Challenges preventing francophone Sub-Saharan Africa's participation in the Clean Development Mechanism

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Abstract

The Clean Development Mechanism (CDM) is a set of operational rules for the trade of greenhouse gas emissions between developed and developing countries defined by the Kyoto Protocol. It provides incentives for developing countries to implement climate-change mitigation projects, which must be compatible with and supportive of the sustainable development principles set at the national level. Developed countries can buy 'carbon credits' for the emission reduction achieved in these projects and use them to comply with their emission targets. However, sub-Saharan African countries have not yet successfully entered this mechanism, as opposed to those in Latin America and Asia. This study aims at demonstrating that the inequitable geographical distribution of CDM projects is due to specific barriers that hinder sub-Saharan countries from developing and implementing such activities. Hence, a quantitative analysis of the CDM projects (registered or validated) hitherto was carried out to identify the current equity gap. In addition, a survey on possible institutional, economical and financial constraints to the CDM was conducted on eight sub-Saharan countries. Statistics show that Latin America is currently leading the market with a larger proportion of projects per inhabitant than Asia. Africa, as expected, lags greatly behind. In addition, results indicate that Sub-Saharan African countries suffer from institutional and technological constraints as well as a lack of information concerning the procedures of the CDM. As a conclusion, reframing the CDM structure could perhaps guarantee a more equitable geographical distribution of projects, but a proactive approach of sub-Saharan African countries to solve their own constraints is crucial.

Key words: Clean Development Mechanism, Sub-Saharan Africa, sustainable development.

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I also kindly acknowledge the participants of my survey in sub-Saharan Africa, who fully inspired me for writing this work.

Lastly, I thank the family genes that gave me the passion for challenges and the stubbornness necessary to face them.

Dedication

I dedicate this thesis to my dear grandmother Ulla Margareta Tysklind, who left us in 2003, too early to hear about my adventures in her second homeland, and even more for my heart to accept her absence.

Acronyms and Abbreviations

CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CLD	Causal-Loop Diagram
CO2	Carbon dioxide
CO2eq	Carbon dioxide equivalent
COP	Conference of the Parties
DNA	Designated National Authorities
DOE	Designated Operating Entity
EB	Executive Board
FDI	Foreign Direct Investment
GG	Greenhouse-gas
GS	Gold Standard
HFC	Hydro fluorocarbons
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LDCs	Least Developed Countries
LULUCF	Land use, land use change and forestry
MDGs	Millennium Development Goals
N2O	Nitrous Oxide
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PDD	Project Design Document
PFC	Perfluorocarbons
PIN	Project Idea Note
SSA	Sub-Saharan Africa
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WWF	World Wide Fund for Nature

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Chapter 1. Introduction

1.1 Setting up the context

The 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change has initiated an artificial global market for a new commodity: greenhouse gas emissions[1]. However, what is being traded is indeed the lack of it, as opposed to other goods. To guide these emissions trading, a set of policy instruments has been created with the purpose to engage countries in climate-change mitigation by giving economic incentives and reducing their emissions abatement costs.

One of these instruments, defined in Article 12.2 of the Kyoto Protocol as the *Clean Development Mechanism* had it start in year 2000 and considers the trade of greenhouse gas emissions between developed and developing countries[2] that have ratified the Protocol. The purpose of this market based financial mechanism is twofold. In addition to assist developed countries in complying with their emission reduction targets and contributing to climate-change mitigation, CDM project activities implemented in developing countries should foster their sustainable development.

In essence, developed countries may purchase 'carbon credits' for the emission reductions achieved in these projects and use them to comply with their emission targets, whilst giving a supplementary source of financing and technology transfer for climate-change mitigation activities in countries that would experience barriers for implementing such projects otherwise (UNFCCC, 1997). In this sense, the CDM represents an attempt to respond to the challenge of working with environment and development policies synergistically (Mathy *et al*., 2001).

