. This representation in a Lorenz curve of energy use underlines that, according to the available data, 20% of the world's population use over half of the total energy. On the other hand, a third of the world's total population uses as little as 10% of the energy total.

Does inequality matter? Beside the United Nations' (UN) view, which recognises the *collective responsibility to uphold the principles of human dignity, equality and equity at the global level* (UN 2000, p. 1) and the undeniable ethical aspects, there are more pragmatic reasons. Considering the gap between poor and rich, from an access to Energy or a monetary point of view, even if the rate of growth and Development is the same for all, this gap tends to further increase in absolute terms. In other words, this growth could be made use of in a wiser manner if better distributed. Disproportionately attributing the positive effects of the progress to the ones who really need them will not only reduce inequality but as well fight poverty quicker and in a better fashion. This is not to be interpreted as redistribution from rich to poor, which would leave someone, the rich, worse-off after the process and thus contradict the Pareto principle and as such would suffer strong opposition from powerful interest groups. Rather the idea considers a redistribution of the products of progress. High disparities limit the opportunities of poor people and have heavy social consequences, eroding social capital (UNDP 2001).

Share of household spending related to Energy

The proportion of the household income spent by poor families for indispensable energy services, such as cooking, is greater than in the wealthy families. This difference is to be found in a local as well as a global point of view. Absolute energy spending usually rises with income, but generally at a less than proportional rate relative (IEA 2002). Furthermore, the poorest frequently relinquish or compromise even on key services like lighting and space heating.

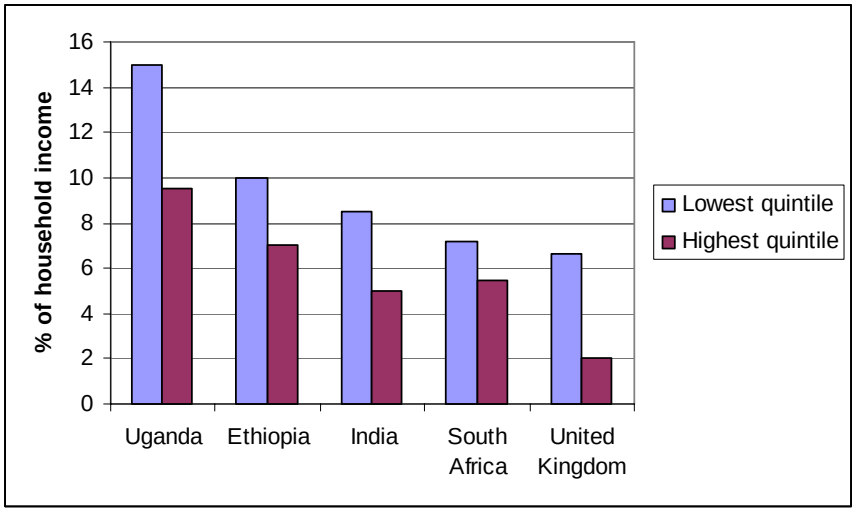

Figure 3: Share of energy expenditures in household income.
Source: Own compilation of data from IEA 2002.

As shown in the Figure 3, the proportion of income spent on energy services is higher for the poorest than for the richest in developed and developing countries. However, this proportion is even higher in the poorer countries compared to the industrialised countries.

Energy for Development

There appears from the literature and research to be a correlation between economic growth and GHG emissions. Sustained economic growth, according to the current patterns, requires either an increase in carbon emissions or a decline in carbon intensity of the economy (ADB 2000) and thus higher technology. So far, the right to use the atmosphere as a temporary deposit for CO_2 has been largely made the most of by industrialised countries. The energy need of developing countries, responsible for a minor part of the GHG emissions to date, is increasing at a very rapid rate and is a source of concern as well. There are therefore two options for pursuing such countries' socio-economic goals. They must either have access to the atmosphere as a temporary CO_2 deposit or benefit from alternative clean technological options. It is probable that the latter option will fail, or be to slow without international cooperation, to respond to the rapidly increasing demand. In regards to the former consideration and if we assume a limited capacity of Nature, industrialised countries need to free up capacity to allow for the developing world's needs, and switch from quantitative development to a qualitative evolution (Costanza et al. 1997). The Kyoto Protocol tries to address both issues at the same time. However, it has to be underlined once again here that the CDM represents at best an offset, moreover temporary in some cases, of emissions rather than

an absolute reduction.

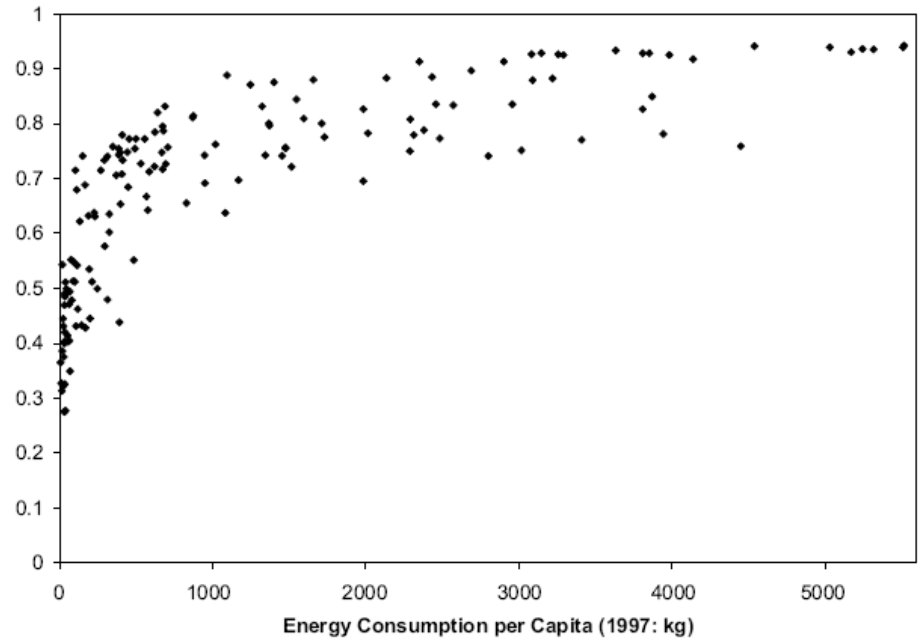

Figure 4: Human Development Index (HDI) in relation to annual per capita energy consumption (in kg of oil equivalent, 1997).

Source: Najam and Cleveland 2003.

There is a correlation, although not a strong one, between energy consumption and Human Development indicators (see Figure 4). There are a few basic assumptions that one can draw from such a representation. Firstly, it seems that the very basic first steps of Development don't strongly depend on Energy, as will be further discussed below. In fact, the first band of energy consumption, say less than 100 kg of oil equivalent, is composed by countries with very different Human Development indexes, with up to a threefold magnitude between the lowest and the highest. This implies that other factors obviously play a major role.

Secondly, after having reached a certain level of Development, it appears from the graph above that the correlation between Development and Energy becomes very weak. The assumption could therefore be that if the energy access and infrastructures in such countries is improved, the positive effect on the Development pattern is not to be taken for granted.

And finally, as far as Energy is concerned, it can be pointed out that a very little increase in the energy access in the so-called Least-Developed Countries could contribute to an important improvement in terms of Human Development. This is of utmost importance as it supports the argument advocating the priority to be focused on the poorest countries rather than on the

ones with transition economies. However, as pointed out above, it must be underlined that in such a context, other factors play a major role. Thus, Energy is crucial in the early stage of Development, but must be accompanied by other essential conditions (DFID 2002). Those conditions go behind the scope of this research.

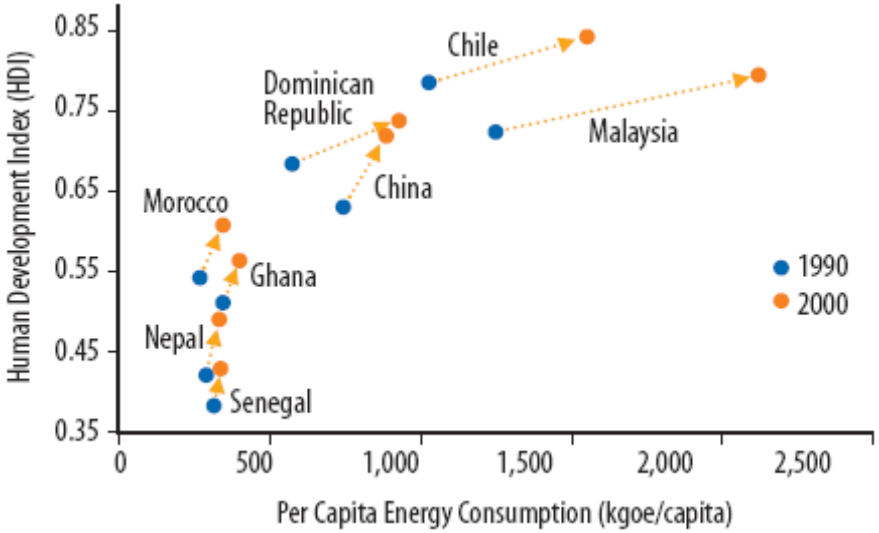

Figure 5: Increase of energy consumption between 1990 and 2000.
Source: UNDP 2005b.

The first steps of Development don't require an important increase of the energy needs (see Figure 5). This demonstrates a rather low inconsistency between Climate and Development objectives in the case of Least Developed Countries. It seems therefore that, as far as Energy is concerned, the most urgent Development requirements, such as the MDG, can be fulfilled with only a relatively small increase of GHG.

Further along the Development process, it appears that industrial development, as well as the emergence and the expansion of the middle-class strata, increases the likelihood for countries to experience a drastic increase in their energy consumption (Michaelowa et al. 2005a) and therefore their emission of GHG to go out of any sustainable proportions.

Development pattern and strategies

Human Development, according to the United Nations, is about *expanding the choices people have to lead lives that they value* (UNDP 2001, p. 9), focusing on the ends rather than the means. This view is similar to that of Sen (1999), whose perspective is that Development should be a process during which real freedoms that people enjoy are expanded. The ultimate

goal is Human freedom, so that one can decide about one's future and participate actively in society. Sen's concept goes much further than focusing on the rise of national accounting figures or means in order to accumulate commodities or energy access. It aims at creating an environment in which people can develop their full potential and lead productive and creative lives in accordance with their needs and interests. Economic Development as such isn't objected, but seen as an instrument rather than the finality, because the link between economic prosperity and the improvement of people's lives is not strong.

Although Sen's idea of *Development as Freedom* seems to be widely acknowledged, there are still barriers of practical acceptance. This conflict of ideas is mainly due to the utility-based approach within the welfare economy currently in place (Prendergast 2003). Thus, while concepts such as the increase of economic welfare appear to represent a major objective of contemporary occidental policies, the focus on the protection of the Environment as well as social factors are often left aside. For a Development strategy to be successful, it must recognise the multidimensional character of Development. The increase of Gross Domestic Product per capita is an integral part of that process. However, it can only be profitable from a Sustainable Development point of view, if a broader Development focus is adopted, building capital of all types (ADB 2000, Sen 1999).

Over the past 50 years, there have been different approaches to Development strategies, but most of them have been driven by the paradigm of quick economic growth. While this method has been successful in some cases, it failed in many others to address poverty and inequity issues. It is now widely recognised that the Development path that has been relatively successful for western countries and some countries with Economies In Transition cannot, or should not, be applied to Least-Developed Countries (Stiglitz 1998). There is no such thing as a single universal Development strategy applicable to all cases (Grasa 1992). Furthermore, the Development path taken by industrialised countries some decades ago is simply not desirable for further application, from an environmental point of view at least (UNDP 2000). Indeed, if developing countries were to follow this model, the consequences for the ecosystems would most likely be disastrous. Unfortunately, the effects of the global economy may lead developing countries towards this development pattern (DEFRA 2006).

The availability of essential energy services is taken for granted in the industrialised world. While hydrocarbons have largely fuelled economic Development in industrialised countries, with their known, and possibly further yet to be known, consequences for the Global Climate,

a concentrated effort is required for developing countries to pursue less carbon-intensive paths to power their Development, so as not to mirror the Development path of industrialised countries. From that point of view, CDM projects related to Energy could play an interesting role.

Energy efficiency and renewable energy

There is great potential in energy-efficient technologies as well as in energy efficiency measures in order to realise the challenge of satisfying basic needs as well as considerably improving living standards without drastically increasing the current per capita energy use. According to Goldemberg (1996), developing countries could achieve the material standard of living that Western Europeans enjoyed during the 1970s with energy requirements as low as 1kW per capita, which is about 20% higher than the 1985 level in developing countries. This remarkable result could be achieved because of the extremely inefficient use of energy today, especially in regards to traditional sources of energy. On the one hand, today's technology allows for a more efficient end-use by improving the equipment that actually provides the energy services. On the other hand, supply-side energy efficiency, which focuses on a more-efficient energy generation, can be achieved by upgrading industrial processes and developing energy recovery systems. Using Energy more efficiently is especially, but not only, important in areas where the existing installed capacity is limited.

Critics sometimes argue that the Energy issues in the developing world are not principally a problem of scarcity, but rather of inefficient energy conversion in order to obtain the desired service (Goldemberg et al. 1995). Yet, it must be underlined here that along the Development path, not only do the energy requirements increase but also the rest of the social metabolism. This increase of material intensity has important environmental consequences. However, as far as Energy is concerned, there is the potential to "leapfrog" the old and inefficient technologies that characterised the occidental Development path and switch directly to more sustainable approaches. Such a Development pattern is of course more difficult to materialise than to describe and depends on strong international commitments as well as local determination. Furthermore, some powerful lobbies could undermine such strategies.

The growing demand in developing countries for energy services presents a historic opportunity to satisfy demand in ways that are compatible with

sustainable development. (WEHAB 2002, p. 7)

The reliability of the energy supply represents another crucial aspect. Indeed, having a clean and efficient production of energy is of no help if the distribution fails to be consistent. Unfortunately, frequent power cuts characterise the electricity grid of many developing countries, preventing trustworthy energy supply to businesses and households.

Renewable energy technologies hold a great potential to satisfy basic needs and to contribute to poverty alleviation in a sustainable manner, especially in decentralised areas. These kinds of equipment, such as thermal and photovoltaic solar panels, windmills, geothermal plants and small-scale hydroelectricity plants, are commercially available and field-proven. As well, as already mentioned, modern biomass plants are particularly promising. Furthermore, it has been demonstrated that in many cases, renewable energy can be implemented easier than conventional energy in remote areas (Michaelowa et al. 2005a, IEA 2002), where grid connection is either non-existent or not reliable. Off-grid small scale projects, as opposed to grid-connected power generation plants which mainly feed urban electricity needs, are particularly attractive at community level. Although not a panacea, renewable energy technologies can play an attractive role for both mitigation and adaptation objectives (IISD 2004).

The international community has a crucial role to play in order to enhance Sustainable Development while achieving energy objectives in developing countries. It requires cooperation in planning and actions on the part of the governments, businesses, civil society and international organisations to face the challenges. Indeed, political determination is necessary to support Sustainable Development. Technology innovation leading to the development and adoption of clean and affordable energy technologies is not happening fast enough and not on a large enough scale to meet the growing demand of developing countries. Hence, innovations and reductions in the cost of renewable energy, energy efficiency and clean conventional technologies will heavily depend on policies and investments made by industrialised countries either domestically or even more effectively, in collaboration with developing countries (IEA 2005).

This represents a great opportunity for North-South as well as South-South cooperation in order to facilitate the exchange of information, technology and experience. Financial partnership will be determinant to achieve social improvements and environmental benefits at

local and global level. A strong focus should be put on the promotion of the capacity building in developing countries in order to avoid situations of technical or financial dependence.

Synthesis

Climate Change issues are currently a high priority on the international environmental agenda. The need for urgent action in both mitigation of and adaptation to climate change is now widely recognised in the scientific community. The Kyoto Protocol is the product of lengthy international negotiations. The CDM allows for industrialised countries to meet their emission targets in a cost-efficient manner while promoting Sustainable Development in developing countries. Sustainable Development is a dynamic concept which is context-dependent. The literature underlines the potential trade-off between the two objectives of the CDM and critics argue that the market tends to favour the cost-effectiveness over the Sustainable Development dividends. Within the CDM portfolio, energy-related projects seem to be the most appropriate in providing broad Sustainable Development dividends. The access to clean and affordable energy services is a crucial factor for Human Development. But importantly, Energy is not the only determinant aspect. Nowadays, the access to energy services throughout the world is very unequal, perhaps as unequal as the distribution of wealth.

Chapter 3: Analysis of the CDM and its current portfolio

The present chapter presents an analysis of the CDM and discusses some of the main shortcomings of the projects currently in the portfolio at validation stage or further. From a Sustainable Development viewpoint, those major drawbacks are threefold. They are namely 1) An insufficient volume in order to play a significant role in the mitigation of anthropogenic Climate Change or to notably contribute to Sustainable Development, 2) A considerable amount of CERs foster only meagre Sustainable Development benefits in the host-country, and 3) A strong geographical inequality in the distribution of CDM activities.

3.1 Quantity

Putting the CDM into a quantitative perspective

The funds flowing into the CDM represent a relatively small amount compared to other investments, public or private. Indeed, Official Development Assistance (ODA) and Foreign Direct Investment (FDI) represent flows far greater than the CDM (Ellis et al. 2004). However, it has to be underlined here that unlike ODA and FDI, the CDM investments directly aim at stimulating low-emissions technologies and Sustainable Development, which is not necessarily the case for other financial flows.

Ellis et al. (2004) highlight that the amount of investment in GHG-friendly equipment and systems stimulated by the CDM could reach 6-8 billion USD over the Kyoto commitment period, which represents in comparison only 1% of the required investments for developing countries' electricity sector exclusively until 2010. The net FDI flow to developing countries is estimated to 165,5 billion USD while ODA accounted for 47,4 billion USD in 2004 only[20]. Nevertheless, the estimated 1 billion USD of carbon payments until 2012 seem significant compared to 1,4 billion USD invested by the Global Environment Facility (GEF) in Climate Change between 1991 and 2002 (Cosbey et al. 2005). The International Energy Agency is expecting massive investments totalling about 568 billion USD per year, out of which

[20] Data source: WB 2005b.

developing countries will require about half, to be made in the energy sector during the following decades in order to meet the growing demand (IEA 2004).

It is foreseen that the demand for carbon credit will be between 869 and 1098 $MtCO_2eq$ (Megaton of Carbon Dioxide equivalent) for the Organisation for Economic Co-operation and Development (OECD) countries in 2010 and out of this, it is estimated that between 217 and 640 $MtCO_2eq$ will be supplied by CER derived from Clean Development Mechanism projects (Cosbey et al. 2005). Yet, according to more recent data, the CDM seems in a position of being able to provide more CER than expected. Indeed, there are currently 654 projects in the pipeline potentially providing over 835 $MtCO_2eq$ of CER by 2012[21].

Nevertheless, it has been argued lately that several Annex 1 countries will struggle in meeting their emission target (UNFCCC 2006, for the case of Spain: Tàbara 2003) and that the demand for CER may exceed the supply in the coming years (Langrock et al. 2005). According to recent forecasts from the World Bank, the demand for CER from CDM may rise to as much as 1400 $MtCO_2eq$, implying a need for between 750 and 2200 CDM projects by 2012 (WBCSD 2005).

Those figures, even if varying greatly, seem rather meagre compared to the yearly release of GHG to the atmosphere, which accounted for about 17 $GtCO_2eq$ (Gigaton of Carbon Dioxide equivalent) in 2003[22] for the Annex 1 countries only. Furthermore, according to the predictions of the IPCC, those emissions will increase for another few decades at least, even in the most optimistic scenario[23]. For those reasons, one could question the effectiveness of this tool in order to efficiently mitigate human-induced Climate Change (Egenhofer et al. 2005).

Although the impacts of the CDM may be limited, it has to be acknowledged that the outcome of many years of hard negotiations represents an option which is better than the business-as-usual scenario. Furthermore, the awareness of Climate Change issues is now spreading worldwide. Also, the CDM, although imperfect, establishes a constructive dialogue between developing and developed countries in the field of Climate Change.

[21] Data source: Fenhann 2006 (status as of the 6 March 2006).
[22] Data source: UNFCCC 2005b. The figures exclude Land Use, Land Use Change and Forestry (LULUCF) related emissions.
[23] For more details, see IPCC 2000, *Special Report on Emissions Scenarios.*

3.2 Quality

The CDM procedure does not define Sustainability criteria. The assessment of the contribution to Sustainable Development of the projects is a sovereign matter of the host-country.

> *[…] it is to the host Party's prerogative to confirm whether a clean development mechanism project activity assists it in achieving sustainable development, […]* (UNFCCC 2002b, Decision 17/CP.7)

This could lead to a lack of consistency in the project approach and design, depending on the different host-countries. The factors that would lead to the acceptance or the refusal of the projects are therefore strongly dependant on national values, and could eventually suffer from the influence of strong stakeholders (Olsen 2005). On the positive side, one could argue that the host-country enjoys a greater autonomy in the choice of its Development strategy. On the other hand, the decision could be influenced by other factors, such as incentive for foreign investment for instance, disregarding social and environmental aspects and therefore defeating or undermining the positive influence on local Sustainable Development sought by the CDM.

The risk of having different host-countries competing in order to attract CDM by easing the minimum criteria is real and could lead to the sometimes called *Race to the bottom* (Sutter 2003). The potential host-country has to define a policy balancing the short-term benefits of FDI and the long-term dividends of Sustainable Development.

Distribution of projects per type

Some CDM projects, including some already approved, are under-performing in terms of local sustainable criteria (Cosbey et al. 2005, Pearson 2004). They represent, for instance, end-of-pipe adjustments of industrial processes to capture gases with a very high Greenhouse effect.