Nevertheless, developing countries are not to be considered a homogeneous group facing the same difficulties and challenges. Therefore, in the annual meeting of the Clean Development Mechanism [CDM] bodies in 2001 that took place in Marrakesh, it was recognised the need for promoting "an equitable geographic distribution of CDM project activities at regional and sub regional levels" (UNFCCC 2001, Decision 17/C.P.7). However, no strategies have been defined so far on how to achieve this purpose. As a result, investors are free to allocate their financial resources where they believe they may face smaller risks and buy cheaper carbon credits, while developing countries have to compete for investments and test their ability to develop projects.

The current geographical distribution of Clean Development Mechanism project activities (shown further on in Chapter 3. 3.1.1, Figure 7) highlights the dominance of Latin American and Asian countries over more then 90% of the market. Sub-Saharan countries are so far only represented by South Africa, Uganda and Nigeria. However, as of November 2005, South Africa was the only out of these to have completed the necessary steps involved prior to project implementation.

Moreover, financing from carbon funds for CDM activities usually require large-scale projects and general enabling investment environment. As a result, large developing countries such as India, Chile and Brazil, which are already the main receptors of Foreign Direct Investment and have a larger industrial sector, are for the ones attracting most CDM investments (see section 4.1).

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[1] Generally referred to as simply 'carbon' or 'carbon equivalents'.

[2] The two other instruments are:

- International Emissions Trading: allows a developed (Annex I) country with emissions lower than its targets to trade (sell) the remaining amount up to the target with other Annex I country (UNFCCC, 1997, Art 6).
- Joint Implementation and allows Annex I countries to invest in projects in other Annex I countries and to be credited for the emission reductions achieved in this projects (Art. 17).

The general investment climate in sub-Saharan African countries is considered less favourable then other developing countries. In addition, 67 % of the 50 countries categorised as *least developed* are located in this region (UNCTAD, 2005). This situation creates the idea that sub-Saharan African countries have not yet been able (or interested) in creating an enabling environment for CDM project activities. Moreover, it raises the issue of marginalisation of a region that has already additional drawbacks and constraints.

1.2 Aim and Objectives

Based on the issue described above, this thesis aims to find out: *What is challenging francophone sub-Saharan African countries involvement in the Clean Development Mechanism?*

Three objectives were set to answer this question:

Objective 1: To analyse the current geographical distribution of CDM projects validated and registered by the CDM Executive Board.

Objective 2: To find out which internal constraints (ex: institutional, technological, economical, legal) might be preventing the involvement of francophone sub-Saharan African countries in the Clean Development Mechanism.

Objective 3: To identify potential ideas for climate-change mitigation projects in francophone sub-Saharan countries.

To investigate Objective 2, we will examine three different hypotheses regarding the main constraints explaining the observed situation:

H1: Project transaction costs are too high for the budget of sub-Saharan African [SSA] countries.

H2: SSA countries are unacquainted to the Clean Development Mechanism, and therefore have not taken the opportunity to participate.

H3: SSA countries have other institutional, political and/or technological problems preventing them from developing and implementing projects eligible for the Clean Development Mechanism.

1.3 Methodology

1.3.1 *Materials and Methods*

In order to achieve the proposed objectives, the study uses quantitative research methods through a positivistic approach. This method is objective and easily replicable. However, the inherent drawbacks to a quantitative approach lie in the possible incompleteness of the chosen set of variables (Kumar 1999).

In order to study the Clean Development Mechanism, a literature review was carried out. The material consulted included scientific articles (pertinent up-to-date information sources), books, guides and information available in official Internet sites (especially important to obtain the latest data available concerning CDM projects status).

Data on the geographical distribution of CDM project activities was obtained through the official website of the United Nations Framework Convention on Climate Change. This website makes data available on all projects in the validation or registration process. One of the results obtained regarding the regional distribution of CDM activities involves a specific calculation. Table 1 below indicates how the calculations were done for Table 8 shown on Chapter 3. 3.1, page 24 were carried out.

TABLE 1 – METHOD USED IN THE CALCULATION OF THE DISTRIBUTION OF PROJECTS IN RELATION TO POPULATION IN CHAPTER 3. PAGE 24.