These kinds of projects are not an issue as such, in the sense that they efficiently contribute to a reduction of GHG release to the atmosphere. However, they are accompanied by very meagre benefits in terms of local Sustainable Development (Cosbey et al. 2005, Olsen 2005). They represent almost no technological transfer, induce only low capital investment, promote

no additional employment and their contribution to social Sustainable Development is either very low or nil. The relatively high potential of delivering Certified Emission Reductions from those end-of-pipe fix types of projects, together with their low costs, could trigger negative effects on the emerging market of emission credits, driving down the prices by saturating the market (Olsen 2005). By doing so, other projects recognised with higher local Sustainable Development profits, like renewable energy projects for instance, are strongly undermined (Sterk et al. 2005).

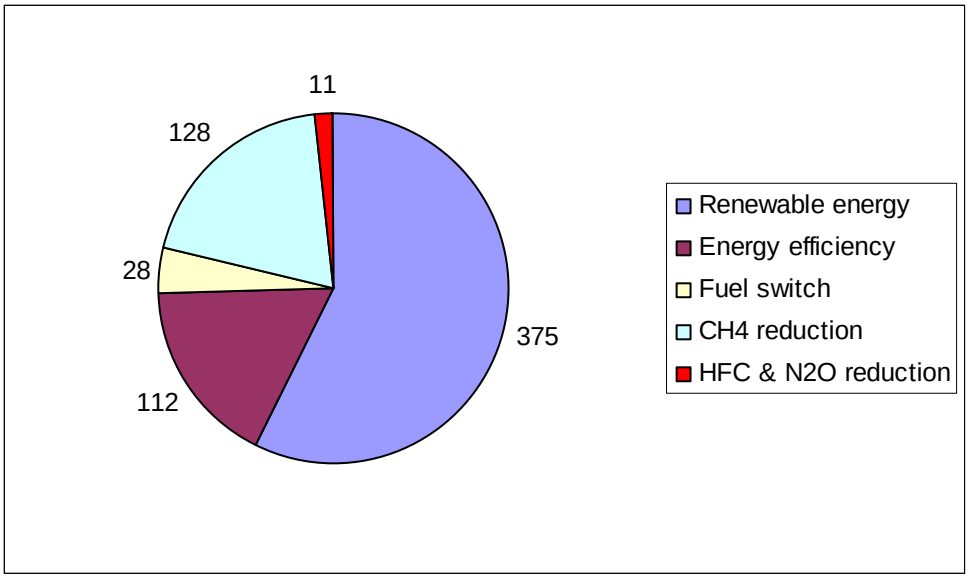

Figure 6: Number of CDM projects by types.

Source: Own compilation of data from Fenhann 2006 (status as of the 6 March 2006).

Projects focusing on renewable energy are relatively numerous, accounting for over half of the current portfolio (see Figure 6). However, in terms of CERs, they represent less than 20 % of the total. HFC and N_2O decomposition projects account for almost half of the Certified Emission Reductions of the projects currently in the pipeline (see Figure 7).

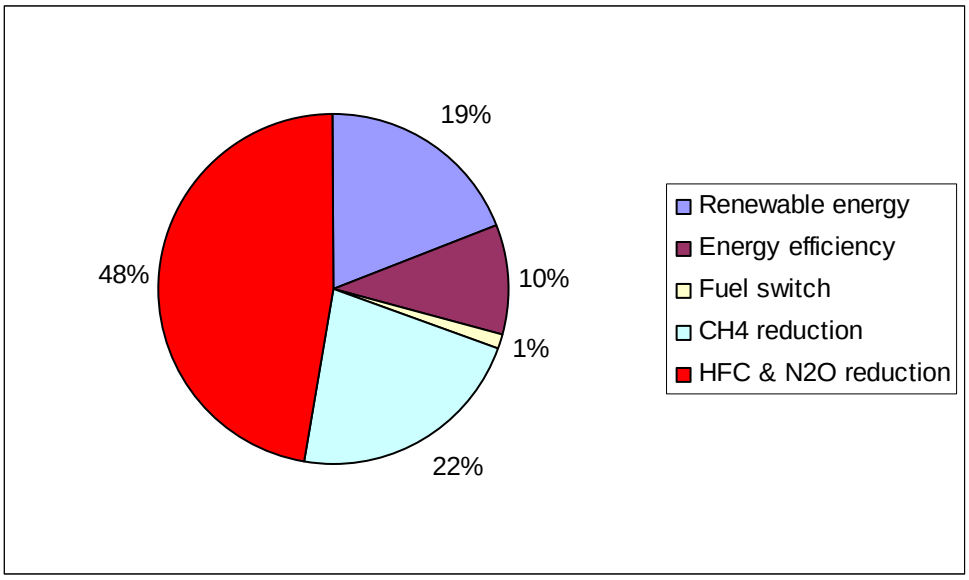

Figure 7 : Proportion of CERs by type of CDM.

Source: Own compilation of data from Fenhann 2006 (status as of the 6 March 2006).

There is a threat for the market in itself not to be able to yield sufficient projects with high Sustainable Development values. Indeed, a few projects with low local positive effects but high CERs, could weaken the opportunity for a greater overall Sustainable Development outcome.

Furthermore, the current status mismatches the proportion of different gases contributing to the Greenhouse effect globally. Indeed, CO_2 accounts for over three quarters of the GHG emissions (measured in Global Warming Potential) leaving only small shares to be split between other gases (Baumert et al. 2005). The CDM, however, seems to target no-CO_2 gases primarily.

Unfair competition

Let's consider the following comparison as an illustration. The *N_2O Emission Reduction in Onsan* project[24] and the *HFC23 Decomposition Project of Zhejiang Juhua Co., Ltd, P. R.*

[24] Decomposition of Nitrous oxide (N_2O), produced as a by-product generated during the production of adipic acid, more information: <http://cdm.unfccc.int/Projects/DNV-CUK1127672024.44/view.html>, viewed 25 October 2005.

China[25] will deliver more CERs than the 198 renewable energy projects in the pipeline altogether[26].

Therefore, in the market-based mechanism in which the CDMs evolve, one single project with low local Sustainable Development benefits can rival a multitude of other projects and their combined recognised broad Sustainable Development dividends.

Evolution of the portfolio over time and future perspectives

The evolution of the proportion of renewable energy in terms of number of projects and CERs (see Figure 8) in the CDM portfolio seems fairly stable or slightly decreasing over time. The fact that several studies (Sterk et al. 2005, Cosbey et al. 2005) come to the conclusion that the potential of high-yielding CER projects is far from being exhausted, doesn't support the hope for projects accompanied by strong Sustainable Development benefits to play a major role in the CDM market.

[25] Decomposition of HFC23 gas, produced as a by-product generated in the production of the fluoric refrigerant HCFC22, more information: http://cdm.unfccc.int/Projects/Validation/view.html?ProjectId=HEBZW7PZJ5O5E7S8J8ZGQEDHLM9V94&OE=DNV-CUK>, viewed 25 October 2005.
[26] Onsan (9151 kCERs/yr), Zhejiang (5795 kCERs/yr), 198 renewable Energy projects (12410 kCERs/yr), own compilation of data from Fenhann 2005 (status as of the 18 October 2005).

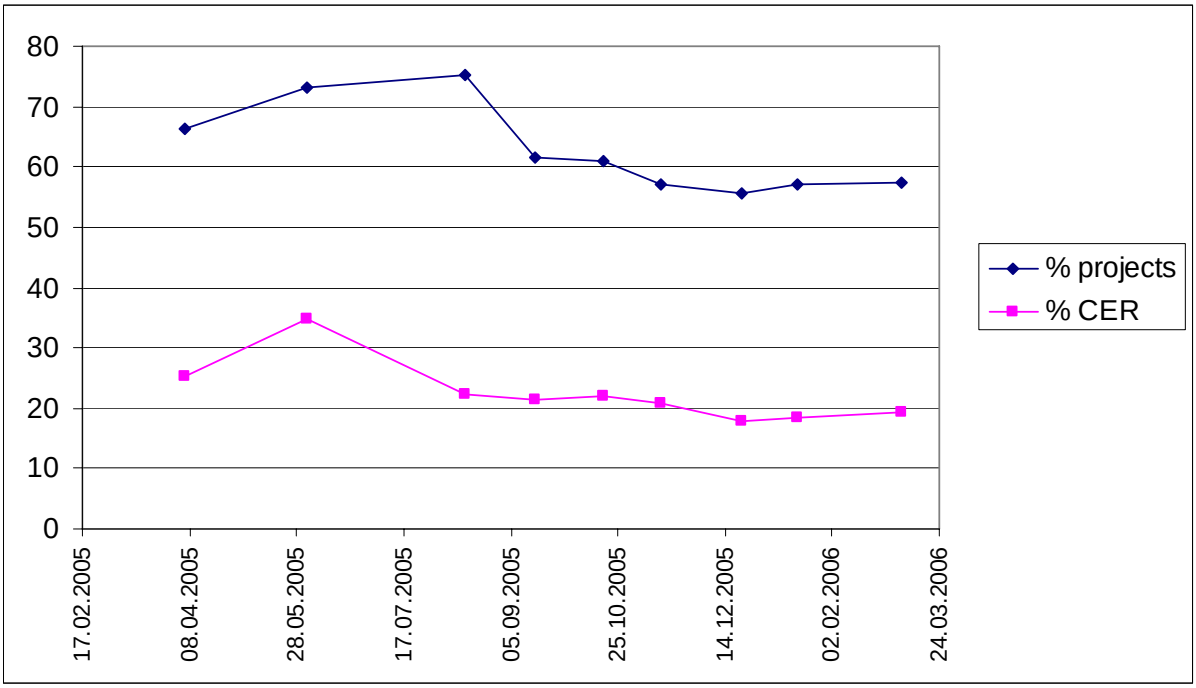

Figure 8 : Evolution of the proportion of CER and projects from renewable energy in the CDM portfolio.

Source: Own compilation of data from Fenhann 2005 & 2006 (status as of the 6 April, 2 June, 15 August, 16 September, 18 October, 14 November, 22 December 2005, 17 January, and 6 March 2006).

Another concern in this regard from critics in developing countries is that the market is likely to promote the most economic options, the sometimes so-called *low-hanging fruit* (Cosbey et al. 2005). Assuming that, at a later stage, developing countries will also have to comply with some form of defined emission caps, they would only have more costly options available in order to do so (Muller 2005), thus representing a paradoxical and contra-productive effect.

Restraining the CDM's scope

One could argue that limiting the scope of the CDM to projects that deliver consequent Sustainable Development dividends, such as renewable energy, would overcome the issue exposed above. However, this view is inappropriate for various reasons. Any limitation to a market-based mechanism is a constraint to its development. Also, from a Climate policy point of view, the high-yielding CER projects efficiently off-set the Greenhouse Gases produced by industrialised countries and therefore contribute to the global mitigation effort on Climate Change.

Another option would be to define a set of minimum Sustainable Development criteria which could be combined with the ones defined by the Designated National Authority (DNA). However, beside being another constraint to the market-based mechanism, such an approach could be seen as an interference in locally defined Development policies. Also, such top-down approach is contrary to core participatory principles. Furthermore, from a practical point of view, a consensus between all the parties in order to define a set of unequivocal criteria is barely imaginable taking into account the divergent interests.

3.3 Distribution

The unequal distribution of CDM projects throughout developing countries is another source of concern. Indeed, the great majority of CDM projects seems to target countries with strong Economies In Transition, such as Brazil and India in particular, those countries being the ones where a large amount of the Foreign Direct Investment already flows to (Ellis et al. 2004). There is little doubt that foreign investments are likely to be profitable in those countries. However, deploying this new form of international cooperation to Least-Developed Countries would certainly be more efficient in terms of alleviating poverty and decreasing global inequity, which are both intrinsic criteria of Sustainable Development (ISSD 2005).

According to Ellis et al. (2004), the impoverished countries which are unable to attract foreign investments also don't seem to be of great interest in terms of investments in CDM projects. Also some of the poorest countries lack the institutional capacity required in order to become potential host-countries (Kim 2003). From a Development policy point of view, it is obvious that the countries the most in need are located in Sub-Saharan and Southern Asian regions. The CDM, in its current form, clearly disregards those regions.

Distribution of projects per host-country

Most CDM projects currently in the pipeline are located in countries with transition economies and medium income average, such as India, Brazil, China, and Mexico (see Figure 9), with the first two countries receiving over half of the projects[27]. Out of the 654 CDM projects currently at validation stage or further, only 7 are hosted in the Least-Developed

[27] Status as of 6 March 2006.

Countries defined by the United Nations Framework Convention on Climate Change, with 3 projects in Bangladesh, 2 in Nepal, and 1 project in both Bhutan and Cambodia[28]. Specifically those people living in the poorest areas of the world are likely to be the most affected by Climate Change as their capacity of adaptation is notably lower, and therefore should be prime candidates to this kind of international cooperation.

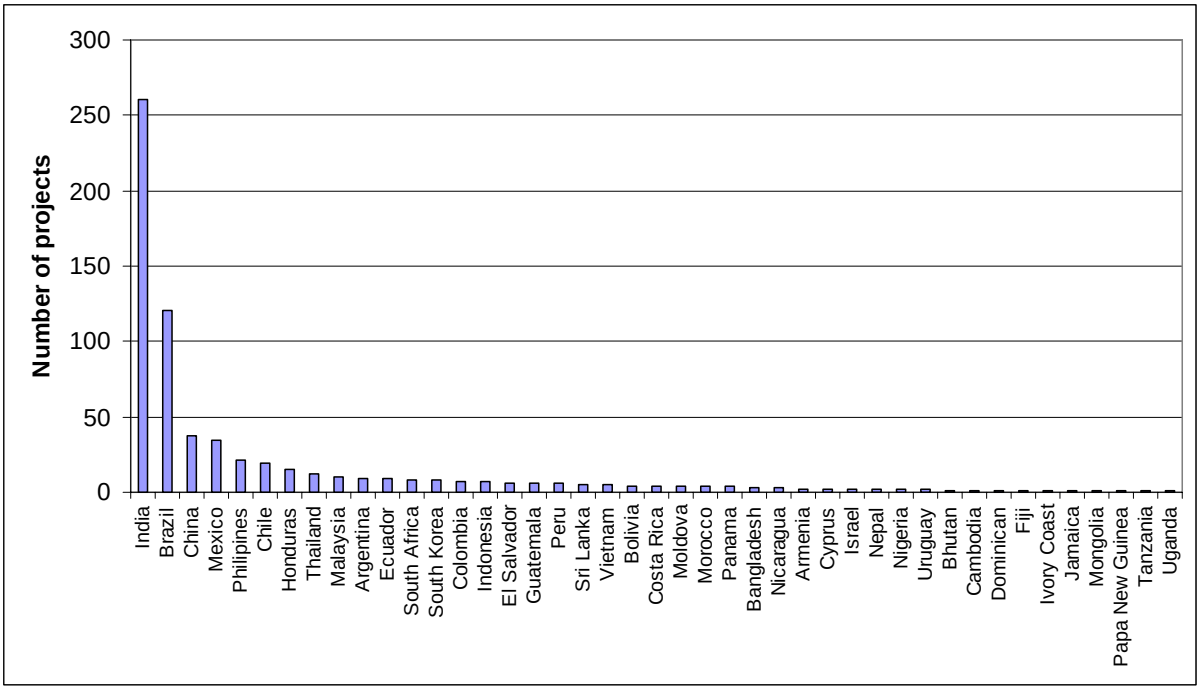

Figure 9 : Distribution of CDM projects by country.

Source: Own compilation of data from Fenhann 2006 (status as of the 6 March 2006).

The lion's share of CER provision, at the stage of writing, is split between China, India and Brazil (see Figure 10). Beside the two huge HFC and N_2O decomposition projects in South Korea and the recent two projects in Nigeria which distort the statistics in terms of Certified Emission Reductions somewhat, the contribution of other countries apart from China, India and Brazil to the total CER is comparatively extremely low.

[28] Status as of 6 March 2006.

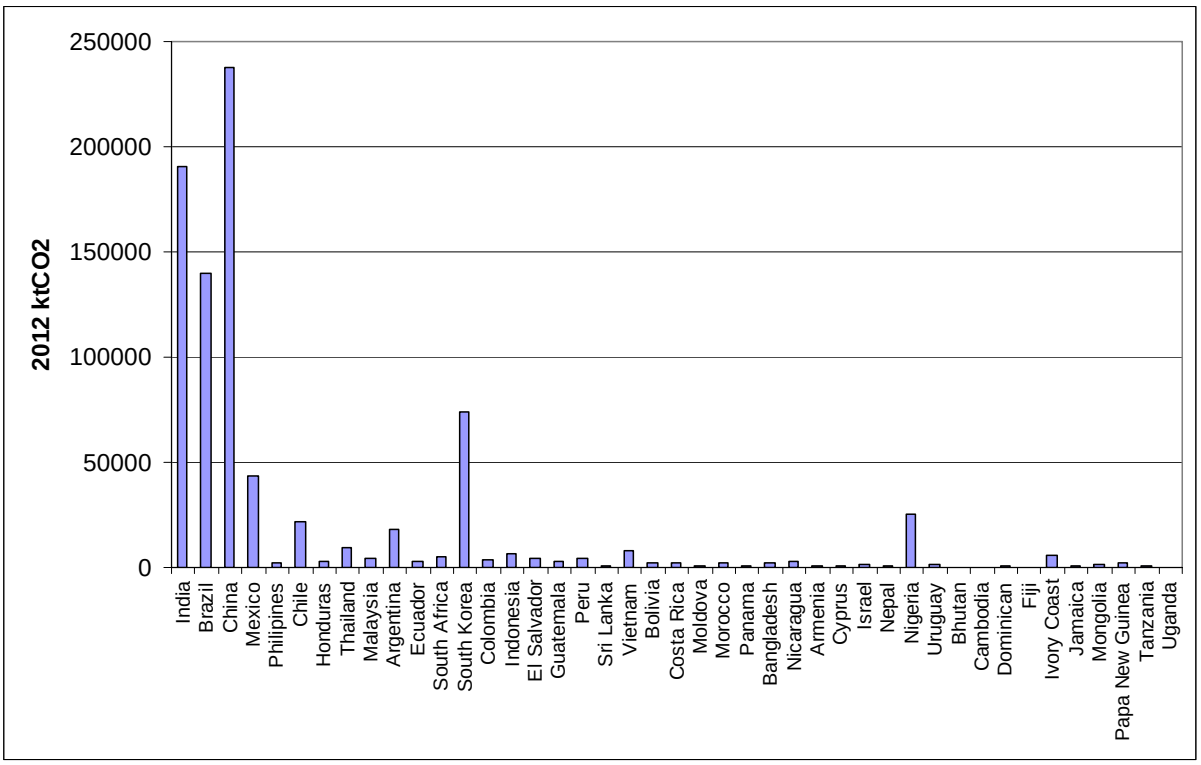

Figure 10 : Distribution of accumulated CERs at 31 December 2012 [$ktCO_2$] by country.
Source: Own compilation of data from Fenhann 2006 (status as of the 6 March 2006).

It seems that the main drivers in the choice of the country for investing in CDM are stable economy, size of the regional market, domestic institutions, and political stability (Cosbey et al. 2005). This position is mainly motivated by economic arguments and is fully understandable from that point of view. It therefore seems evident for the CDM investments to follow a similar distribution as Foreign Direct Investment. However, concentrating those projects in relatively prosperous areas of the world may very well exacerbate inequity between countries (ADB 2000).

Interregional inequality

Some authors (Sirohi 2005) have reported the possibility of encountering distributional inequality within a country as well. In order to verify that claim, data are analysed in the case of India. India is playing a major role in the CDM market and has the advantage of having reliable data available.

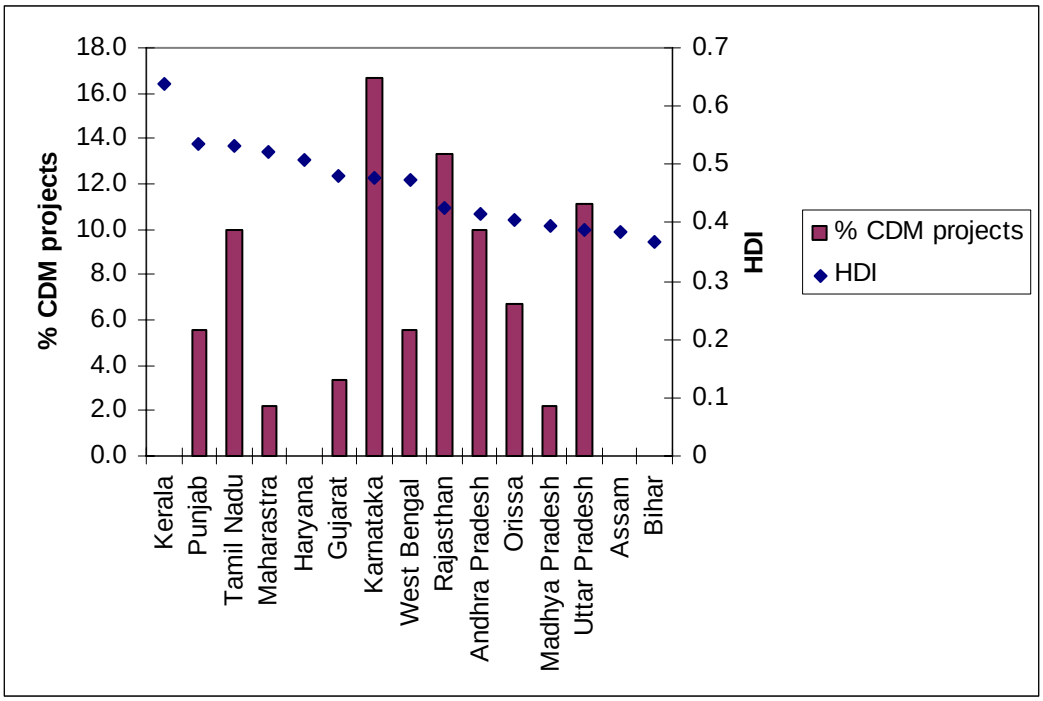

Figure 11 : Interregional distribution of host-country approved CDM projects in India compared with respective Human Development Indexes (HDI).