	REGION A	REGION B	TOTAL SHARE REGION A (%)	TOTAL
Number of countries	A1	B1	S1=100*A1/T1	T1 = A1+B1
Population (millions)	A2	B2	S2 =100*A2/T2	T2=A2+B2
Validated projects	A3	B3	S3= 100*A3/T3	T3=A3+B3
Registered projects	A4	B4	S4= 100*A4/T4	T4=A4+B4
Validated projects/inhabitants	A3/A2	B3/B2	A3/S2	
Registered projects/inhabitants	A3/A2	B3/B2	A4/S2	

1.3.2 *Survey method*

Data concerning project constraints and preferences was collected through a survey method. Although the inconvenience of this method is its reliance on the respondent's subjectivity, it is inexpensive and easy to analyse statistically.

The survey (questionnaire) was designed taking into account main pre-requirements for participation in the CDM, information degree on the CDM and awareness relevant to the steps involved in CDM project. Therefore, questions were related to institutional, political, technological aspects. In addition, some questions tried to identify ideas for climate-change mitigation projects, and opinions concerning the ability of the CDM for assisting in the Millennium Development Goals and other development issues. The questionnaire combined mainly dichotomous rating (yes/no), which are simple to analyse statistically, and ranking methods, which involve special treatment. In this case, the variance and deviation of the answers were considered, in order to draw a conclusion on the importance of the factors. In addition, respondents could optionally comment on each questions, and add information concerning their answers.

The questionnaire consisting of a single electronic document in French was sent by e-mail to each respondent (see Appendix 6 for a translated version of the questionnaire). The summary of responses to the questionnaire is in Appendix 7 p.40.

1.3.3 *Sample and sampling method*

The sample for the survey consisted of eight francophone Sub-Saharan African countries. These countries were: Benin, Burundi, Cameroon, Congo, Guinea, Mali, Mauritania, and Togo. Several criteria were used for the selection of this sample. The main reason was the involvement of the author as an intern in a capacity building project for 11 francophone sub-Saharan African countries on the Clean Development Mechanism. The internship was carried out in Vienna, Austria, at the headquarters of the United Nations Industrial Development Organisation [UNIDO]. The period of internship started August 1st 2005 and finished November 15th 2005. However, this research study was carried outside the scope of the internship.

None of the countries involved in the project has developed or submitted for approval a CDM activity, and therefore their participation in the capacity building project. The informative documentation concerning the Clean Development Mechanism in French is still rather limited, compared to that of English. Besides, all documents concerning the project must be submitted to the CDM Executive Board in English, creating an additional cost for translations. In a previous year, a sample of English speaking sub-Saharan African countries (Nigeria, Tanzania, Ghana, Kenya and South Africa) was chosen for similar capacity building project at UNIDO.

Table 2 shows basic information on these countries concerning development indexes and other statistical data. Note that only Cameroon and Congo are not in the list of 50 Least Developed

Countries of the United Nations Conference on Trade and Development (UNCTAD, 2005), mainly because of their higher Gross National Product (GDP) per capita. However, the Human Development Index (HDI) of Cameroon is still categorised as low by the United Nations Development Programme (UNDP, 2005).

TABLE 2 – DEVELOPMENT INDEXES AND OTHER STATISTICAL DATA ON THE EIGHT FRANCOPHONE SUB-SAHARAN AFRICAN COUNTRIES SELECTED FOR THE SURVEY

AFRICAN REGION	COUNTRY	POPULATION* (MILLIONS)	URBAN POP** (%)	LIFE EXPECTANCY AT BIRTH (YEARS)	GNP PER CAPITA*	HDI*	ADULT LITTERACY RATE > AGE 15 * (%)		FEMALE LABOUR FORCE IN AGRICULTURE (%)	CORRUPTION PERCEPTION INDEX***
							M	F		
West	Benin	7,3	44	54	440	Low	52	24	52	2,9
	Guinea	9,2	28	53,7	430	Low	55	27	88	n/a
	Mali	13,4	32	47,9	290	Low	36	16	81	2,9
	Togo	5,6	35	54,3	310	Medium	72	43	61	n/a
East	Burundi	6,2	10	43,6	100	Low	56	40	97	2,3
Central	Cameroon	16,1	n/a	45,8	640	Low	67,9		n/a	2,2
	Congo	3,8	n/a	52	640	Medium	82,8		n/a	2,3
North	Mauritania	3	61	52,7	430	Low	51	30	63	n/a

Source: *Human Development Report UNDP (2005), **UNCTAD (2005)***Transparency International 2005. Scale 0 = totally corrupt and 10 = very transparent.