Data source: Own compilation of data from Planning Commission 2002 and India's DNA[29].

According to Figure 11, there is no clear trend demonstrating that the CDM is targeting mainly well developed states. Therefore, the claim made above is not verified in this case. A further step would be to analyse the trend at sub-state level. The aggregated data at state level may mask local disparities.

The issue of unequal distribution within a same country could be dealt with by the national DNA. Indeed, while approving or rejecting CDM activities, the DNA could promote a fair regional distribution. However, this is impossible at international level.

Associated activities

The current trend runs in counter-flow with the well-intended decisions taken at the Conference of the Parties 7 in Marrakesh which emphasise 'the need to promote equitable geographic distribution of clean development mechanism project activities at regional and subregional levels' (UNFCCC 2002b, Decision 17/CP.7, p. 20). The strong regional

[29] Available at : <http://66.235.181.44/demo/cdm/index.htm>, viewed 25 November 2005.

inequality of the CDM contrasts with the concept of Sustainable Development, considered from a global rather than a local perspective (Cosbey et al. 2005).

The goal of the COP 7's resolution mentioned above seems to go further than advocating a fair distribution of projects amongst developing countries. Hence, under *activities* should be understood all the other matters related to the CDMs, including the high-value added businesses, like consulting work, certificates trade, auditing, credit-validation and investments. Here again, the current process seems to favour wealthy industrialised countries. While developing countries have been able to get hold of almost half of the CDM consultancy market (Michaelowa 2005), the Designated Operational Entities (DOE), responsible for the validation and verification of the CDM projects, are essentially based in high-level income countries such as, in order of importance in terms of number of projects, UK and Germany followed by Japan, Spain and the Netherlands[30]. The opportunities created by the emergent market of the CDMs are unevenly distributed around the world and the market in itself appears to be unable to address this issue (ADB 2000).

Corrective actions

From an Economic and Development opportunity point of view, the hope for developing countries is contrasted by real concerns. Many NGOs, such as CDM Watch and IISD for instance, have stressed the risk of most of the rent and economic surplus of such activities to flow to developed countries. For some of the developing countries, the participation as an active actor represents a significant challenge as those countries may lack of technical and/or institutional capacity to face the complexity of the process. In order to counteract this situation, specific Development programs, such as the *Capacity Development for the CDM*[31] for example, have been launched. Also, some institutions, like the World Bank for instance, attempt to face this issue and develop models which promote fairer geographical distribution by creating incentives for small-scale and community related projects in Least-Developed Countries[32]. Some of those undertakings will be discussed in the next chapter.

[30] Status as of 6 March 2006.
[31] For more information, see Capacity Development for CDM (CD4CDM), <http://www.cd4cdm.org/>, viewed 26 October 2005.
[32] For more information, see Community Development Carbon Fund (CDCF), http://carbonfinance.org/cdcf/home.cfm, viewed 26 October 2005.

Chapter 4: Additional Incentives to foster broader Sustainable Development dividends from the CDM

Sutter (2003) identifies three groups that can play a significant role in encouraging local benefits for the host-country from a CDM project. Project developers can ensure premium quality by going beyond the strict minimum requirements. CER buyers have the opportunity to give preference to certain types of projects, even if they have to pay a little more. Also, NGOs and research centres act as watchdog agencies or rewarding institutes. Some institutions propose alternative approaches for the design and the monitoring of CDM projects with the intention of fostering broad(er) Sustainable Development dividends. The influence of some of those additional incentives will be analysed in the following chapters by evaluating and comparing CDM projects that benefit from such attributes with some that do not.

4.1 The Gold Standard

The Gold Standard[33] proposes a methodology to develop high-quality emission reduction projects with high environmental integrity and secured local social, environmental and economic benefits (Schlup 2005). First initiated by the World Wide Fund for Nature (WWF), the Gold Standard is owned and managed by an international coalition of Non-Governmental Organisations[34]. This innovative approach intends to provide project developers with a tool that allows for ensuring the delivery of credible projects with real benefits for the host-country (Gold Standard 2003).

Overview

Under the framework of the CDM, the Gold Standard designed an add-on methodology which aspires at fostering broad Sustainable Development dividends at local level. This non-profit organisation's initiative, which is free of charge, seeks to develop a label that represents the best practice benchmark for the CDM, by proposing a rigorous assessment framework

[33] For more information on the Gold Standard, see: <http://www.cdmgoldstandard.org/index.php>, viewed 30 November 2005.
[34] For more details about the history of the Gold Standard, see: Gold Standard 2003.

which is directly compatible with the CDM project cycle. The objectives of the Gold Standard are: 1) Ensuring the off-set of the GHG by assessing the additionality in a conservative manner. 2) Promoting low-carbon energy systems. 3) Supporting Sustainable Development in the host-countries. The concept is based on the assumption that, left to the market forces, the CDM does not significantly contribute to Sustainable Development.

The Gold Standard eligibility screening is threefold. The projects must represent a paradigm shifting energy technology, have inherent additionality and sustainability attributes, as well as benefit from the widespread support of environmental NGOs (Gold Standard 2003). As a result of this, the scope finds itself limited to renewable energy and demand-side energy efficiency projects.

In order to ensure the Sustainable Development benefits of the project activities, the evaluation of the Gold Standard includes three interdependent elements, namely a Sustainability matrix, an Environmental Impact Assessment (EIA), and a stakeholder consultation (Gold Standard 2003). The Sustainability matrix allows for a simple participatory assessment of the project's contribution to Sustainable Development. An EIA is performed either when the host-country's regulations require it or when environmental pre-screening or initial stakeholder consultations demonstrate that the impacts are likely to be significant. The participatory approach represents a crucial feature in ensuring that the local Sustainability benefits are real. As well, the involvement of the stakeholders reduces the risk of oppositions and delays in a later stage of the project, an argument which is often brought forward to project developers.

The Gold Standard assessment is designed as complementary to the CDM project cycle and is fully compatible with the UNFCCC requirements. Additional activities, and thus expenditures, to obtain the Gold Standard label might be required. A pre-assessment allows for testing the minimum conditions for eligibility of the CDM activity as Gold Standard. The CDM activity is eligible if it is of the following types: renewable energy (Solar thermal; photovoltaic; ecologically sound biomass, biogas and liquid biofuels; wind; geothermal; small low-impact hydro) or end-use energy efficiency improvement (industrial energy efficiency; domestic energy efficiency; energy efficiency in the transport sector, in the public sector, in the agricultural sector, and in the commercial sector) (Gold Standard 2006). The CDM activity must also demonstrate the additionality (must be additional to what would have occurred in the absence of the project) of the emission reductions. The Gold Standard defines

a list of Sustainable Development indicators (see Figure 12) against which the project is assessed following a scoring system (from -2 for major negative impacts to +2 for major positive impacts). The project is eligible if 1) each of the components has a sub-total score that is non-negative, 2) the grand total is positive, and 3) none of the indicators receives the score of -2. An EIA is conducted either if required by the host-country law, or if required by the CDM Executive Board, or if the outcome of the initial public consultation process indicates that environmental impacts could be significant. And finally, the Gold Standard requires at least two rounds of stakeholders' consultation.

Local/regional/global environment Water quality and quantity Air quality (emissions other than GHGs) Other pollutants: (including, where relevant, toxicity, radioactivity, POPs, stratospheric ozone layer depleting gases) Soil condition (quality and quantity) Biodiversity (species and habitat conservation)
Social sustainability and development Employment (including job quality, fulfilment of labour standards) Livelihood of the poor (including poverty alleviation, distributional equity, and access to essential services) Access to energy services Human and institutional capacity (including empowerment, education, involvement, gender)
Economic and technological development Employment (numbers) Balance of payments (sustainability) Technological self reliance (including project replicability, hard currency liability, skills development, institutional capacity, technology transfer)

Figure 12 : Sustainable Development indicators.
Source: Gold Standard 2006, p.11.

Once the CDM activity has passed the pre-assessment, the project will be subject to validation. It must be validated by an UNFCCC-accredited DOE, as part of the standard CDM process. This stage is a prerequisite for obtaining the Gold Standard label.

The critique

Some authors (Langrock et al. 2003, Sterk W. et al. 2003) argue that the Gold Standard addresses four loopholes of the CDM. First, it limits the scope to certain types of projects because specific project activities are renowned for having a higher risk of climatic, environmental or social impacts. Second, as many NGOs dispute the validity of the demonstration of additionality for several projects already approved, the Gold Standard

proposes a conservative approach in this regard. Third, the importance of the stakeholder participation is recognised. And fourth, the contribution to real Sustainable Development dividends is reinforced. On the downside, these authors argue that if CER from Gold Standard projects are notably more costly, it may be difficult to find buyers. Once registered, it is estimated that the price of Gold Standard CER could be between 7 and 35 % higher than standard projects (GTZ 2006a). Also, the Gold Standard doesn't appear to be in a position to significantly influence the market in terms of volume.

In addition to this, one could bring forward a slight structural limitation of the Gold Standard that could weaken its credibility. The Sustainable Development assessment of the project is left to the Designated Operational Entity (DOE), the institution responsible for the validation and the request for registration of the CDM projects. Although there is little doubt about the qualification of those entities in regards to carbon quantification and project assessment, one could question their ability to assess local Sustainability[35]. The position of the Gold Standard organisation on that matter is that if the Sustainable Development assessment was to be executed by a specially accredited body, it would only complicate the process and add very little value. This view is mainly based on pragmatism due to limited resources.

The current status

To date[36], only one project of the CDM portfolio received the Gold Standard certification. This project, located in South Africa, aims at improving energy efficiency in households. About a dozen projects applying the Gold Standard methodology found themselves in an advance stage, but are currently held back by financial and institutional difficulties[37].

Although this niche market is likely to stay marginal, some institutions, like FIFA (Fédération Internationale de Football Association) World Cup 06 and the UK Government, have manifested their interest of acquiring premium Gold Standard CER (GTZ 2005).

[35] Comment raised by Felicia Müller-Pelzer (Humboldt University Berlin) during the conference *Climate or Development?* in Hamburg, 28 October 2005, and answered by Michael Schlup, director of the Gold Standard.
[36] Data source: <http://www.cdmgoldstandard.org/index.php>, status as of the 27 May 2006.
[37] Data source: personal communication with Michael Schlup, Gold Standard Director, email 28 February 2006.

4.2 Community Development Carbon Fund (CDCF)

The World Bank's Community Development Carbon Fund[38] (CDCF) targets small-scale projects located in underprivileged environments, and aims at fostering broader Sustainable Development benefits as well as at reducing the unequal distribution of projects.

Overview

Small-scale CDM projects demonstrate a relatively high contribution to Sustainable Development (Sutter 2001) at community level. However, because of the transaction costs, small-scale projects are likely to be rejected by the market if not benefiting from external support (WB 2003).

The fund is designed with the goal of purchasing emission reductions from CDM projects which give the opportunity to communities in developing and least-developed countries to benefit from new investments in clean technologies. The CDCF aims at encouraging Sustainable Development while promoting a fairer distribution of the benefits throughout countries as well as within the host-countries. Also, the CDCF implements capacity building measures in order to reduce investment risks, facilitate project development and replication (WB 2003) through its program CDCF*plus*[39].

The CDCF screening ensures that the project is located in a developing country which is part of the UNFCCC, that no more than 10% of the Fund's assets contribute to projects in the same country, that a minimum of 25% of the Fund is dedicated to projects in Least-Developed Countries or in other countries if these projects provide demonstrable benefits to the poorer communities of those countries, and finally, that the projects comply with the small-scale definition stated in the Marrakesh Accords (WB 2003).

[38] For more information on the CDCF, see: < http://carbonfinance.org/cdcf/home.cfm>, viewed 30 November 2005.
[39] For more information on CDCF*plus*, see: <http://carbonfinance.org/cdcf/router.cfm?Page=About>, viewed 1 December 2005.

The current status

To date[40], a dozen projects are at validation stage, four of which are already registered. The projects are hosted by Argentina, Honduras, India, Moldova, Peru, Nepal and South Africa, and focus mainly on renewable energy and energy efficiency.

4.3 Other relevant facts

As already mentioned, there are other actions which could lead to support CDM projects that have a higher impact on local Sustainable Development.

Governmental decisions

China decided to put a levy on certain types of CDM projects. Hence, the Chinese government will take 65% of the CER benefits from HFC and PFC projects, 30% from N_2O projects and only 2% from projects identified as being priorities, such as energy efficiency, renewable energy and methane recovery and utilisation (NCCCC 2005). By doing this, the Chinese government intends to promote investments which could foster technological upgrades in climate-friendly energy systems.

In Spain for instance, the Designated National Authority defined priorities for public investment in selected CDM project types. These are: energy efficiency, renewable energy, and waste management. Also, projects activities based in Latin America, in the Magreb, or in Eastern Europe represent the main focus. The Spanish government sees the CDM as an opportunity for international cooperation[41], and not only as a means to reach emission targets.

In Belgium, trade unions pressured the government to include additional screening criteria. In particular, the project proponents should sign a letter of social responsibility as to respect basic conventions of labour organisations. Also, the project evaluation must include criteria on social sustainability, such as quality of job created, respect of work norms, and quantity of job created (FGTB 2005).

[40] Data source: Fenhann 2006, status as of the 17 January 2006.
[41] Source of information: speech from Arturo Gonzalo Aizpiri from the Spanish Government's Department of Environment during the conference Expo CO_2, Barcelona, 4 May 2006.

This list is far from being exhaustive as several other Annex 1 countries define complementary conditions (to those imposed by the UNFCCC) for the use of CER from CDM activities according to their respective aspirations. The above-mentioned undertakings serve as examples to illustrate the point.

Chapter 5: Multi-Criteria Evaluation Method

As mentioned previously, certain CDM projects' contribution to local Sustainable Development has been questioned. Some institutions propose alternative methodologies aimed at fostering broad Sustainable Development in the host-countries.

The evaluation method exposed hereafter can be seen as a first approach in order to allow for a discussion on the potential benefits of additional incentives, such as the Gold Standard and the CDCF, on the Sustainable Development dividends from CDM projects. This analysis claims in no way to provide an absolute evaluation of the contribution of each project to Sustainable Development as such. Rather, it allows for a basic and transparent comparison between different projects.

5.1 Multi-Criteria Evaluation

Sustainable Development is multidimensional. Hence, the evaluation of a project's influence on Sustainable Development requires the examination of several aspects. Therefore, a multi-criteria approach appears to be ideally suited to such analysis. Indeed, multi-criteria methods aim at reflecting the multidimensional aspects of an issue.

Unlike other assessment methods, like Cost-Benefit Analysis (CBA) for example which only relies on monetary evaluation, Multi-Criteria Analysis (MCA) reposes on a core principle of Ecological Economics: the concept of *weak comparability*, which in turn implies *incommensurability*[42]. In regards to Sustainable Development assessment, there is no common unit of measurement with which a criteria, say the number of jobs created or lost, can be evaluated against another one, say the impact on natural resources. However, this does not imply incomparability, but rather that the comparison across the values is *weak* and can only, or should preferably, be performed without the use of a single type of measure. Multi-criteria evaluation proposes a methodological tool that allows for dealing with the incommensurability of values (Martínez-Alier et al. 1998).

[42] For more information in regards to the shortcomings of CBA, see Munda 1996.

The approach doesn't solve all the issues related to multi-aspects evaluation and nor does it reduce the uncertainty linked to such assessment. Nevertheless, it assists in structuring the problem (Cavallaro 2005) and allows for a clear and transparent appraisal and therefore has a clear advantage over informal judgments. MCA techniques help to deal with complexity (Afgan et al. 2001) by establishing preferences between alternatives to serve a predefined objective.

In practice, it is unlikely for any given option to perform best in every single criteria. MCA is designed to establish preferences between options for which measurable independent criteria have been defined.

5.2 Description of the method applied to the cases study

The method used for the comparison of CDM projects in the empirical part of this research is essentially based on a book from Christoph Sutter (2003), *Sustainability Check-Up for CDM Projects*, derived from his PhD Thesis at the Swiss Federal Institute of Technology in Zurich (Switzerland).

The method, called Multi-Attributive Assessment of CDM (MATA-CDM), reposes on the Multi-Attributive Utility Theory (MAUT) framework and is tailor-cut for the evaluation of CDM projects. It includes a proposed set of criteria with their respective utility functions. The MATA-CDM methodology assists in making explicit the contribution of each studied CDM project to the different aspects of Sustainable Development and thus allowing for a comparison between projects. The transparency of the evaluation process is increased by the fact that each criterion, being quantitative or qualitative, is evaluated in its own dimension, avoiding reduction to a common unit, like a monetary value for instance.

The data necessary for the evaluation of the projects will be derived from the respective Project Design Document (PDD). The limitation to one source may seem restrictive. However, this approach presents many advantages. Firstly, the PDD is a public document available on the Internet and thus accessible. Secondly, the document and its content can be assumed as being fairly reliable. Indeed, the PDD represents the official document submitted to the authoritative body, the Executive Board, for the approbation of the project. Previously, the PDD had to be reviewed and approved by a Designated Operational Entity to ensure its

concordance with the UNFCCC requirements. Furthermore, the procedure requires for the document to be subjected to public comments as well as to take into consideration those comments. Thirdly, the form being standardised contains relatively homogenous data.

Overview

The general equation of the MATA-CDM methodology is the following:

$$U(P) = \sum_{i=1}^{n} w_i u_i \left[c_i (P) \right]$$

Equation 1 : MATA-CDM general equation.
Source: Sutter (2003), p.79.

Where:

U : Overall Utility Function
P : CDM Project P
w_i : Weighing of criterion i
u_i : Single Utility of criterion i
c_i : Sustainable Development criterion
n : Number of criteria
And $\Sigma\, w_i = 1$

Evaluation procedure

The general context of the evaluation lies within the framework of the Clean Development Mechanism. Assuming that additionality is real, as it should be since the CDM projects evaluated have been approved already, local Sustainable Development represents the core objective. The different projects represent the different alternatives considered under the multi-criteria evaluation.

The MATA-CDM evaluation can be divided in 5 distinct steps:

Step 1: Identification of Sustainable Development criteria

The first step consists in the election of the criteria. The MATA-CDM suggests a set of 12 criteria split into three categories representing the three pillars of Sustainable Development. They are namely the economic, social and environmental dimensions (see Figure 13). The criteria must be independent and assessable.

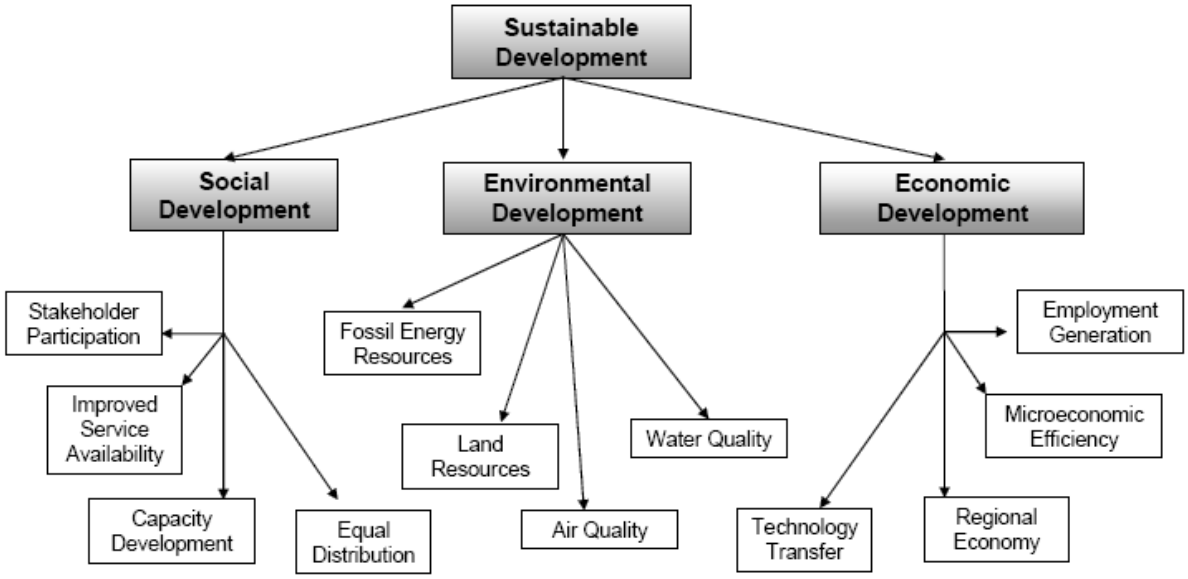

Figure 13: Hierarchy of the Sustainable Development criteria suggested in the MATA-CDM
Source: Sutter (2003), p. 81.

The assessment of a project's contribution to Sustainable Development would require context specific criteria. However, for the purpose of this study, the same set of criteria is used for the evaluation of all the projects in order to allow for a comparison between them. As this exercise does not claim to assess the contribution of a project to Sustainable Development as such, a pre-defined matrix of criteria is necessary in order to compare the projects to one another.

For the purpose of this first order assessment, the criteria suggested in Sutter (2003) are used. For Social Development, they are: stakeholder participation, improved service availability, equal distribution of project returns, and capacity development; for Environmental Development: fossil energy resources, air quality, water quality, and land resource; and for Economic Development: regional economy, microeconomic efficiency, employment generation, and sustainable development technology. A more detailed definition of the criteria can be found in the Annex A.

It is acknowledged here that the choice of the criteria is arbitrary. However, the set of criteria

suggested is based on the experience from existing studies applying the MATA-CDM methodology (Sutter 2003). The set of criteria needs to represent a balanced compromise between representativness and operationability.

The design of an alternative set of criteria as well as utility functions specific to this study would significantly increase the resource required without to have a guaranteed positive influence on the qualitative findings of the analysis.

Step 2: Definition of the Utility Functions

Every criterion requires a Utility Function. Such functions can be found in the Annex A. Again, most of the data are derived from Sutter (2003), with the exception of the criteria Equal Distribution of Project Returns, which is based on Sutter et al. (2005), because of its more appropriate operationability.

The basic principle for the design of the Utility Functions is that the maximum utility (1) represents the benchmark of best-practice. A utility of zero characterises a neutral state where the influence of the project compared to the reference or baseline in negligible. A negative utility signifies a negative impact of the project in that particular criterion.

Other approaches suggest for the maximum utility in one criterion to be defined by the best score of all projects for that criteria. However, this method requires a discrete set of alternatives. On the contrary, if the benchmark is defined by a hypothetical ideal project, other projects can be evaluated at any point of time and compared with the projects already evaluated without to have to modify their assessment. This point is relevant in the case of the CDM since the portfolio is constantly growing and one cannot wait for all alternatives to be presented before undertaking the evaluation.

Step 3: Weighting of the criteria

According to Sutter (2003), the weighting of the criteria allows for a distinction in the relative importance of each criterion. Indeed, one criterion could be assumed as more relevant than another in relative terms.

Sutter (2003) proposes two weighting systems. The first one, the so-called Direct weighting, allocates weighting independently to the different criteria. The individual relative weights

represent a proportion of the total, which is scaled down to 1. The second system, the Analytic Hierarchy Process, is based on the pair-wise comparison of all the criteria. For this study, the former system is preferred. The direct weighting is easier to handle and a superior accuracy of the latter system is not demonstrated[43].

The weightings, as well as the criteria as it will be discussed above, depend on the local context. It is acknowledged that for an accurate evaluation of the Sustainable Development dividends of a single project, peer-reviewed specific criteria and perhaps weightings should be applied based on local stakeholder consultation.

For the purpose of this assessment, all criteria will be arbitrary weighted equally, for reasons that will be developed below (see 5.4 Diversion from the original method). A sensitivity analysis will analyse the role that the weightings might play in the evaluation.

Alongside with the projects evaluation, a survey has been undertaken in order to fetch potential divergence in the relative importance assigned to the pre-defined criteria by different CDM stakeholders. This allows for the evaluation of the perception of Sustainable Development based on the set of criteria by professionals involved with the CDM process. Indeed, such notions as Sustainable Development are value-driven. CDM stakeholders deal daily with such interpretational issues and related trade-offs.

For this purpose, a questionnaire (see Annex B) has been designed in order to obtain the evaluation of each criterion in terms of relative importance from different stakeholders. Four groups of individuals have been identified. They are: Academic, NGO, Government and Business. Each individual conceptualises Sustainable Development differently. The distribution of the questionnaire has been done with the objective of a fair distribution between the different roles played by those actors, a fair geographical representation over the countries as well as a fair mix between Annex 1 and non-Annex 1 countries (for the list of actors, see Annex C). The list includes project Participants of all five CDM projects evaluated below.

The actors have been asked to assign relative weightings to the pre-defined dimensions of Sustainable Development criteria firstly (Social, Environmental, and Economic), and then to assign relative weightings to the 4 criteria of each dimension. The final weighing of each

[43] For a discussion on the weighting methods, see Sutter 2003, p. 86.

single criterion is obtained by multiplicating the weight given to the particular criteria with the weight of the category it belongs to (see Figure 14). The weightings are then scaled down to form a sum of 1, according to the current practice for weightings.

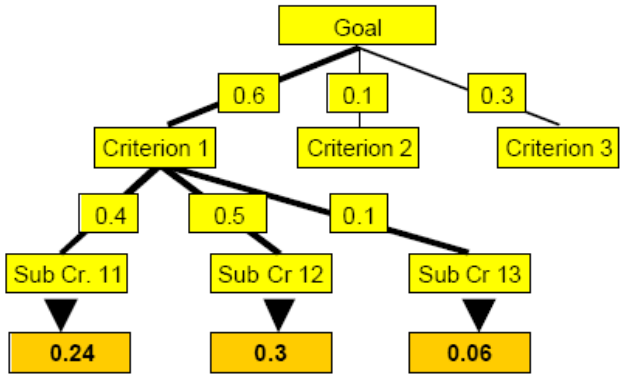

Figure 14 : Representation of the calculation of the weighting of each criterion according to its category.
Source: Heuberger 2003, p. 27.

Example: The criterion Air Quality gets assigned a relative weight of 0.4 within its dimension. The dimension, Environmental Development, receives a relative weight of 0.6. Therefore, the final specific relative weight is: 0.4 * 0.6 = 0.24.

Step 4: Assessment of the CDM projects

The different CDM projects are assessed on each criterion according to the corresponding utility functions and the data available in the respective PDD.

Step 5: Aggregation and interpretation of the results

The aggregation is not performed as described by the original methodology for several reasons. Those reasons are discussed below (see 5.4 Diversion from the original method).

5.3 Justification for the method chosen

MATA-CDM is field-proven. Indeed, this method already demonstrated its potential in several case studies[44]. Moreover, the method is used in practice. The Uruguayan Designated

[44] For applications in case studies, see Sutter 2003, Heuberger 2003 and Sutter et al. 2005.

National Authority (DNA), for example, applies the MATA-CDM for the evaluation of CDM projects in order to decide on whether they sufficiently contribute to Sustainable Development and thus give their approval or not (Sutter 2003, Sutter et al. 2005).

A MAUT appears to be particularly appropriate in this specific case because the total number of the alternatives (CDM projects) to serve the objective (Sustainable Development) is unknown. Indeed, other MCA methods are based on pair-wise comparisons and require a finite set of options. On the contrary, MATA-CDM allows for the independent evaluation of a project and for comparison at any point of time with others previously analysed without having to go through the evaluation of the complete set of alternatives again. This point is important in the CDM framework since some projects need to be evaluated while others are still in the early phase of design.

Typical additive MAUT methodologies allow for compensation. The bad performance of an option in one of the criterion can be compensated by a good performance in others. Those trade-offs are acceptable to a certain extent. However, it would be unacceptable for a considerable water pollution to be compensated by the creation of employment for example. One could argue that minimum threshold should apply for each criterion under which a project would be disqualified. However, the definition of those limits represents a challenge. This issue is another argument for not aggregating the outcome of the utility functions. By representing each criterion separately, the potential trade-offs can easily be identified and evaluated if necessary.

The outcome of the analysis is likely to be more reliable and definitely more objective if the definition of the criteria as well as the evaluation is executed by a team rather than an individual. Because of the limited resources available for this study, a peer-review of those elements was not impossible. However, it must be noted that the criteria derived from the MATA-CDM already benefit to a certain extent from extended consultation, although not context-specific.

Another attractiveness of the MATA-CDM lies in the fact the methodology is relatively simple to apply and does not require advanced knowledge of multi-criteria techniques. Therefore, its possible application is wide and not limited to the academic sphere.

5.4 Diversion from the original method

The way the evaluation is executed in this study differs slightly from the proposed original MATA-CDM methodology for various reasons. Firstly, the goal of this analysis is not to establish a ranking between projects but rather to compare and discuss the contribution of additional incentives, such as the Gold Standard for example, to Sustainable Development. Therefore, the aggregation to a single final utility is not necessary. The ultimate objective reposes on a qualitative comparison of the Sustainable Development dividends profiles. In this context, the so-called utility functions are to be rather understood as means of scaling the criteria, resulting in scores for each criterion.

Secondly, as already mentioned above, the fact that a multi-criteria additive method allows for compensation can be seen as a weakness and contrary to the core principles of Ecological Economics. The final aggregation is therefore not desirable. The omission of that final stage allows the decision-maker to visualise the potential compensative effects hidden in the classical approach, acknowledging the potential technical incommensurability (Giampietro et al. 2006) of the indicators.

And thirdly, unlike the original methodology, the present study does not claim to assess the contribution of CDM projects to Sustainable Development as such. Rather it proposes a platform to compare projects in order to discuss a specific aspect: the influence of additional incentives to foster broad local Sustainable Development dividends.

Some limitations of the methodology are discussed further, in the sub-chapter 7.4 Discussion.

5.5 Sensitivity analysis of the weightings

As mentioned above, the weightings are arbitrary assigned the same value for each criterion. A sensitivity analysis is performed in order to evaluate the potential impacts of this assumption. In order to do so, some of the criteria weightings are forced to an artificial value alternatively. If the outcome of the evaluation is not biased by doing this, the assumption that equal weighting doesn’t distort this particular analysis is validated.

Chapter 6: Cases Study

This chapter presents the different projects of the cases study together with their evaluation using the methodology described in the previous chapter. The appraisals are performed based on data available in the respective Project Design Document (PDD). For some specific criteria, no precise data are available. In such cases, an educated guess is applied.

Some of the projects benefit from additional incentives, such as the Gold Standard or the CDCF, in order to foster broad local Sustainable Development, while others do not include such incentives. The objective of this empirical part is to analyse the influence of those additional incentives.

This section does not claim to evaluate how well a project performs in terms of Sustainable Development. Such an appraisal would require a different approach, with context-specific indicators. Rather, it allows for a basic and transparent comparison between projects.

The projects chosen for the evaluation all have particular characteristics. Their all are at validation stage or further, for data quality reasons mentioned already. The only Gold Standard CDM project at that stage to date[45] will obviously be evaluated. Out of the CDCF portfolio, the project chosen for the evaluation here is the only one sharing the methodology (energy efficiency in household) with the Gold Standard project. The third project is of particular interest for being promoted by a local NGO (Women for Sustainable Development) rather than by a national or international consultant. The fourth and fifth projects are located in Brazil and India, the most potent countries in the CDM market at the moment. The evaluation focuses on energy-related projects. However, a project of another type, GHG capture and destruction, is included in the evaluation. This kind of main stream project, representing the large majority of CER and thus playing a significant role in the market, is compared with the others in terms of Sustainable Development.

[45] Status as of 27 May 2006.

6.1 Kuyasa low-cost urban housing energy upgrade project[46], Khayelitsha, South Africa

The Kuyasa project represents the first and only Gold Standard CDM project registered to date[47]. It has been validated on the 22 June 2005 and registered on the 27 August 2005.

This project is a so-called small-scale CDM activity since it will generate the equivalent of less than 15 MW of thermal energy and will reduce energy consumption on supply/demand side of less than 15 GWh per year. It therefore benefits from administrative advantages linked to such projects, such as simplified registration procedures and lower registration fees amongst others[48]. It falls under the category of Energy Efficiency measures in households and applies several different CDM methodologies, such as *Thermal energy for user*, *Demand-side energy efficiency programmes for specific technologies* and *Energy efficiency and fuel switching measures for buildings*.

The emission reductions are expected to be 6.58 ktCO_2eq per year.

Short description of the project

The Kuyasa project activities are aimed at improving the thermal performance of housing units, through the introduction of energy efficient lighting and solar water heaters.

The project focus is threefold. 1) Ceiling insulation will be installed in order to improve comfort and reduce space heating needs. 2) Solar Water Heaters will be installed in order to provide hot water from a renewable energy source. 3) The efficiency of lighting will be improved. With all those measures, the project will reduce the electricity consumption and subsequently avoid CO_2 emissions locally and regionally. They will be implemented on existing houses as well as on new construction in a later phase. The project is located in a relatively low-income residential area in the city of Cape Town, South Africa.

[46] Hereafter referred to as Kuyasa project.
[47] Data source: <http://www.cdmgoldstandard.org/index.php>, status as of the 27 May 2006.
[48] For more information on Small-scale CDM project activities, including definitions and eligibility, see FCCC(CP/2002/7/Add.3, available at: <http://cdm.unfccc.int/Reference/Documents/AnnexII/English/annexII.pdf>, viewed 16 January 2006.

Educational and capacity building benefits are also part of the project objectives. Indeed, residents will learn about energy savings and the use of energy efficient technologies. They will be invited to actively participate into the project design, development and implementation[49].

Evaluation

See Annex D.

Sustainable Development outcomes

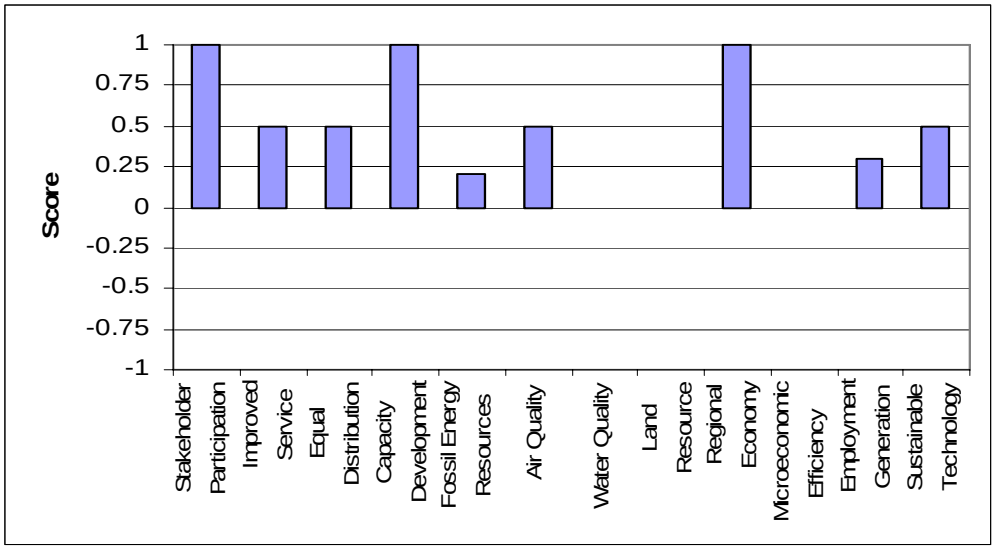

Figure 15: Kuyasa project Sustainable Development outcomes.

The notion of *Suppressed Demand*

Normally, the contribution of a CDM project is calculated by subtracting the conditions foreseen during the project to the conditions of the baseline or reference, which are the assumed conditions in the absence of the CDM activity. For example, the emissions caused by the project minus the emissions that would happen in the absence of the project represent the benefit due to the project. In this particular project, the baseline is not based on the situation where the project wouldn't have happened but rather on the notion of *Suppressed Demand*.

[49] For more information about the project, see the specific PDD available at: <http://cdm.unfccc.int/UserManagement/FileStorage/FS_292989657>, viewed 16 January 2006.

The *Suppressed Demand*, for energy services in this case, is characterised by the state where the current level of access to energy services is inadequate because of infrastructure or income constraints. It therefore does not reflect the real demand for such services. The baseline scenario refers to the case where those constraints would not exist.

It could therefore lead to the paradoxical case where the emissions increase because of the project activities while still emitting credit for emissions abroad. This fact is acknowledged in the Marrakesh Accords:

> *The baseline may include a scenario where future anthropogenic emissions by sources are projected to rise above current levels, due to the specific circumstances of the host Party.* (UNFCCC 2002b, p. 37)

We are here in the presence of a conflict between Climate protection and Development objectives. On one hand, the increase of emissions should be hampered. On the other hand, it is inappropriate for one to contradict the aspiration of underprivileged communities to access to a better standard of life.

6.2 Moldova Biomass Heating in Rural Communities project[50], Republic of Moldova

The Moldova project is a Community Development Carbon Fund (CDCF) activity and requested registration on 7 December 2005. It has been validated on the 7 November 2005.

The project is qualified as small-scale as well and falls under the category of Energy Efficiency measures in households too, allowing for a relevant comparison with the previous project. It applies three different CDM methodologies. These are *Thermal energy for the user*, *Energy efficiency and fuel switching measures for buildings* and *Switching fossil fuels*.

The emission reductions are expected to be 17.89 $ktCO_2eq$ per year.

[50] Hereafter referred to as Moldova project.

Short description of the project

The project intends to use the carbon value of the CERs to support the Moldova Social Investment Funds (SIF) and its project Participants by implementing heat production clean technologies in rural areas using renewable biomass energy (straw), natural gas or modern coal technology as well as by applying other buildings' energy conservation measures. It represents a bundle of independent small-scale activities geographically spread out over the country.

The Moldova project aims at rehabilitating and upgrading deteriorated heating systems in public buildings, such as schools, kindergartens, orphanages, community halls, and health centres. It will displace conventional coal fired energy production which is currently inefficient and responsible for important environmental contamination.

A number of about 400 project activities will be financed in rural areas, implying the involvement of almost as many communities into the project. The owners of the public buildings, such as local public authorities, are the owners of the respective project activity and, through the elected project committee, are responsible for the organisation and implementation of the investment project[51].

Evaluation

See Annex E.

[51] For more information about the project, see the specific PDD available at: <http://cdm.unfccc.int/UserManagement/FileStorage/QRPUB84Q94GBDV55M00C7C74JEB6JQ>, viewed 18 January 2006.

Sustainable Development outcomes

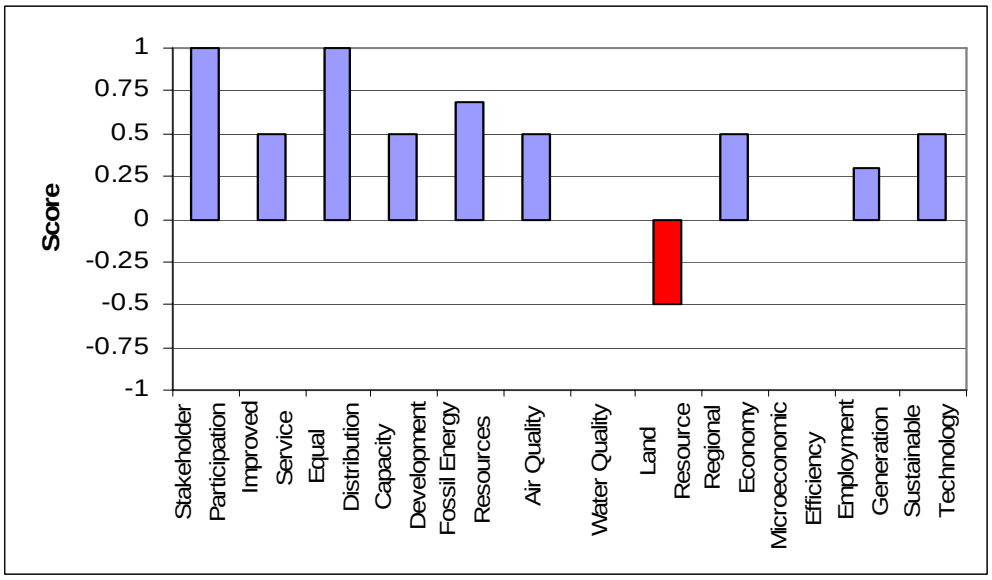

Figure 16: Moldova project Sustainable Development outcomes.

6.3 Bagepalli CDM Biogas Programme[52], Kolar District, Karnataka, India

The Bagepalli project is neither a CDCF activity nor has it been accredited the Gold Standard label and is therefore relevant for comparison with the two previous projects. A further interesting characteristic of this project for consideration here lies in the fact that its host-country, India, represents a major actor in the CDM market. On the top of that, a local NGO acts as promoter of the project. This project has been validated on the 8 August 2005 and registered on the 10 December 2005.

The project qualifies under the small-scale framework and falls under the category of Biomass renewable energy. It applies only one methodology, namely *Thermal Energy for the user*.

The emission reductions are expected to be 19.55 $ktCO_2eq$ per year.

[52] Hereafter referred to as Bagepalli project.

Short description of the project

The Bagepalli project will allow for the set up of biogas plants for individual households. The digester will be fed by dung from cows and will provide energy services for cooking and hot water. Commonly used inefficient wood fires will be replaced by clean and renewable energy technology. Because the quantity of firewood used is not covered by the growth of the forest, the source is considered as non-renewable releasing greenhouse gases into the atmosphere. By contrast, the project proposes a carbon-neutral option.

The project aims at facilitating up to 5500 individual biogas plants to provide energy requirements at household level. Methane production from cow-dung in a local manufactured digester allows for the provision of biogas and will provide energy. This energy should replace the inefficient wood fired mud stoves.

It is estimated that the current requirement is 1.3 to 2.5 kg of fuelwood per person per day. The area of the project activities suffers from fuelwood deficit like many other regions in India. A study estimates at over three quarters the quantity of biomass harvested that should be considered as non-renewable because exceeding the growth of the forest. There is therefore a net release of carbon into the atmosphere. Also, local families use kerosene as supplementary energy source. The switch to biogas will therefore allow for a reduction of greenhouse gases emissions [53].

Evaluation

See Annex F.

[53] For more information about the project, see the specific PDD available at: <http://cdm.unfccc.int/UserManagement/FileStorage/VCMNQ0S69WTHD75WFC5P4HSFE73TOO>, viewed 19 January 2006.

Sustainable Development outcomes

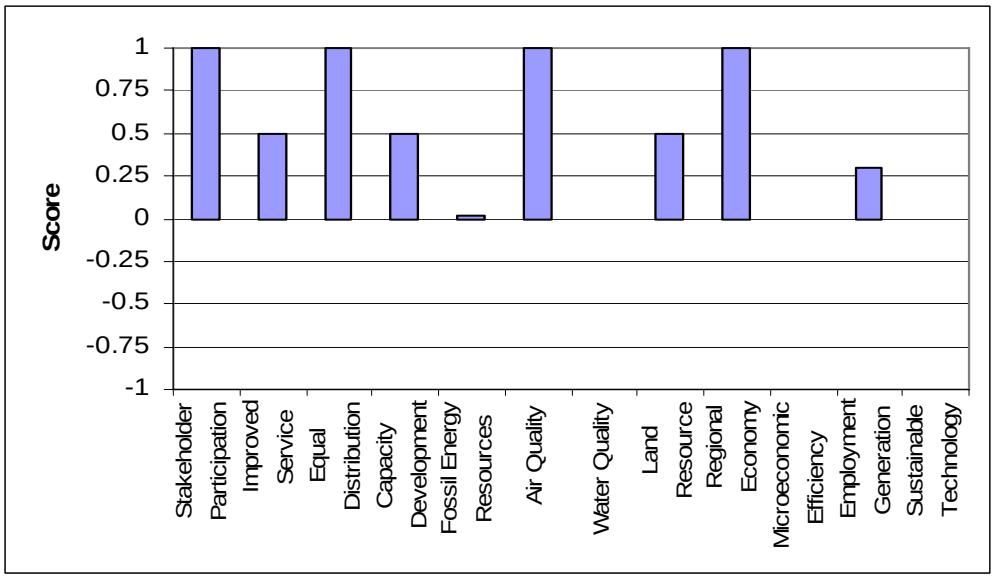

Figure 17: Bagepalli project Sustainable Development outcomes.