1.3.4 *Repondents of the survey*

Two experts (from the public and the private sectors) in energy and/or climate change from each of the eleven countries came to Vienna for a 5 days workshop on the development of CDM project activities. The selection of these national experts was made in consultation with their governments. Taking advantage of the nomination of these national experts and potential pilot developers of CDM projects, the author has sent the questionnaire to all 22 participants, subsequent to the workshop. In addition to the countries chosen for study in this thesis, Niger, Cote d'Ivoire and Burkina Faso were part of this UNIDO capacity building project on the CDM. However, these countries did not answer the survey and therefore were taken out of the sample. One national expert answered the questionnaire for each country, in a total of eight respondents. The names and affiliation of each respondent are listed on Table 3 below.

TABLE 3 - RESPONDENTS OF THE QUESTIONNAIRE IN EACH OF THE EIGHT SUB-SAHARAN AFRICAN COUNTRIES SELECTED FOR THE STUDY.

	NAME	COUNTRY	SECTOR
1	Mr. Ibila DJIBRIL	Benin	Ministry of the Environment, the Habitat and Urban Planning.
2	Mr. Evariste SINARINZI	Burundi	Geographical Institute of Burundi (IGEBU)
3	Mr. Blaise BIGNOM	Cameroon	Electricity Sector Regulation Agency
4	Ms. Adélaide ITOUA	Congo	Ministry of Forest Economy and Environment
5	Ms. Aissatou SOW	Guinea	Ministry of Forest Economy and Environment
6	Mr. Mamadou GAKOU	Mali	Ministry of Environment
7	Mr. Alioune AOUBOK	Mauritania	Agro-business
8	Mr. Koffi VOLLEY	Togo	Ministry of Environment and Forest Resources

1.4 Scope and limitations

This study focuses only on mitigation policy, omitting adaptation processes that develop in response to climate-changes. The scope of this research does not expect to embrace the complexity of the whole Clean Development Mechanism or of the emissions trading market.[3] Moreover, additional emphasis will be placed upon the constraints related to the Clean Development Mechanism rules and procedures, rather than to the barriers created by market influences on investments. It will also consider the mitigation potential of sub-Saharan countries based solely on their latest registered emissions reports.

This research can be seen as having a "retrospective-prospective" timeframe (Kumar, 1999): it focuses both on past trends of CO2 emissions and investments, and long-term outcomes of climate-change mitigation for the sustainable development in Sub-Saharan African countries.

1.5 Definitions

"Equity" will be used here in the sense of fair environmental decision-making, taking both procedural and distributive justice into account (Ikeme, 2003). "Climate change", is a term referring to "dangerous anthropogenic interference with the climate system", as defined by the Intergovernmental Panel on Climate Change (2001 p.2). Climate change refers in this context to the consequence of the current "socio-economic development paths" (p.3) on the environment.

[3] For further reading on the CDM, see e.g. Rosales & Pronove (2002), UNEP (2004b) or Global Environmental Foundation (2004).

2.1 Sub-Saharan African countries in the current international Climate Change policy

2.1.1 *Burden-sharing of greenhouse gas emission reductions in the Framework Convention*

Pioneers in the industrialization process, the so-called developed countries have experienced a steadily strong rate of economic growth while emitting considerable amounts of greenhouse gases (IPCC, 2001). Figure 1 compares the amount of CO_2 emissions per capita in year 1998 from a sample of developed and developing countries. In addition, it shows that the amounts emitted by the sub-Saharan region are almost one fifth of the global average, while the United States of America are, on the other hand, five times above this same amount.