Remark

The project is administrated and managed by local NGOs, Women for Sustainable Development and Agricultural Development and Training Society.

6.4 Brazil NovaGerar Landfill Gas to Energy project[54], Nova Iguaçú, Rio de Janeiro, Brazil

The NovaGerar project does not benefit from any additional incentive for Sustainable Dividend either. Brazil is the other main actor, together with India, in the CDM market. NovaGerar project has been validated on the 6 May 2003 and has been the first project to be registered by the CDM Executive Board on the 18 November 2004.

The project is a large-scale landfill gas to energy activity and applies the methodology *Simplified financial analysis for gas capture projects*.

The emission reductions are expected to be 670 $ktCO_2eq$ per year.

[54] Hereafter referred to as NovaGerar project.

Short description of the project

The goal of the NovaGerar project is to exploit landfill gas by collecting and combusting methane to produce electricity to export to the grid with an expected final capacity of 12 MW. The excess gas will be flared. Both activities will convert the methane contained in the landfill gas into CO_2, thus reducing the greenhouse gas effect.

The project activities aim at collecting landfill gas from existing waste deposit sites. The methane will be burnt in order to produce electricity with generation plants which will be fed into the national grid. Small modular generators are particularly suited to the varying landfill gas flow as they can be relocated when the volume of the landfill gas decreases with time.

One landfill site already contains about 2 million tonnes of waste deposit and is subject to rehabilitation. Another one, recently commissioned, is expected to receive 2'000 tons of municipal waste per day. Both are located in a densely populated area, in the vicinity of Rio de Janeiro. Combustion and flaring will reduce the emission of greenhouse gases[55].

Evaluation

See Annex G.

[55] For more information about the project, see the specific PDD available at: <http://cdm.unfccc.int/UserManagement/FileStorage/FS_609234123>, viewed 19 January 2006.

Sustainable Development outcomes

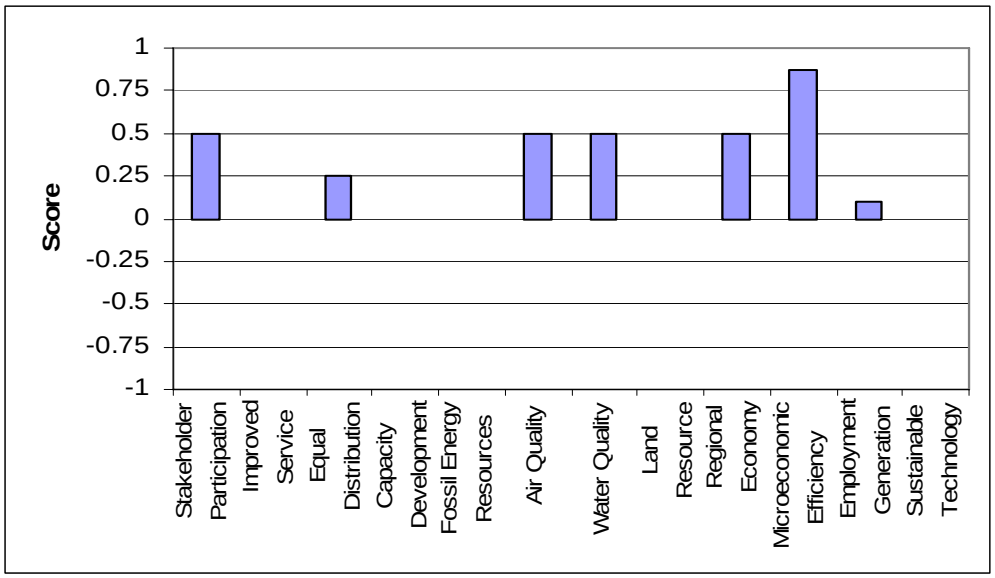

Figure 18: NovaGerar project Sustainable Development outcomes.

Remark

As a condition for its licence, NovaGerar will donate approximately 10% of the generated electricity to the local municipal authority to provide lighting for local schools, hospitals and other public buildings.

84% of Brazil's methane emissions come from waste dumping in uncontrolled rubbish sites. Currently, 76% of the total waste generated in Brazil is disposed in dumps without management. This illustrates the potential of such projects in Brazil.

6.5 GHG emission reduction by thermal oxidation of HFC23 at refrigerant manufacturing facility of SRF Ltd[56], Rajasthan, India

Although the focus of this research lies on energy projects, this CDM activity is integrated into the analysis because it represents a major part of the total CERs currently in the pipeline. Also, there is still a very high potential for projects capturing and destroying gases with very

[56] Hereafter referred to as SRF project.

high greenhouse effect. India is a key-player as host-country together with Brazil in the CDM market. This project is the biggest registered CDM activity in terms of CERs in this country to date[57]. It has been validated on the 17 July 2005 and registered on the 24 December 2005.

The activity is applying the CDM methodology of *Incineration of HFC 23 waste streams* and is obviously classified as a large-scale project.

The emission reductions are expected to be 3833 $ktCO_2eq$ per year.

Short description of the project

SRF Limited manufactures refrigerant gases. HFC 23, a gas with a very high greenhouse effect (GWP of 11'700)[58], is generated as a by-product during the manufacture of HCFC 22, a refrigerant gas, and currently vented to the atmosphere. The project intends to capture and destroy the HFC 23 through thermal oxidation.

SRF produces different refrigerant gases alternatively. While producing HCFC 22, HFC 23, which had a very high greenhouse gas effect, is released to the atmosphere. There is currently no regulation in India obliging companies to destroy or capture such gases. Also, the market is too insignificant to be of any relevance in the present case. The carbon finance due to the CDM activity will allow the financing of the investment into the plant necessary for the capture and destruction of the gas[59].

The thermal oxidation plant will be imported from abroad and represent a so-called end-of-the-pipe fix in order to reduce the emission of greenhouse gases.

Evaluation

See Annex H.

[57] Status as of 17 January 2006.
[58] Data source, PDD, p.2.
[59] For more information about the project, see the specific PDD available at: <http://cdm.unfccc.int/UserManagement/FileStorage/C71S3S0NXMHFZ9VBQSJ0NOXOE0DRHA>, viewed 17 January 2006.

Sustainable Development outcomes

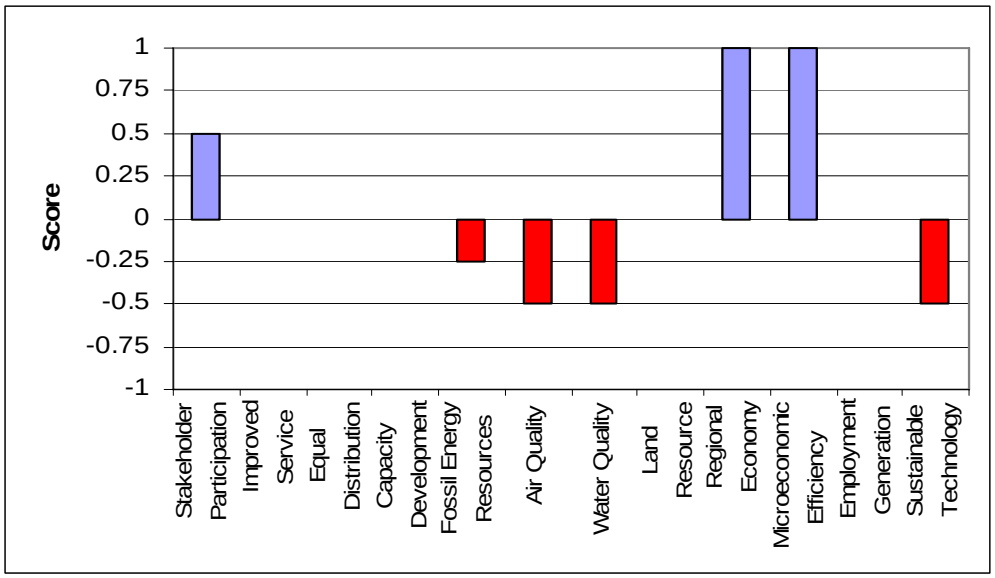

Figure 19: SRF project Sustainable Development outcomes.

Remark

SRF proposes to use some of the project revenue for interventions to contribute to Sustainable Development in the region. However, no clear strategies are described and the process is not guaranteed to be participative.

Chapter 7: Results of the cases study and Discussion

This chapter presents the outcome of the multi-criteria evaluation of the projects. The results are critically discussed. The results of the questionnaires in regards to the weighting by stakeholders are analysed. Then, a sensitivity analysis is carried out in order to determine the influence of the weighting on the evaluation outcome. A discussion concludes the chapter.

7.1 Comparison of the projects

The numerical evaluation, which should be interpreted as illustrative, is exploited to draw qualitative comparative information. The data are derived from the evaluations presented in the previous chapter and are aggregated into graphical form.

Qualitative comparison of the Sustainable Development profile

Based on the MATA-CDM methodology, the results of the projects' evaluation for each criterion are presented in Amoeba graphs. The objective is to draw information about the influence of additional incentive for Sustainable Development on CDM projects.

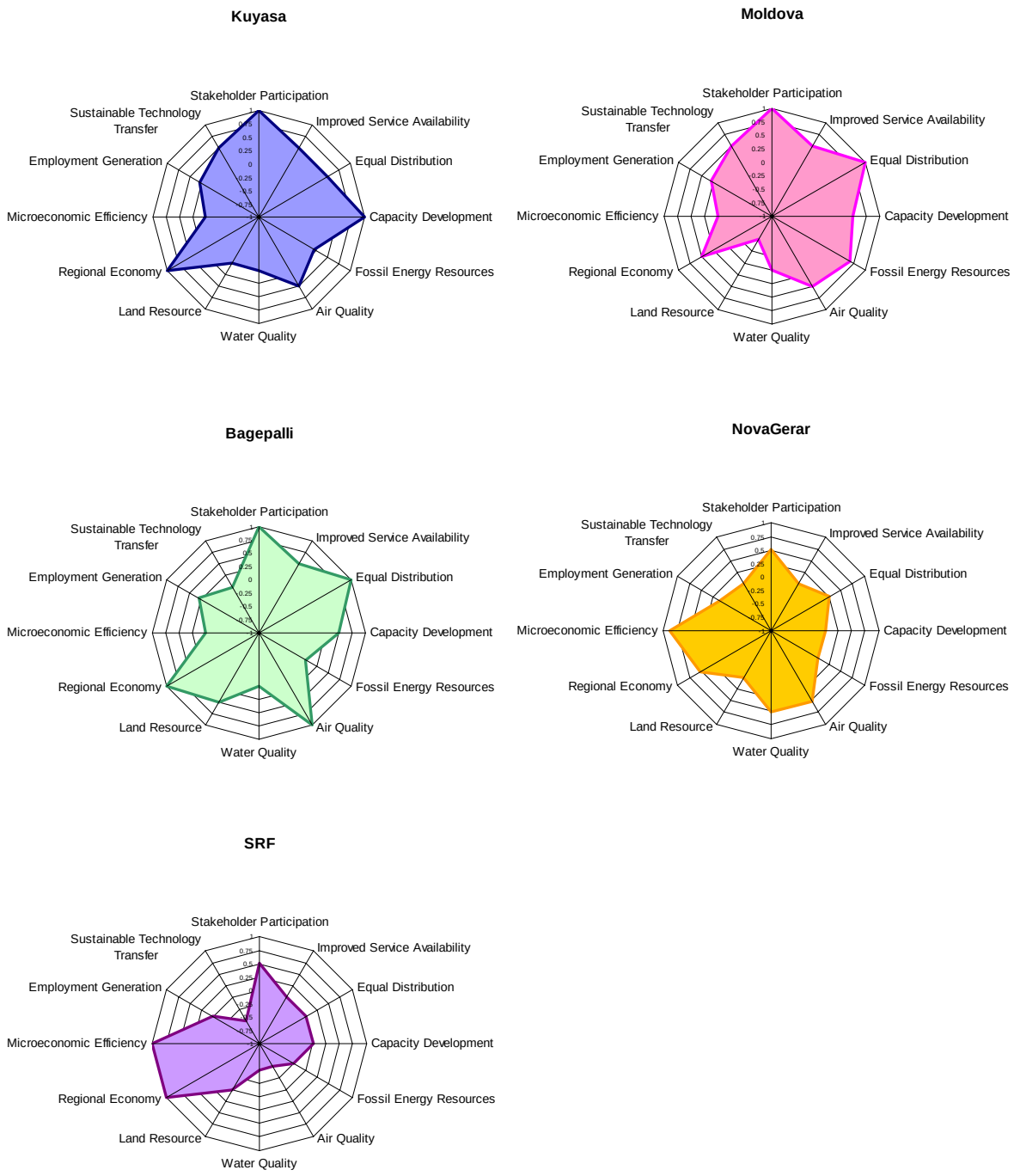

Figure 20: Sustainable Development profile of the five CDM projects evaluated.

One can observe that the projects benefiting from additional incentives for Sustainable Development, the Kuyasa project (Gold Standard) and the Moldova project (CDCF), perform relatively well according to the evaluation (see Figure 20). Not only is the overall profile ample, but as well relatively evenly balanced between the three categories, Social Development (from 12 to 3 o'clock in the diagrams), Environmental Development (from 4 to

7 o'clock), and Economic Development (from 8 to 11 o'clock).

Beside that, this assessment reveals that other projects which do not benefit from additional incentives, such as the Bagepalli project and to a lesser extent the NovarGerar project, also reveal a reasonable profile. The Bagepalli project seems to surpass the NovarGerar project somewhat, but the distribution between the criteria of the latter might be more uniform.

The SRF project doesn't appear to perform as well according to the applied methodology, neither in global terms nor in regards to the distribution amongst the criteria. Indeed, this project demonstrates a very strong performance in some of the economic criteria, while the contribution to social development is low or neutral, and the influence on environmental criteria is negative.

According the this approach, it seems therefore that projects benefiting from additional incentives, such as the Gold Standard and the CDCF, perform relatively well in terms of Sustainable Development. However, some other projects demonstrate a similar profile, if not a better one perhaps in the case of the Bagepalli project. The only main stream project considered here, the SRF project, shows a very different Sustainable Development profile, an outcome which is consistent with the critiques in the literature (Cosbey et al. 2005, Pearson 2004).

Relative contribution by category

The aggregation of the evaluation results by categories, social, environmental, and economic, in relative terms allows for analysing the main focus of the project in terms of local Sustainable Development.

According to the evaluation performed, the Gold Standard Kuyasa project demonstrates a strong social component, while the environmental contribution is relatively low (see Figure 21). The CDCF Moldova project shows an even stronger social element. The relative distribution between the three categories of the Bagepalli project is similar to the Kuyasa project, with a more important environmental component in relative terms. The NovaGerar reveals the most balanced distribution between the categories, with somewhat stronger environmental and economic sections compared to the social one. The SRF project, beside the negative environmental impact, discloses the predominance of the economic fraction which

represents about three quarter of the (positive) contribution.

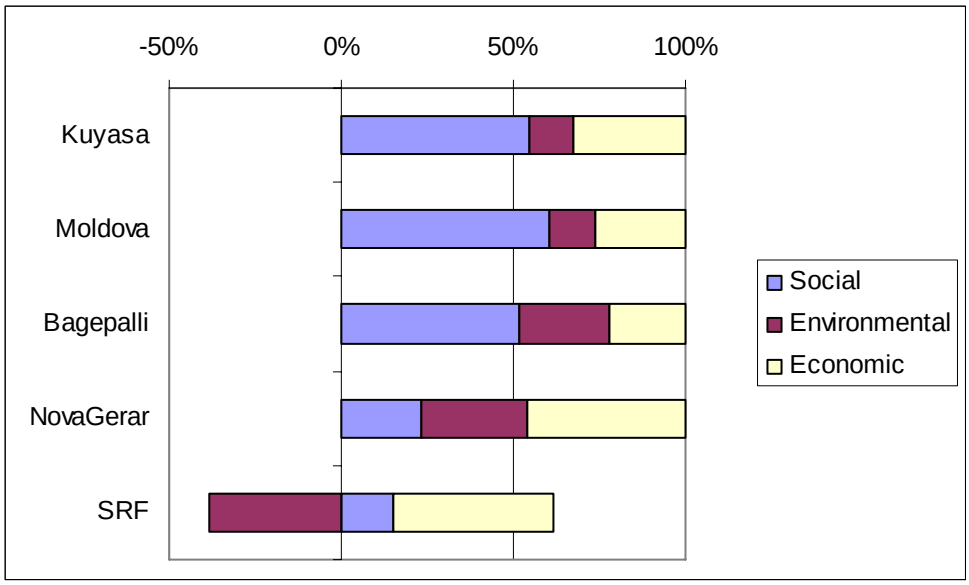

Figure 21: Relative contribution by categories for each project evaluated.

The two projects benefiting from additional incentives, the Kuyasa and the Moldova projects, demonstrate a predominant social component representing over half of the total contribution. They are both strongly involving the local community in all phases of the project. On the contrary, local communities of the NovaGerar and the SRF projects are relatively excluded from the decision-making process. The relative social contribution of those two projects is minor. Rather the focus lies on the economic performance.

7.2 Questionnaire

This section presents the outcome of the questionnaire sent to different CDM stakeholders (for list of stakeholders contacted, see Annex C) via email. The aim is to assess the relative importance different stakeholders would assign to a pre-defined set of Sustainable Development criteria.

The interpretation of Sustainable Development being value-driven, this approach allows for investigating the potential similarities or mismatch amongst actors' groups, such as actors from Annex 1 and non-Annex 1 countries, or having different professional interests.

Comments on the questionnaire

In the questionnaire (see Annex B), a field was provided allowing the actors to add comments. Some stakeholders wrote lengthy comments, which included an interaction via emails with the author sometimes. The discussion on the weighting should start with a review of those comments.

1) Three actors highlighted the context-dependence of the weightings.

More than just the weightings, the whole evaluation, including the choice of the methodology, the definition of the relevant criteria and stakeholders, is context-dependent if one claims to assess the contribution of an activity to Sustainable Development in absolute terms, assuming for this to be possible. However, this does not represent the goal of the present evaluation. The objective is to compare projects in order to discuss a particular issue, which is the influence of additional incentive for Sustainable Development. For that purpose, a matrix of criteria needs to be pre-defined to allow for the comparison. Unfortunately, the CDM portfolio doesn't, and most certainly never will, contain two projects in exactly the same context, one benefiting from additional incentives and the other one not.

It is acknowledged here that the weightings would allow for an 'adjustment' to the local context. However, this goes beyond the scope of this study for logistic reasons. Contacting local stakeholders, out of whom many don't have access to telecommunication facilities, would require enormous resources. Also, defining the weightings as importance factors is a contentious issue, as it will be discussed further.

Finally, a sensitive analysis will be performed in order to verify the potential influence of the weightings and thus the robustness of the analysis.

2) One actor argued that the impact on poverty alleviation is also an important factor.

This might be very true. However, it does not represent the focus of the current study. The Kyoto Protocol defines a dual-objective, off-setting greenhouse gases emissions and contributing to Sustainable Development. This evaluation focuses on the latter goal.

Poverty may be alleviated, as a side-effect, through contribution to Sustainable Development. However, this does not represent a direct objective of the Kyoto Protocol.

According to the literature, if poverty alleviation was to be the objective, there would most probably be a more efficient tool than the CDM to serve that particular purpose[60].

3) Another actor underlined the interrelation of social, economic, and environmental criteria.

Those aspects are interrelated indeed, with one influencing the other, as discussed in chapter 2.2 Sustainability, Sustainable Development and the CDM.

4) Lastly, an actor suggested having different approaches according to the technology applied for the project.

A specific approach to a particular technology may lead to a more accurate evaluation of such a project, as is the case for the context as well. However, as already discussed, in order to allow for a comparison between the projects and their associated technologies, a pre-defined matrix of criteria is necessary. Furthermore, technology, although a crucial aspect, is not the focus of this particular study.

Results from the questionnaire

Out of the 24 actors contacted, 11 filled out and returned the questionnaire. The repartition of the answer amongst the different actor groups was relatively well balanced (Academia: 3 responses; Business: 3; Government: 2; NGO: 3), and so was the distribution between Annex 1 and Non-Annex 1 countries (Annex 1: 5 responses; non-Annex 1: 6).

The criteria of the different dimensions in one of the questionnaire returned did not sum up to 100, as requested. In that case, the weightings assigned by the actor were proportionally scaled in order to match the others and be comparable.

[60] For a discussion on Poverty and the CDM, see Michaelowa et al. 2005a, Schlup 2005, Sirohi 2005, ReNED 2005.

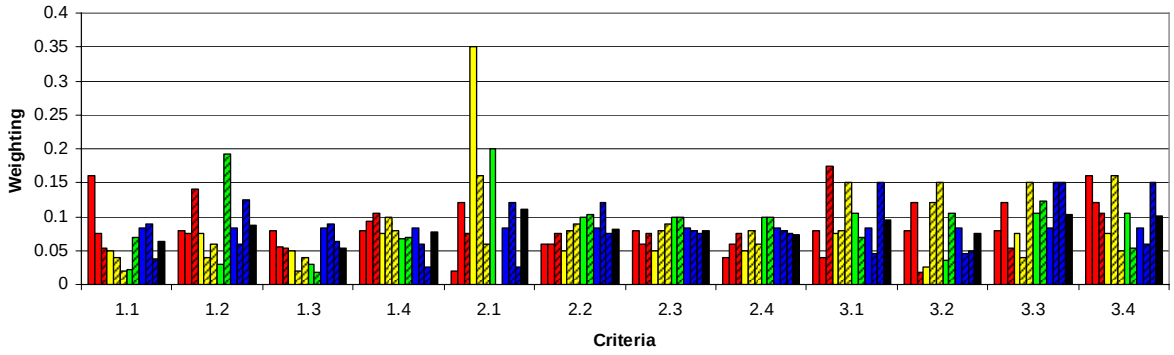

Figure 22: Overview of the relative weighting attributed by selected stakeholders.
1.1: Stakeholder participation; 1.2: Improved service availability; 1.3: Equal distribution of project returns; 1.4: Capacity development; 2.1: Fossil energy resources; 2.2: Air quality; 2.3: Water quality; 2.4: Land resource; 3.1: Regional economy; 3.2: Microeconomic efficiency; 3.3: Employment generation; 3.4: Sustainable technology transfer. In red: Academia; In yellow: Business; In green: Government; In blue: NGO. The bars with plain colour represent actors from Annex 1 countries, and the bars with black stripes represent actors from non-Annex 1 countries. The black bars (right-hand side of each criterion) represent the average.

No clear pattern can be deduced from the results of the questionnaires (see Figure 22). Indeed, there is no strong evidence for a group of stakeholders to significantly favour one or the other criteria, or even a category. Globally, there is a slight predominance for the economic criteria (average of 0.094), followed closely by the environmental criteria (average of 0.086), and lastly the social criteria (average of 0.07). This contrasts with the evaluation of the projects where the majority demonstrates a strong social component in relative terms (see Figure 21). On the other hand, the relative importance attributed to the economic contribution by the stakeholders reflects the outcome of the projects evaluation where the majority has a relatively strong economic fraction.

The results of the questionnaire, although not statistically relevant, are relatively consistent between the stakeholders for most of the criteria. The criteria Equal distribution of project returns, Capacity development, Air quality, Land resource, and Water quality, are those where the consensus is the strongest, with a standard deviation ranging from 0.015 to 0.025. The Fossil energy resource seems to be the criterion for which divergences of opinion are the most predominant (standard deviation 0.1). Indeed, for one stakeholder, this specific criterion is regarded as very important in relative terms while for another one it is insignificant.

7.3 Sensitivity analysis of the weighting

According the Sutter's MATA-CDM methodology, the weights assigned to the criteria are a

means of reflecting their relative importance. For the purpose of this study, all criteria have been weighted equally. However, without this assumption, the outcome of the evaluation could be different. The sensitivity analysis presented here tests the robustness of the evaluation under the equal weighting assumption.

In order to do so, the 'raw' evaluation with equal weightings is qualitatively compared with the same evaluation having one of the criterion's weight artificially forced to an arbitrary value. In the case where all the criteria are weighted equally, the specific weight of a single criterion represents a twelfth (1 / 12 = 0.083). The weight of a first criterion, Employment generation, is then forced to 0.2 (see second line of graphs in Annex I). The other criteria are weighted equally ((1 - 0.2) / 11 = 0.073). Then, the same procedure is applied with other criteria, Stakeholder participation and Microeconomic efficiency, alternatively (see third and forth line respectively of graphs in Annex I).

This scenario is highly unlikely as the criterion forced would be evaluated as over 2 times more important than when equally weighted (0.083), and almost thee times more important than the average of the other criteria. As seen from the questionnaires, the outcome from the weighting process can be expected as being relatively homogenous, with few exceptions. If this wasn't the case, one could argue that the criteria themselves haven't been chosen properly.

In the first three scenarios, equal weighting, or with the importance of the criteria Employment generation and Stakeholder participation alternatively artificially increased, the quantitative comparison between the projects is not altered (see Annex I). Indeed, the Kuyasa (in blue) and the Moldova (in pink) projects together with the Bagepalli project (in green) behave well both in terms of overall performance and in terms of distribution between the criteria. They are followed by the NovaGerar project (in yellow) which performs almost as well. The SRF project (in purple) lies behind with a strong disequilibrium between the performances in the different criteria for all scenarios.

In the last scenario, where the relative importance of Microeconomic efficiency is increased, the overall performance of the SRF project improves. However, it remains far behind the other projects and sees its distribution even worsened.

This sensitivity analysis of the weightings demonstrates that the outcome of the evaluation

wouldn't be altered by a modification of the weightings in this case.

7.4 Discussion

It is not claimed for the evaluation presented above to be conclusive. A great potential for improvement is present in several levels. This evaluation allows for a critical discussion and a must be seen as a learning process. Also, the sample of projects is not representative of the whole portfolio and hence represents no statistical value as such. The evaluation presented in this paper should thus be seen as an exploratory assessment, out of which no unequivocal conclusions can be drawn.

Participation

The empirical evaluation of this study represents an integrated assessment in the sense that it addresses simultaneously different dimensions, social, environmental and economic. A move further towards *Post-Normal Science* as suggested by Ravetz and Funtowicz (1999) would definitely require a more participative approach, amongst other conditions. Participation in an evaluation as suggested in this research could take many forms, and starts with the choice of the methodology and problem structuring (Giampietro et al. 2006). The resources necessary for this would be multiplied.

Because Sustainable Development is complex, multidimensional, and value-driven, an objective analysis of it results challenging. A plurality of knowledge and opinion is therefore desirable during the whole evaluation process. Although the modified methodology applied for this evaluation may lack reflective and iterative participation to be considered as a true *Integrated Assessment* in van der Sluijs (2002) sense, yet it entails some characteristics of such assessment, like for example the interdisciplinarity of the process as well as the interpretation of knowledge coming from diverse scientific disciplines.

For this particular evaluation, the comparison between the projects required a set of criteria applicable to all projects. The choice of those criteria would ideally necessitate the implication of a peer-community. The weightings could be used as a means for local stakeholders to adjust the evaluation to the context, although a consensus might result impossible to obtain.

Small-scale vs. large scale, renewable vs. mainstream

Amongst the 5 projects evaluated, the so-called small-scale projects clearly surpass the larger ones in regards to local Sustainable Development. Although this study does not have any statistical significance and the results can therefore not be extrapolated to the whole CDM portfolio, it appears that there might be a trade-off between the contribution to climate change mitigation and Sustainable Development objectives.

In this analysis, the renewable energy projects display a superior local Sustainable Development profile than the other type of the project evaluated. Even though, again, the approach used in this paper does not allow for generalisation, this finding is consistent with the literature (Sterk et al. 2005).

The limitation of the methodology

The MAUT entails many limitations. It is too normative, reposes on substantive definitions and is thus arbitrary, assumes strong comparability, and can lead to prescriptive conclusions. One can question the ability of such a tool to analyse Sustainability. Obviously, this evaluation doesn't claim to represent an appropriate evaluation of the projects' contribution to Sustainable Development. The methodology, which is in itself already arguable, required many assumptions, many of which are debatable. Yet, this approach contributes to bringing some insights on the impacts of additional incentives in order to foster broad Sustainable Development dividends from CDM Projects.

Also, it is of utmost importance to recognise along the process, including participation or not, the uncertainty entailed in the evaluation in order to deal with it as explicitly as possible. 'All models are wrong, but some are useful' is the famous quote from George E. Box (1978). The evaluation executed above does not reduce uncertainty in any way but rather makes some of it visible.

Furthermore, it highlights the potential difficulties that the DNAs are facing in thoroughly assessing the contribution of CDM projects to Sustainable Development. Some host-countries may lack of required capacity in order to evaluate the projects with an integrated participatory assessment. And even if that capacity was available, the resources necessary in terms of time and manpower are substantial, and thus costly. In India for example, where 52 projects have been approved 'in a rush' (GTZ 2006b) in December 2005, the number of projects requesting

national approval is such that a comprehensive examination by the DNA of all of them would imply enormous requirements, although some argue that it is their task (Michaelowa et al. 2005b).

Nevertheless, the goal of this projects comparison wasn't to design and propose the ideal methodology to assess the contribution of CDM projects to local Sustainable Development. Neither was it to evaluate the contribution of the projects to Sustainability as such. Such ambitious and idealistic objectives are not claimed here. Rather, the goal was to apply, and critically discuss, a tool which is already used in the field while focusing on a particular aspect, the influence of additional incentives for Sustainable Development on CDM projects.

Another issue that should be discussed here is the one of weighting. Indeed, weightings represent a controversial, and well debated, issue in the framework of MCA. If assigned by an individual, weightings can seem arbitrary and value-driven. On the other hand, weightings derived from participatory processes are not ideal, if feasible at all. A consensus over the set of criteria to be evaluated might be possible. However, in the case of assigning relative importance to those criteria, such a consensus is not conceivable. If divergences emerge, an aggregation of the values, like an average for instance, is not desirable. Also and most importantly, Munda (2006) argues that, in a compensatory framework such as the MAUT, using weights to embody intensity of importance represent a theoretical inconsistency. In the case of linear compensatory aggregation models, weights are to be understood as trade-offs, or judgments about compensability and not importance factors.

Chapter 8: Conclusion

The main objectives of the study should be recalled briefly. Firstly, this work aims at developing an understanding of the Clean Development Mechanism in the framework of international negotiations on Climate Change, including a discussion of the role that the CDM could play in terms of Sustainable Development. The focus lies on energy-related projects. Secondly, the research offers a critical analysis of the current CDM portfolio. And lastly, a multi-criteria evaluation is performed in order to evaluate the influence of additional incentives aimed at fostering broader local Sustainable Development dividends from the CDM in the host-country.

The Kyoto protocol was adopted in Japan in 1997 and entered into force at the beginning of 2005 with the ratification of the Russian Federation. The protocol establishes three flexible mechanisms, beside domestic actions, in order the reduce Greenhouse Gases emissions in Annex 1 countries, namely International Emissions Trading, Joint Implementation, and Clean Development Mechanism. The latter, which is the product of lengthy international negotiations, represents a delicate compromise between the desire of industrialised countries to reduce their greenhouse gases emissions in a cost-effective manner and the aspiration of developing countries for Sustainable Development.

By not defining Sustainable Development requirements, the UNFCCC allows the host-country to approve CDM projects which promote Development aspects in line with domestic policies. However, the lack of consistency in the Sustainability assessment approach and criteria could trigger adverse competition amongst potential host-countries for which the enthusiasm for the CDM could be motivated by other interests, such as very much needed foreign investments in some cases. CDM activities have the potential of significantly influencing local Sustainable Development. Yet, this assumption is not to be taken for granted.

Sustainable Development is multidimensional, dynamic, and context-dependent. Despite divergent interpretations, a consensus appears in arguing that the concept consists of a threefold objective. It should favour people's aspiration to live a decent life, the ecosystem should be seen as a finite system, and equity should be enhanced.

The notions of Climate Change and Human Development are interdependent. Yet, their respective policies can have contradictory objectives. Indeed, allowing the enhancement of the developing world at a minimum environmental cost, so as not to match the dirty development path industrialised countries went through, represents a challenge. At first, the CDM seems to be an interesting tool for combining Climate Change and Sustainable Development efforts.

Energy is present in many aspects of Development. A lack of energy, for cooking or space heating, can seriously compromise human survival. The availability of energy for further requirements is believed to support Human Development through improved healthcare, reduced indoor fumes from wood fires, and economic activity. Energy alone will not reduce poverty. However, an access the clean and affordable energy services represents an crucial factor for Development.

Inequality in energy consumption throughout regions is strong, almost as strong the inequality in wealth distribution. High disparities limit the opportunities of the most impoverished and can lead to important adverse social consequences.

There seems to be a correlation between Human Development indicators and energy consumption. Amongst countries with similar levels of very low energy consumption, significant differences in their Human Development index are to be observed. This indicates that, on one hand, measures in order to facilitate the access to energy services could enhance important improvements in terms of Development. On the other hand, it reveals that energy access only represents one factor, and surely not the most important one, for human emancipation. Furthermore, it appears that reaching a certain level of energy consumption, the correlation becomes very weak and that further increase in the energy consumption does not necessarily imply a higher degree of Development.

Human Development is often associated with an increase of welfare. Although the role of economic development is not denied, some scholars and institutes advocate for broader Development objectives. Indeed, they see energy or welfare as a means rather than an end. Such approach endorses the view of Development as the expansion of people's choices to live the life they value. Only then, people can develop their full potential by leading productive and creative lives. This view clashes with the welfare economy most occidental policies are

based upon.

From a Sustainable Development point of view, the major drawbacks of the CDM currently in the pipeline are threefold. Firstly, the CDM fall short in terms of *Quantity*. The flows triggered by the CDM are minor compared to Foreign Direct Investments or even Official Development Aid. Also, the demand for Certified Emission Reduction from Annex 1 countries may be such that the offer from the CDM would be surpassed.

Secondly, the *Quality* of the CDM projects is debatable. Some projects, including some already approved, are underperforming in terms of local Sustainable Development. Projects based on renewable energy, which are believed to promote broader local Sustainable Development profits, represent only a minor part of the total CERs. The majority of the CERs are due to end-of-the-pipe fix of industrial processes. Those projects are not an issue per se as they efficiently contribute to the mitigation of Climate Change. However, they compete in a market with other activities which perform better in terms of local Sustainable Development.

Thirdly, the geographical *Distribution* throughout the potential host-countries is unequal. The majority of CDM activities are hosted in countries with strong economies in transition, such as Brazil and India. The poorest, and thus most in need, countries seem to be unable to attract investments in CDM. When choosing a country for investing in the CDM, the main factors seem to be the stability of the regional economy and the reliability of the local institutional structure.

Several actions have taken place intending to remedy to some of those shortcomings. The Gold Standard rewards best-practice (in terms of local Sustainable Development) CDM projects. The CDCF promotes CDM activities located in underprivileged communities. The effects of those two actions are evaluated with a multi-criteria assessment.

According to the evaluation of the five cases study, it appears that the CDM projects which benefit from additional incentives in order to foster broad Sustainable Development dividends perform well in terms of both overall results and even distribution amongst the different criteria. Intriguingly, other projects not benefiting from such incentives perform reasonably well too. Mainstream CDM activities seem to lie far behind.

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Annex A

Utility Functions

This section presents the utility functions used for each criterion in the evaluation as well as a more detailed description of the indicators. They are aggregated into three categories:

- Social development
  - Stakeholder participation
  - Improved service availability
  - Equal distribution of project returns
  - Capacity development

- Environmental development
  - Fossil energy resources
  - Air quality
  - Water quality
  - Land resource

- Economic development
  - Regional economy
  - Microeconomic efficiency
  - Employment generation
  - Sustainable technology transfer

Criterion 1.1: Stakeholder Participation

The stakeholders can participate in the project development.

Category: Social Development

Type: Qualitative

Data source: PDD

Evaluation

The criterion examines to what extent concerned stakeholders are involved in the project development. Relevant stakeholders are: people living in the vicinity of the project, people who are directly involved in the project (labourers and suppliers), and relevant NGOs.

A: Stakeholders can participate actively in the decision process

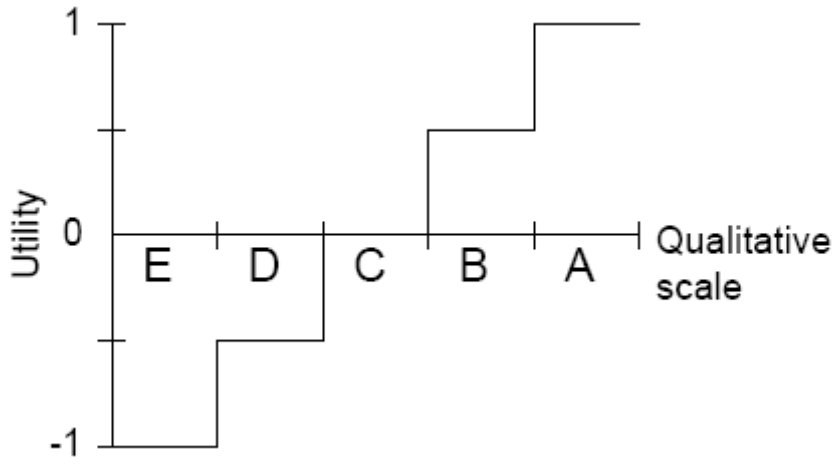
B: Stakeholders are invited to give inputs and raise concerns

C: Stakeholders are informed

D: Stakeholders are only informed upon request

E: Stakeholders are not involved at all; no access to data is possible

Utility Function



Source: Sutter (2003).

Criterion 1.2: Improved Service Availability

The project contributes to improve the availability of essential services.

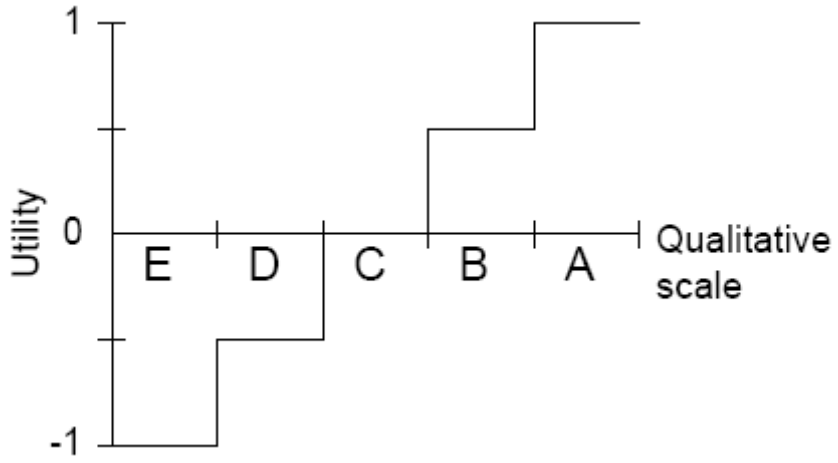
Category: Social Development
Type: Semi-Quantitative
Data source: PDD

Evaluation

The criterion represents a quantitative compilation of affected services and qualitative judgements. The effects of the project on locally important services are compared to the baseline. Services under consideration include access to fresh water, access to energy services, transport facilities, communication facilities, sanitation, etc.

A: Significant increase in availability of important services
B: Moderate increase in the availability of important services
C: No change compared to baseline
D: Moderate decrease in the availability of important services
E: Significant decrease in the availability of important services

Utility Function



Source: Adaptation from Sutter (2003).

Criterion 1.3: Equal Distribution of Project Returns

The share of turnover, which benefits disadvantaged people, increases.

Category: Social Development
Type: Semi-Quantitative
Data source: PDD

Evaluation

The criterion examines the distribution of the benefits generated by the project. In order to do so, the ownership structure of the project activities is assessed, assuming that a locally owned and managed project is more likely to benefit disadvantaged people than if the owner is an international company[61].

A: The largest fraction of the profits from CER revenues flows to the poorer 50% of the host-country population (e.g. the project owner is a small producer, local association)

B: The largest fraction of the profits from CER revenues flows to the host-country population (e.g. the project owner is a corporation of the host-country, a host-country owned entity)

C: The largest fraction of the profits from CER revenues flows to people outside the host-country (e.g. the project owner is an internationally hold corporation)

D: The project activities reduce revenues of the host-country

E: The project activities reduce revenues of the poorer 50% of the host-country population

Utility Function

Same as criterion 1.1.

Source: Sutter et al. (2005).

[61] Fore more information and details about this assumption see Sutter et al. 2005.

Criterion 1.4: Capacity Development

The project generates opportunities for additional capacity development.

Category: Social Development

Type: Qualitative

Data source: PDD

Evaluation

The criterion examines the opportunities for capacity development facilitated by the project compared to the baseline. The created and annihilated opportunities are considered, alongside with their quality.

A: Significant increase in opportunities for capacity development

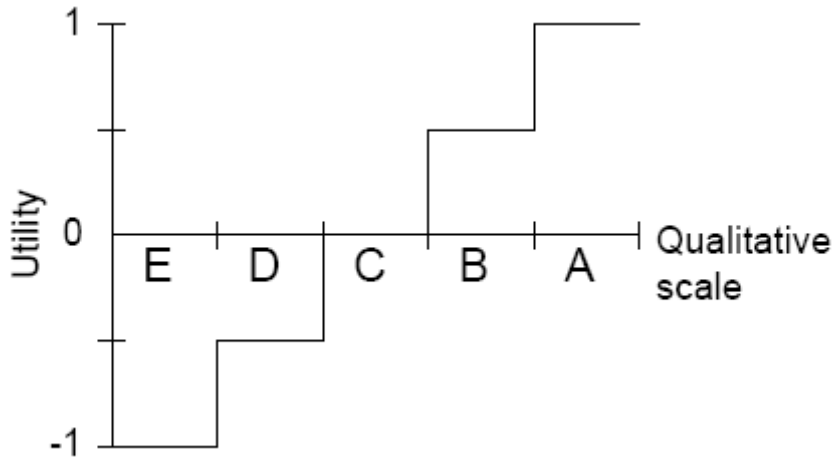
B: Moderate increase in opportunities for capacity development

C: No change compared to baseline

D: Moderate decrease in opportunities for capacity development

E: Significant decrease in opportunities for capacity development

Utility Function



Source: Sutter (2003).

Criterion 2.1: Fossil Energy Resources

The project contributes to reduce the consumption of fossil energy resources.

Category: Environmental Development

Type: Quantitative

Data source: PDD

Evaluation

The criterion examines the use of fossil energy resources compared to baseline.