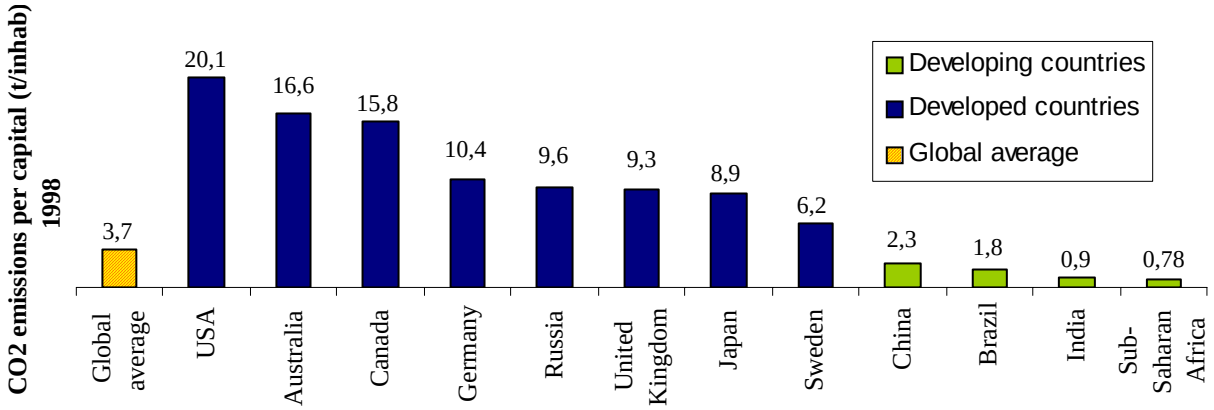

FIGURE 1 EMISSIONS OF CO_2 PER CAPITA DURING THE YEAR 1998 FOR A SAMPLE OF DEVELOPED AND DEVELOPING COUNTRIES, INCLUDING THE SUB-SAHARAN AFRICAN REGION AND GLOBAL AVERAGE.

Source: World Resources Institute, 2005.

International negotiations on climate change mitigation have considered these differences when determining that developed countries should take the lead in reducing greenhouse gas emissions, in addition to their historical responsibility for accumulated greenhouse gas emissions, and the differences in development stages among countries. Therefore, the 1992 United Nations Framework Convention on Climate Change [UNFCCC] considers that: "the Parties [to the Convention] should protect the climate system for the benefit of present and future generations, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities" (Article 3). The Convention groups countries into two categories according to these responsibilities and capabilities criteria. Annex I refers to all developed countries that signed the Convention on Climate Change while Non-Annex I list developing countries.

In this matter, the Convention recognizes that "the share of global emissions originating in developing countries will grow to meet their social and development goals" and thus exempts them from limits on greenhouse gas emissions in the Kyoto Protocol.[4] Nevertheless, the Protocol has

[4] The necessity of an equitable proposal to solve emissions disparity when dealing with climate-change mitigation inspired the creation of many other models for burden-sharing and, as a result, the literature contains extensive research and studies on the question of emission reductions allocation and responsibility. E.g. the "Contraction and Convergence" model by Aubrey Meyer from the Global Commons Institute (http://www.gci.org.uk/, 2005). According to this model, until the year 2100, global greenhouse gas emissions must 'contract' towards a sustainable level, set as an atmospheric concentration of CO_2 at 450 ppmv. (Swedish Environmental Protection Agency, 2002 p.30). Consequently, developed countries have to decrease their emissions per capita levels down to this ideal level, while other countries should 'converge' towards it. This would allow for economic growth and developing in poorer countries. However, according to the Swedish Environmental Protection Agency (2002 p. 31), this proposal for "burden sharing" did not

included developing countries into climate change mitigation policy by creating the *Clean Development Mechanism.* Although the Kyoto Protocol has only entered into force February 2005, the Clean Development Mechanism [CDM] has even started five years before that. Article 12.2 of the Protocol defines its primary objectives as:

- "To assist countries not included in Annex I [developing countries] in achieving sustainable development and in contributing to the ultimate objective of the [Framework] Convention [on Climate Change]"and,
- "To assist Parties included in Annex I [developed countries] in achieving compliance with their quantified emission limitation and reduction commitments under Article 3 [of the Kyoto Protocol]."