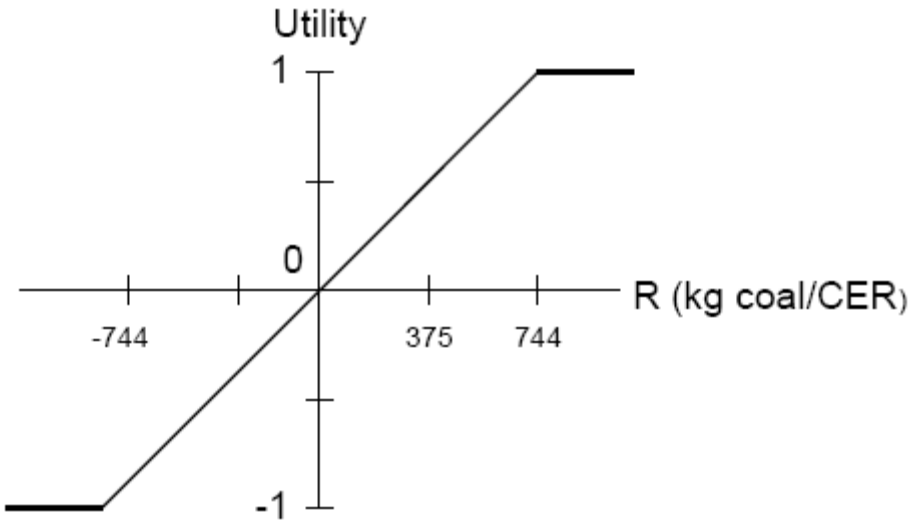
$$\frac{tC_B - tC_P}{CER} = R$$

Where: tC_B : tons of coal equivalent per year used by baseline
tC_P : tons of coal equivalent per year used by project
CER : Certified Emission Reduction

Utility Function

The maximum utility (1) represents a project which generates CER by replacing Energy generation from coal with a non-fossil source.

Remark: This calculation is based on the carbon content of coal at 36.7% (Sutter 2003, p. 244).



Source: Adaptation from Sutter (2003).

Criterion 2.2: Air Quality

The project contributes to decrease the pressure on the regional air quality.

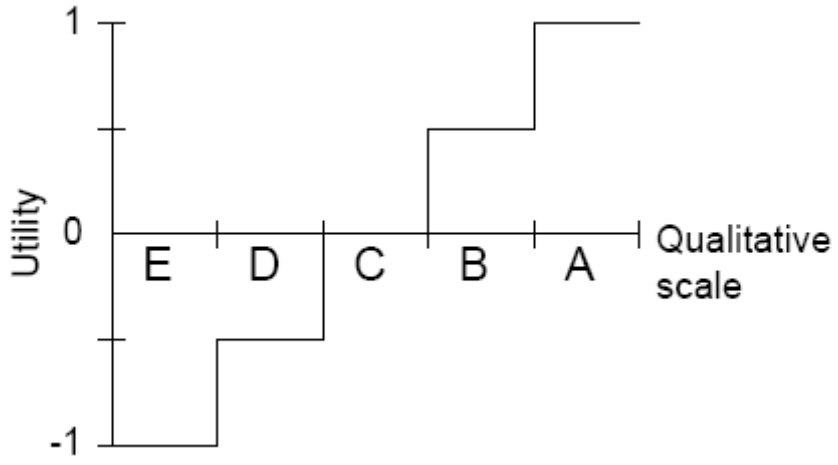
Category: Environmental Development
Type: Semi-Quantitative
Data source: PDD

Evaluation

The criterion examines the effects of the project on emissions of pollutant and their corresponding risks for respiratory diseases and odour nuisance compared to the baseline.

A: Significant decrease of air pollutant emissions
B: Moderate decrease of air pollutant emissions
C: No change compared to baseline
D: Moderate increase of air pollutant emissions
E: Significant increase of air pollutant emissions

Utility Function



Source: Adaptation from Sutter (2003).

Criterion 2.3: Water Quality

The project contributes to decrease the pressure on the regional fresh water quality/quantity.

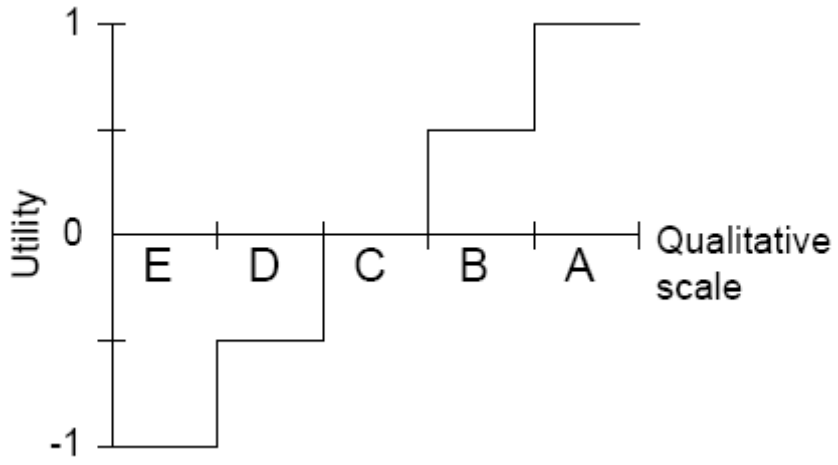
Category: Environmental Development
Type: Semi-Quantitative
Data source: PDD

Evaluation

The criterion examines the effects of the project on the water supply compared to the baseline, including quality of drinking water, availability of fresh water for other purposes, impacts on the watershed.

A: Significant decrease of pressure on the water supply
B: Moderate decrease of pressure on the water supply
C: No change compared to baseline
D: Moderate increase of pressure on the water supply
E: Significant increase of pressure on the water supply

Utility Function



Source: Adaptation from Sutter (2003).

Criterion 2.4: Land Resource

The project contributes to decrease the pressure on the regional land resources.

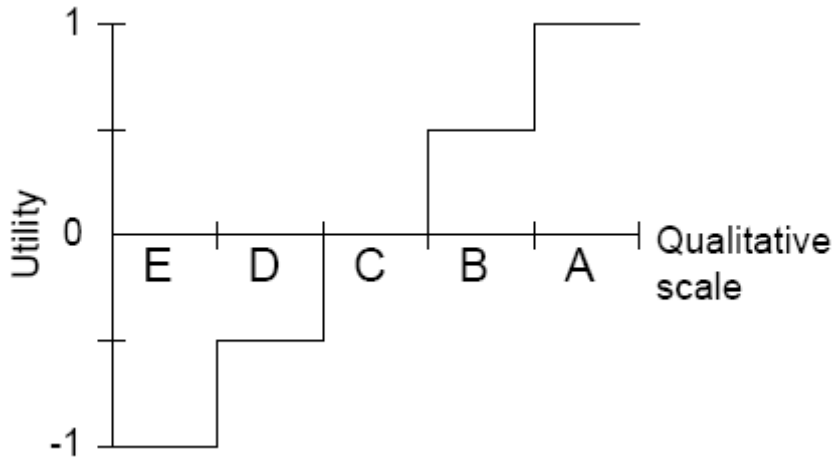
Category: Environmental Development
Type: Semi-Quantitative
Data source: PDD

Evaluation

The criterion examines the effects of the project on the availability of land compared to the baseline, including pressure on land use, soil pollution, waste production, erosion, impacts on biodiversity, and unsustainable use of biomass.

A: Significant decrease of pressure on land resources
B: Moderate decrease of pressure on land resources
C: No change compared to baseline
D: Moderate increase of pressure on land resources
E: Significant increase of pressure on land resources

Utility Function



Source: Sutter (2003).

Criterion 3.1: Regional Economy

The project contributes to the generation of wealth in a disadvantaged region.

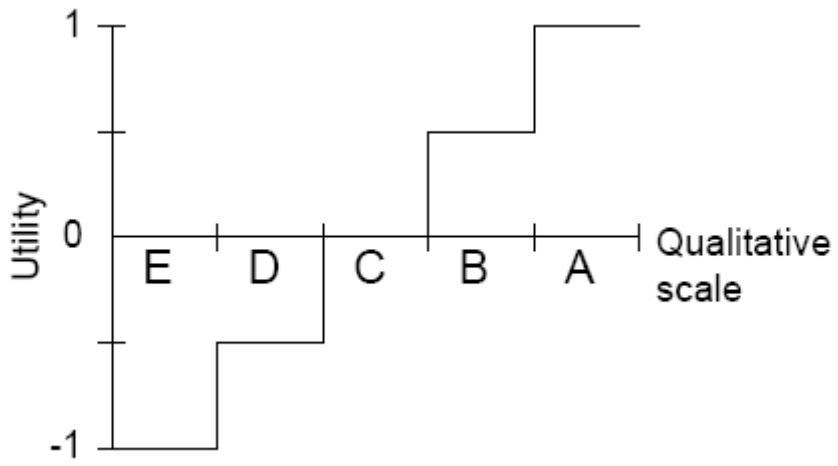
Category: Economic Development
Type: Qualitative
Data source: PDD

Evaluation

The criterion examines the location of the project to assess whether the project contributes to the development of economically disadvantaged regions within the country.

A: Project location economically disadvantaged
B: Project location economically average
C: Project location economically privileged
D: Project location economically average which hinders development of disadvantaged location
E: Project location economically privileged which hinders development of disadvantaged location

Utility Function



Source: Sutter (2003).

Criterion 3.2: Microeconomic Efficiency

The Project has a high Internal Rate of Return (IRR).

Category: Economic Development

Type: Quantitative

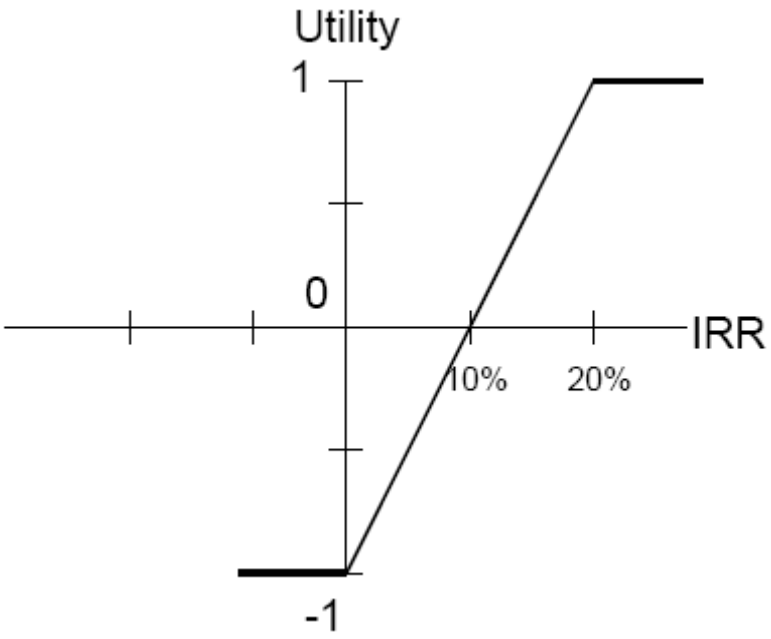
Data source: PDD

Evaluation

The criterion examines the IRR of the project.

Utility Function

The minimum utility (-1) characterises projects with negative IRR. A medium utility (0) represents projects with IRR around the discount rate. An IRR of over 20%, which represents the typical minimum under which no investor would invest in a risky developing country, corresponds to the maximum utility (1).



Source: Sutter (2003).

Criterion 3.3: Employment Generation

The project creates jobs.

Category: Economic Development

Type: Quantitative

Data source: PDD

Evaluation

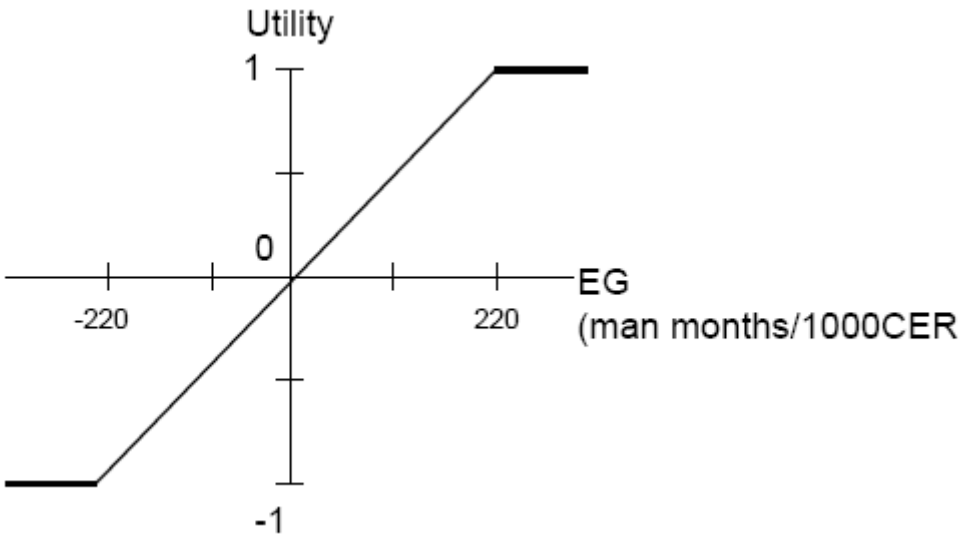
The criterion examines the jobs created by the projects per CER, including construction and operation phases.

$$\frac{JP - JB}{CER} = EG$$

Where: *JP* : man-months created by the project
JB : man-months created in the baseline case
CER : Certified Emission Reduction

Utility Function

The maximum utility (1) is achieved when at least 220 additional man-months of job opportunities are generated by the project per 1000 CERs, representing a realistic best-practice project (Sutter 2003, p. 237). A medium utility (0) represents no change compared to baseline. The rest of the curve is obtained by linear extrapolation.



Source: Sutter (2003).

Criterion 3.4: Sustainable Technology Transfer

The project applies innovative, locally manageable technology.

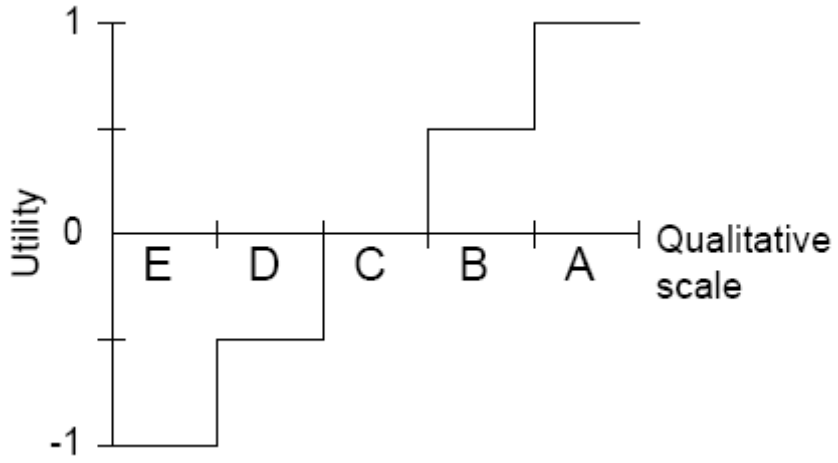
Category: Economic Development
Type: Qualitative
Data source: PDD

Evaluation

The criterion examines whether the applied technology is innovative for the country and can be locally maintained.

A: The technology is innovative and the capacity exists locally to maintain and manage it
B: The technology is innovative but external assistance is require to develop local skills
C: There is no technological transfer or the innovative technology requires durable external assistance
D: External skills must be imported and the project creates dependence
E: The new technology cannot be maintained and managed in the long-term.

Utility Function



Source: Adaptation from Sutter (2003).

Annex B

Questionnaire

Weighting of Sustainable Development Criteria

In the framework of my Master Thesis, I wish to discuss the influence of additional incentives, such as the Goldstandard for example, on the Sustainable Development dividends of Clean Development Mechanism (CDM) projects. In order to do so, I want to compare different projects applying a Multi-criteria evaluation method. This approach is essentially based on Sutter 2003 (Sustainability Check-up for CDM Projects).
The Sustainable Development criteria are organised according to the so-called three pillars theory of Sustainability, namely Social, Environmental and Economic Development, with 4 criteria for each category.
For a more detailed description of the criteria, please scroll down to the bottom of the document.
The goal of the questionnaire is to weight up each criterion according to your values.

The goal of this questionnaire is not to establish unilateral Sustainable Criteria. Obviously, the relevant criteria as well as their weighting strongly depend on the context. However, the perceived impacts of a project is value-driven. This questionnaire aims at fetching your opinion by weighting the criteria according to your values.

Questionnaire's instructions:
Please weight up every criteria (yellow fields) based on the aspects of Sustainable Development a CDM project should contribute to in your opinion, by attributing a total of 100 points for each group (Overall Sustainable Development, Social, Environmental and Economic). A high number of points means that the criteria is important, and consequently, a low number of points that the criteria is less important according to your opinion

Overall Sustainable Development Criteria		
Social Development		
Environmental Development		
Economic Development		
Total	0	= 100

Social Criteria		
Stakeholder Participation		
Improved Service Availability		
Equal Distribution of Project Return		
Capacity Development		
Total	0	= 100

Environmental Criteria		
Fossil Energy Resource		
Air Quality		
Water Quality		
Land Resource		
Total	0	= 100

Economic Criteria		
Regional Economy		
Microeconomic Efficiency		
Employment Generation		
Sustainable Technology Transfer		
Total	0	= 100

Remark:

Description of the criteria*:

Stakeholder Participation	The stakeholders can participate in the project development.
Improved Service Availability	The project contributes to improve the availability of essential services.
Equal Distribution of Project Return	The share of turnover, which benefits disadvantaged people, increases.
Capacity Development	The project generates opportunities for additional capacity development.
Fossil Energy Resource	The project contributes to reduce the consumption of fossil energy resources.
Air Quality	The project contributes to decreasing the pressure on the regional air quality.
Water Quality	The project contributes to decreasing the pressure on the regional fresh water quality/quantity.
Land Resource	The project contributes to decreasing the pressure on the regional land resources.
Regional Economy	The project contributes to the generation of wealth in a disadvantaged region.
Microeconomic Efficiency	The project has a high internal rate of return.
Employment Generation	The project creates jobs.
Sustainable Technology Transfer	The project applies innovative, locally manageable technology.

*Based on Sutter 2003 (Sustainability Check-Up for CDM projects)

Annex C

List of actors contacted

Name	Institution	Country	Group	Annex I	Role
Axel Michaelowa	HWWA	Germany	Academia	yes	CDM analyst, PDD consultant
Juan Carlos Parreño	Wageningen University	Netherlands	Academia	yes	CDM researcher
Jusen Asuka	Tohoku University	Japan	Academia	yes	CDM analyst
Karen Olsen	UNEP Risoe Center	Danemark	Academia	yes	CDM analyst
Smita Sirohi	National Dairy Research Institute	India	Academia	no	CDM researcher
Christoph Sutter	Factor	Switzerland	Business	yes	PDD consultant
Einar Telnes	DNV	Norway	Business	yes	Kuyasa DOE
Han Seung-Ho	The Korea Management Corporation	South Korea	Business	no	DOE
Henrique Moura Costa	NovaGerar	Brazil	Business	no	NovaGerar project participant
Marcelo Junqueira	Econery Brasil	Brazil	Business	no	PDD consultant
Ralph Harthan	Oeko-Institut	Germany	Business	yes	Credit buyer, FIFA
Ram Moham	SRF limited	India	Business	no	SRF project participant
Stela Drucioc	Carbon Finance Unit	Moldova	Business	no	Moldova project participant
Holger Liptow	Gesellschaft für Technische Zusammenarbeit	Germany	Government	yes	Credit buyer
Shirene Rosenberg	City of Cape Town Urban Renewable Programme	South Africa	Government	no	Kuyasa project participant
Rajesh Kumar Sethi	Ministry of Environment and Forests	India	Government	no	DNA
SenterNovem	SenterNovem	Netherlands	Government	yes	Credit buyer
Yvan Keckreis	SECO	Switzerland	Government	yes	DNA
Anandi Sharan	Women for Sustainable Development	India	NGO	no	Bagepalli project participant
Ben Pearson	CDM Watch	Australia	NGO	yes (not ratified)	CDM watchdog
Jiwan Acharya	Winrock International Nepal	Nepal	NGO	no	PDD consultant
Jean-Philippe Thomas	Environnement et Développement du Tiers-Monde	Senegal	NGO	no	Capacity development
Michael Schlup	Goldstandard	Switzerland	NGO	yes	CDM rewarding institute
Stefan Raubenheimer	SouthSouthNorth	South Africa	NGO	no	Kuyasa project intervener

Annex D

Modified MATA-CDM evaluation of the Kuyasa low-cost urban housing energy upgrade project, Khayelitsha, South Africa

All the data mentioned below are derived from the PDD (page number stated in parentheses), except where mentioned otherwise.

- Criterion 1.1: Stakeholder Participation

The up-grade of the house energy systems are left to individual household choice (p.4). Also, local NGOs and local government (p.12) are closely involved with the project design, development and implementation. Public participation forms an integral part of the project design (p.30).

Stakeholders can actively participate in the decision process. Rating: A.

- Criterion 1.2: Improved Services Availability

The indoor comfort is believed to increase due of a more adequate space heating system (pp.5,35,36). Hot water is made available for shower and washing purposes (pp.5,36). The project activities should allow households to save in energy costs (p.35).

The availability of some important services is increased. Rating: B.

- Criterion 1.3: Equal Distribution of Project Returns

The project Participant is the City of Cape Town (p.3).

The project revenues are likely to flow to the host-country population. Rating: B.

- Criterion 1.4: Capacity Development

The capacity development of local artisans, such as plumbers, electricians and builders, should increase because of their involvement with the design, manufacture, installation and maintenance of modern but accessible technology, such as solar thermal systems (pp.35,36). It is believed that households, mostly represented by women (p.36), will be empowered through training in regards to energy efficiency and the use of renewable energy (p.5).

The project generates a significant increase in opportunities for capacity development. Rating: A.

- Criterion 2.1: Fossil Energy Resources

The reliance on fossil fuel should decrease because of the energy efficiency measures (p.35). Furthermore, renewable energy will displace fossil fuel or non-renewable biomass sources (p.6). Calculation (pp.26-29): Fossil energy required for the baseline : 331 + 1447 + 7710 = 9488 [kWh/(household*yr)]; Fossil energy required for the project : 74.5 + 5595 = 5669 [kWh/(household*yr)] (hot water heated with solar energy and therefore carbon-neutral); 9488 – 5669 = 3818 [kWh/(household*yr)]; 6580 [tonCO_2/yr] / 2.85 [tonCO_2/(household*yr)] = 2309 [household] considered for the calculation in the PDD; 3818 [kWh/(household*yr)] * 2309 [household] = 8816 [MWh/yr] -> 31737764 [MJ/yr]; assuming the electricity from the grid in South Africa is mainly produced with fossil fuel, 31737764 [MJ/yr] / 31 [MJ/kg] = 1023799 [kgCoal/yr] -> 1023 [tonCoal/yr]; R = 1023 [tonCoal/yr] / 6.58 [ktonCO_2/yr] = 156 [kgCoal/CER]; Therefore, according to the Utility Function: 156 / 744 = 0.21.

Score: 0.21.

- Criterion 2.2: Air Quality

The new introduced technologies will replace coal-generated electricity as well as reduce the use of biomass energy inside the house (p.35). Emission of suspended particulates, Sulphur Oxides (SO_x) and Nitrogen Oxides (NO_x) should therefore be reduced (p.36).

The project induces a moderate decrease of air pollutant emissions. Rating: B.

- Criterion 2.3: Water Quality

There is no significant change compared to the baseline (p.36).

Rating: C.

- Criterion 2.4: Land Resource

There is no significant change compared to the baseline (p.36).

Rating: C.

- Criterion 3.1: Regional Economy

The project targets low-income housing development (p.4).

The project is located in an economically disadvantaged area. Rating: A.

- Criterion 3.2: Microeconomic Efficiency

No precise figure is available in regards to the IRR. However, the fact that public funding is required for the project activities (p.6) indicates that the microeconomic efficiency is not high.

The anticipated carbon finance will only contribute to 20-25 % of the project implementation costs[62].

A medium IRR is assumed at 10%. Score: 0.

- Criterion 3.3: Employment Generation

Studies demonstrate the creation of 110 man-years of employment considering only the installation, which is conservative (pp.35,36). Calculation: 110 [man-year/1000 households] * 12 [month/year] = 1320 [man-month/1000 households]; 2.85 [CER/(household*year)] * 7 [year] = 19.95 [CER/household]; 1320 [man-month/1000 households] / 19.95 [CER/household] = 66 [man-month/1000 CER]; According to Utility Function 3.3 (Annex A), 1 / 220 * 66 = 0.30.

Score: 0.30.

- Criterion 3.4: Sustainable Technology Transfer

The applied technology is innovative and can be locally maintained (p.36). However, the use of imported compact fluorescent light bulbs induces a slight external dependence (p.36). The project is replicable (p.6).

The technology is innovative but not totally self-reliant. Rating: B.

[62] Information facilitated by Shirene Rosenberg (Project participant, City of Cape Town) via email (03.02.2006).

Annex E

Modified MATA-CDM evaluation for the Moldova Biomass Heating in Rural Communities project, Republic of Moldova

All the data mentioned below are derived from the PDD (page number stated in parentheses), except where mentioned otherwise.

- Criterion 1.1: Stakeholder Participation

The beneficiaries of the SIF project participate actively in the CDM project activities (p.5). The targeted communities are invited to a general meeting where a project committee is elected (p.6). The project finances activities are owned by the local communities (p.5). Also, numerous local NGOs have been involved in the debates regarding the project propositions (p.41).

Stakeholders can actively participate in the decision process. Rating: A.

- Criterion 1.2: Improved Services Availability

The project is expected to improve the availability of heating services and hot water for housing and public buildings (p.4), thus leading to better comfort.

The availability of some important services is increased. Rating: B.

- Criterion 1.3: Equal Distribution of Project Returns

The project activity owners are the beneficiaries of the SIF project (p.5). The project is monitored by the Carbon Finance Unit (p.5), a body created under the Ministry of Ecology and Natural Resources of Moldova (p.6).

The project revenues are likely to flow to the poorer 50% of the host-country population. Rating: A.

- Criterion 1.4: Capacity Development

Local artisans' opportunities of capacity development should increase because of their involvement with modern but accessible technology (p.6,16).

The project generates a moderate increase in opportunities for capacity development. Rating: B.

- Criterion 2.1: Fossil Energy Resources

The project will allow for switching from conventional coal-fired boilers to modern heat production based on biomass (pp.8,9). Calculation: the basic concept is to calculate the use of fossil energy for the baseline and subtract the fossil energy used by the project activity in tons of coal equivalent, using the assumptions (efficiency coefficients, heat value, total heat consumption and scenarios) applied in the PDD. 1) Transformation Coal-Biomass: Biomass being carbon neutral, all the coal used before can be taken into account. 39032 [MWh] * 18 % = 7026 [MWh], 7026 [MWh] / (5.556 [MWh/tonCoal] * 0.42) = 3011 [tonCoal]; 2) Transformation Coal-Gas: 39032 [MWh] * 40 % = 15613 [MWh], 15613 [MWh] / (5.556 [MWh/tonCoal] * 0.42) = 6686 [tonCoal], 15613 [MWh] / (0.009306 [MWh/m^3gas] * 0.92 * 0.98) = 1860841 [m^3gas], conversion: 1860841 [m^3gas] * 33.5 [MJ/m^3] / 20 [MJ/kgCoal] = 3116909 [kgCoal] -> 3117 [tonCoal], 6686 [tonCoal] - 3117 [tonCoal] = 3569 [tonCoal]; 3) Transformation Coal-Coal: 39032 [MWh] * 26 % = 10148 [MWh], 10148 [MWh] / (5.556 [MWh/tonCoal] * 0.42) = 4349 [tonCoal], 10148 [MWh] / (5.556 [MWh/tonCoal] * 0.75 * 0.98) = 2485 [tonCoal], 4349 [tonCoal] - 2485 [tonCoal] = 1864 [tonCoal]; 4) Transformation Gas-Gas: 39032 [MWh] * 16 % = 6245 [MWh], 6245 [MWh] / (0.009306 [MWh/m^3gas] * 0.62) = 1076151 [m^3gas], 6245 [MWh] / (0.009306 [MWh/m^3gas] * 0.92 * 0.98) = 740033 [m^3gas], 1076151 [m^3gas] - 740033 [m^3gas] = 336118 [m^3gas], conversion: 336118 [m^3gas] * 33.5 [MJ/m^3] / 20 [MJ/kgCoal] = 562998 [kgCoal] -> 563 [tonCoal]; Total: 3011 + 3569 + 1864 + 563 = 9007 [tonCoal]; R = 9007 [tonCoal] / 17.89 [ktonCO$_2$] = 503 [kgCoal/CER]; Therefore, according to the Utility Function: 503 / 744 = 0.68.

Score: 0.68.

- Criterion 2.2: Air Quality

The substitution of coal by natural gas and biomass should substantially reduce the emission of pollutants, such as SO_x and NO_x (pp.4,40). However, the increase of flying particles due to the use of straw represents a negative effect (p.40).

The project induces a moderate decrease of air pollutant emissions. Rating: B.

- Criterion 2.3: Water Quality

There is no significant change compared to the baseline.

Rating: C.

- Criterion 2.4: Land Resource

The removal of straw from fields could potentially cause the loss of organic soil matter (p.40). The problem could be eased by applying ash as fertilizer (p.40). The storage of the straw requires land resources (p.40).

The project represents a moderate increase of pressure on land resources. Rating: D.

- Criterion 3.1: Regional Economy

The project targets local rural communities (pp.5,7).

The project is located in an economically average area. Rating: B.

- Criterion 3.2: Microeconomic Efficiency

Public funding is required for the project (p.46). Although no precise figure is available in regards to the IRR, the microeconomic efficiency can be assumed as low.

A medium IRR is assumed at 10%. Score: 0.

- Criterion 3.3: Employment Generation

The project activities are believed to increase local employment (p.4). However, no figure is provided in the PDD. A similar influence as for the Kuyasa project is assumed, as the installation of the new equipment should be executed by local labour as well.

Score: 0.30.

- Criterion 3.4: Sustainable Technology Transfer

The technology is considered to be independent and highly replicable (p.7). However, modern heat production equipment and material will have to be imported (p.10).

The technology is innovative but external assistance is required. Rating: B.

Annex F

Modified MATA-CDM evaluation for the Bagepalli CDM Biogas Programme, Kolar District, Karnataka, India

All the data mentioned below are derived from the PDD (page number stated in parentheses), except where mentioned otherwise.

- Criterion 1.1: Stakeholder Participation

The installation of the biogas plant is done on request of the household owner (p.33). The project Participants are active members of the local communities (p.32). Other stakeholders, such as families and NGOs, were consulted through surveys, informed in meetings and invited to participate to the project (pp.32,33).

Stakeholders can actively participate in the decision process. Rating: A.

- Criterion 1.2: Improved Services Availability

The project should improve the availability of energy for cooking purposes and hot water (p.3).

The availability of some important services is increased. Rating: B.

- Criterion 1.3: Equal Distribution of Project Returns

The project is owned and managed by the local community (p.27). Furthermore, the project activities will target the households identified as being the most in need (p.9).

The project revenues are likely to flow to the poorer 50% of the host-country population. Rating: A.

- Criterion 1.4: Capacity Development

Considerable time and body energy is spent regularly on collecting firewood (p.9). Capacity Development should increase because of the opportunity to deploy those resources elsewhere.

The project generates a moderate increase in opportunities for capacity development. Rating: B.

- Criterion 2.1: Fossil Energy Resources

The project should allow for saving 31.2 litres of kerosene per household yearly (pp.3,16). Calculation: 5500 [household] * 31.2 [litresKerosene] * 0.75 [kg/litre] = 128700

[kgKerosene]; conversion: 128700 [kgKerosene] * 44.75 [MJ/kgKerosene] / 20 [MJ/kgCoal] = 287966 [kgCoal] -> 288 [tonCoal]; R = 288 [tonCoal] / 19.55 [ktonCO$_2$] = 14.7 [kgCoal/CER]; Therefore, according to the Utility Function: 14.7 / 744 = 0.02.

Score: 0.02.

- Criterion 2.2: Air Quality

The project should increase the quality of the air, especially indoors, by reducing fumes from wood fires in kitchens which include harmful products of incomplete combustion (pp.4,11,16). Respiratory diseases caused by fumes represent an important issue in underprivileged households (pp.3,33). The quantity of other pollutants in the biogas is considered as negligible (p.11).

The project induces a significant decrease of air pollutant emissions. Rating: A.

- Criterion 2.3: Water Quality

There is no significant change compared to the baseline.

Rating: C.

- Criterion 2.4: Land Resource

The district of the project activities is a fuelwood deficient region (pp.9,15). About three quarters of the fuelwood can't be considered as renewable (pp.3,8,11,15). The pressure on the land could be lessened by reducing uncontrolled deforestation (p.3). Also, it could avoid additional pressure due to plantation projects in order to cover the firewood needs (p.10).

The project represents a moderate decrease of pressure on land resources. Rating: B.

- Criterion 3.1: Regional Economy

The project activities are based in rural communities (pp.12,15).

The project is located in an economically disadvantaged area. Rating: A.

- Criterion 3.2: Microeconomic Efficiency

The project is financed almost exclusively by the carbon revenues (p.3). There is no public funding involved (p.13). No precise figure is available. The IRR is estimated as being relatively low.

A medium IRR is assumed at 10%. Score: 0.

- Criterion 3.3: Employment Generation

The construction of the plants should create employment locally (p.4). However, no figure is provided in the PDD. A similar influence as for the Kuyasa project is assumed, as the installation of the new equipment should be executed by local labour as well.

Score: 0.30.

- Criterion 3.4: Sustainable Technology Transfer

The required material for the construction of the plants is locally accessible (p.4). The technology as well as the know-how is already available in India (p.5).

There is no technological transfer due to the project. Rating: C.

Annex G

Modified MATA-CDM evaluation for the Brazil NovaGerar Landfill Gas to Energy project, Nova Iguaçú, Rio de Janeiro, Brazil

All the data mentioned below are derived from the PDD (page number stated in parentheses), except where mentioned otherwise.

- Criterion 1.1: Stakeholder Participation

Stakeholder consultation processes have taken place based on meetings and interviews, including environmental agencies, NGOs, municipalities and government, private sector representatives and local, national as well as international climate change organisations (pp.26,27).

Stakeholders are invited to give inputs and raise concerns. Rating: B.

- Criterion 1.2: Improved Services Availability

There is no significant change compared to baseline.

Rating: C.

- Criterion 1.3: Equal Distribution of Project Returns

The project is a joint venture between an international finance company, EcoSecurities, and a civil engineering and construction firm based in São Paulo, Brazil (p.3).

Some project revenues will flow to the host-country population and some abroad. Rating: B-C.

- Criterion 1.4: Capacity Development

There is no significant change compared to baseline.

Rating: C.

- Criterion 2.1: Fossil Energy Resources

The emission reductions from the renewable energy production due to the displacement of a certain amount of fossil fuel used for electricity generation are not claimed by the project under the CDM framework (pp.3,15) and therefore won't be accounted for in this analysis either. There is no significant change compared to baseline.

Score: 0.

- Criterion 2.2: Air Quality

The project developers claim that the uncontrolled release of landfill gas negatively impacts on the health of local population (p.3), creates odour nuisances (pp.25,26), and leads to risks of explosions (pp.3,4,9,26). The collection of the gas allows for diminishing those negative effects. Landfill gas electricity generators can produce NO_x emissions and flaring can release toxic material (p.25). However, these emissions are viewed as significantly less harmful than the continued uncontrolled release of landfill gas (p.25).

The project induces a moderate decrease of air pollutant emissions. Rating: B.

- Criterion 2.3: Water Quality

Contaminated surface run-off from the landfill can affect down-stream ground and surface water (p.3). Managing the landfill site allows for reducing the risks related to those issues. The water residues will be channelled and treated on-site (p.5). Unlike other power plants, landfill gas generation plants don't rely upon water for cooling and therefore require very little water for operational purposes (p.26).

The project induces a moderate decrease of pressure on the water supply. Rating: B.

- Criterion 2.4: Land Resource

The power generation facility will require space. However, it is negligible compared to the size of the landfill site. There is no significant change compared to baseline.

Rating: C.

- Criterion 3.1: Regional Economy

The project is located on the outskirts of Rio de Janeiro, in an industrial area (p.5).

The project is located in an economically average area. Rating: B.

- Criterion 3.2: Microeconomic Efficiency

There is no Official Development Assistance in this project (p.7). The project demonstrates an IRR of 18.72 % (p.32). Therefore, according to the Utility Function: (18.72-10) / (20-10) = 0.87.

Score: 0.87.

- Criterion 3.3: Employment Generation

The construction, the operation and the management of the site should have a small but positive impact on employment (p.4).

The Score is estimated at: 0.1.

- Criterion 3.4: Sustainable Technology Transfer

The project is highly replicable. Some components of the power generator facility may be imported.

There is no significant technological transfer due to the project. Rating: C.

Annex H

Modified MATA-CDM evaluation for GHG emission reduction by thermal oxidation of HFC23 at refrigerant manufacturing facility of SRF Ltd, Rajasthan, India

All the data mentioned below are derived from the PDD (page number stated in parentheses), except where mentioned otherwise.

- Criterion 1.1: Stakeholder Participation

Local stakeholders are informed and consulted (pp.27,55), but don't actively participate.

Stakeholders are invited to give inputs and raise concerns. Rating: B.

- Criterion 1.2: Improved Services Availability

There is no significant change in the availability of services due to the project activity.

No change compared to baseline. Rating: C.

- Criterion 1.3: Equal Distribution of Project Returns

The project Participants are mainly international companies (p.3).

The project revenues are likely to flow mainly outside of the country. Rating: C.

- Criterion 1.4: Capacity Development

It is expected for the project activity to result in widening the skill base of the local community, as some work will be outsourced to local labour and workmen (p.42). However, this indirect effect seems to be negligible if one considers the size of the project in terms of CERs.

No significant change compared to the baseline. Rating: C.

- Criterion 2.1: Fossil Energy Resources

Small quantity of Hydrogen gas, as supplement fuel, will be introduced as HFC 23 has a low calorific value (p.5). Although Hydrogen can't be considered as fossil energy, it is probable that fossil fuel will have to be burnt to produce it. Because of the lack of available data on this issue as well as the enormous quantity of CERs delivered by the project, it is assumed that the amount of fossil fuel saved by the project activity per CER emitted is negative, but small.

Assumption for the Score: -0.25.

- Criterion 2.2: Air Quality

The project should result in an increase of pollutant's emissions (p.6). The emission will conform to Indian standards (p.6).

The project induces a moderate increase of air pollutant emissions. Rating: D.

- Criterion 2.3: Water Quality

The project should use 18 m^3/day (p.26). The water scarcity is an issue in the region due to severe drought (p.44). SRF proposes to devote some of the project revenues to water management in the region (pp.29,42,56). The waste water generated will be treated at the existing plant (p.5).

The project induces a moderate increase of the pressure on the water supply. Rating: D.

- Criterion 2.4: Land Resource

There is no significant change compared to the baseline.

Rating: C.

- Criterion 3.1: Regional Economy

The project is located in a rural area (p.41). The increased activity and income due to the project is believed to result in a redistribution of the benefits through allied services (p.42).

The project is located in an economically disadvantaged area. Rating: A.

- Criterion 3.2: Microeconomic Efficiency

No public funding is used for this project activity (p.7). Due to the amount of CERs emitted, one can assume that the IRR will be rather high.

A high IRR is assumed at 20%. Score: 1.

- Criterion 3.3: Employment Generation

SRF specifies that a few new jobs (15-20) are likely to be created and that employment would be offered to local people where possible (pp.29,56). Calculation: assuming 20 jobs over the crediting period (10 years): 20 [men] * 12 [month/year] / 3833 [CER/year] = 0.06 [man-month/1000 CER; According to Utility Function 3.3 (Annex A), 1 / 220 * 0.06 = 0.0003.

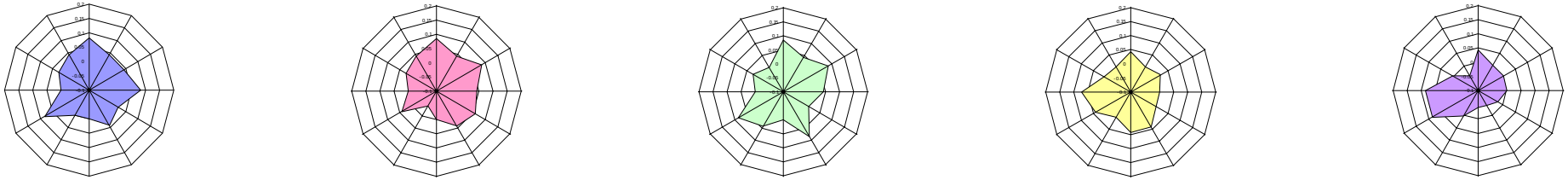
Score: 0.

- Criterion 3.4: Sustainable Technology Transfer

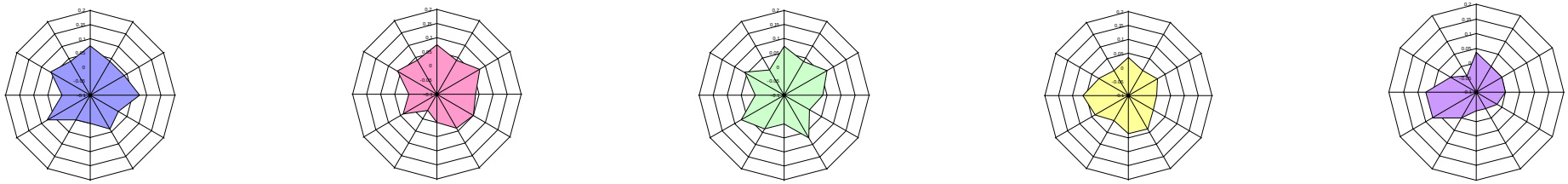
Most of the new technology for the thermal oxidation process will be imported from abroad (p.56).

External skills must be imported and the project creates dependence. Rating: D.

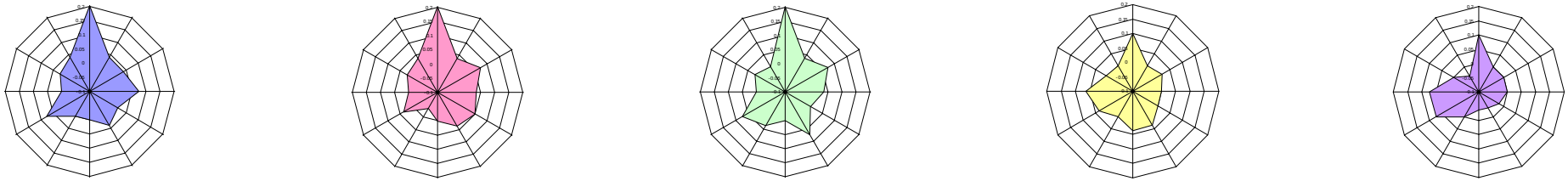
Annex I



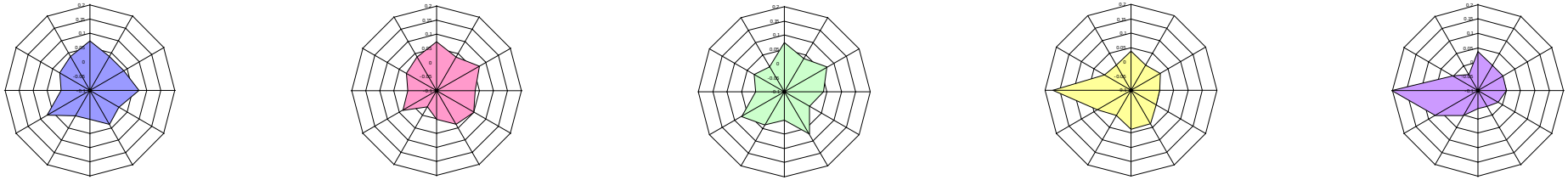
Evaluation with equal weightings (1 / 12 = 0.083). (Blue: Kuyasa; Pink: Moldova; Green: Begapalli; Yellow: NovaGerar; Purple: SRF)



Evaluation with the criterion Employment generation forced to 0.2. Other criteria equally weighted at 0.073.



Evaluation with the criterion Stakeholder participation forced to 0.2. Other criteria equally weighted at 0.073.



Evaluation with the criterion Microeconomic efficiency forced to 0.2. Other criteria equally weighted at 0.073.