Developing countries have in this case the role of hosts to projects in the areas of renewable energy, energy efficiency or alternative fuels. The eligibility for these projects depends above all on the method used to calculate the baseline of greenhouse gas emission in the business-as-usual scenario and the contribution of the project to national sustainable development. Moreover, Official Development Aid cannot be used to finance these projects. Section 2.2 will further explain the requirements and basic procedures for participation in the CDM.

2.1.2 *Sub-Saharan African countries contribution to climate change*

Figure 2 below indicates the amount of CO2 tons per capita in each of the Sub-Saharan African countries that will be considered under in this study. It shows that Mauritania has the highest level of relative emissions of all the eight countries, and even above the region's average. Moreover, Burundi and Mali are close to zero ton emission per capita.

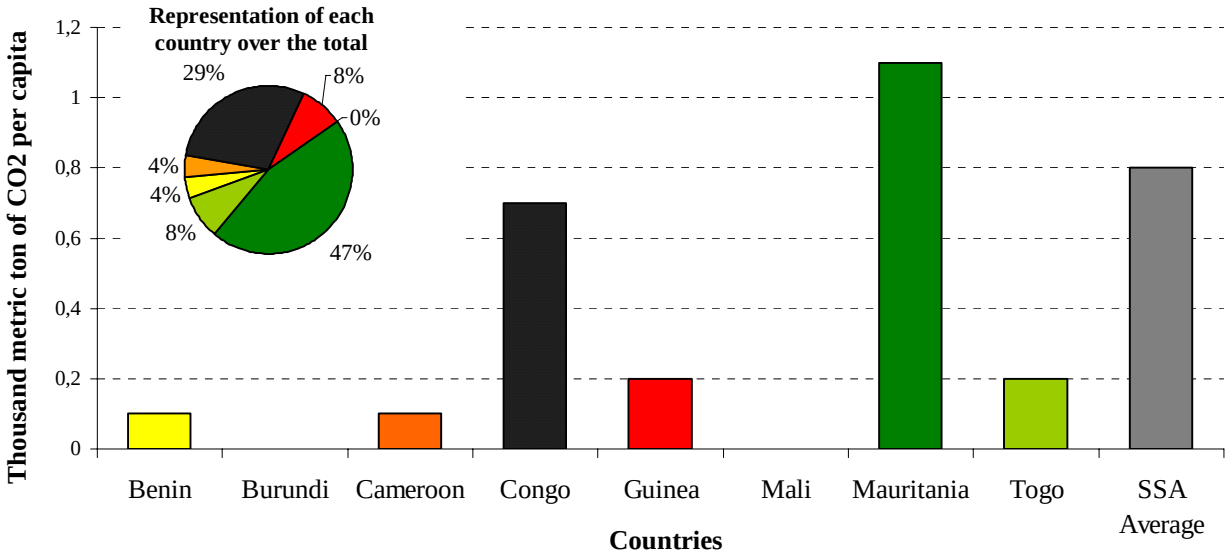

FIGURE 2 CO_2 EMISSIONS PER CAPITA DURING YEAR 1998 OF THE EIGHT SUB-SAHARAN AFRICAN COUNTRIES UNDER STUDY AND THEIR REPRESENTATION OVER THE TOTAL IN PERCENTAGE.

Source: data from World Resources Institute (2005)

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achieve a high political acceptability, as opposed to other such as "cumulative emissions" and emissions per Gross National Product [GDP]. Other examples are Yohe , Montgomery & Balistrery (2000), who studied several target options for all countries and Sugiyama & Deshun (2004) who considered the "time and spatial efficiency" of emission reduction targets.

Figure 3 shows the main sources of CO_2 emissions. In this case, the main source in all the eight sub-Saharan African countries under consideration in this study is liquid fuels. Only Burundi has emissions due to solid fuels, and Congo to gas flaring. Solid fuels include fuel wood and coal. The cement industry is a high source of emissions in Togo and Benin, a medium source in Cameroon and Guinea, and negligible in other countries.

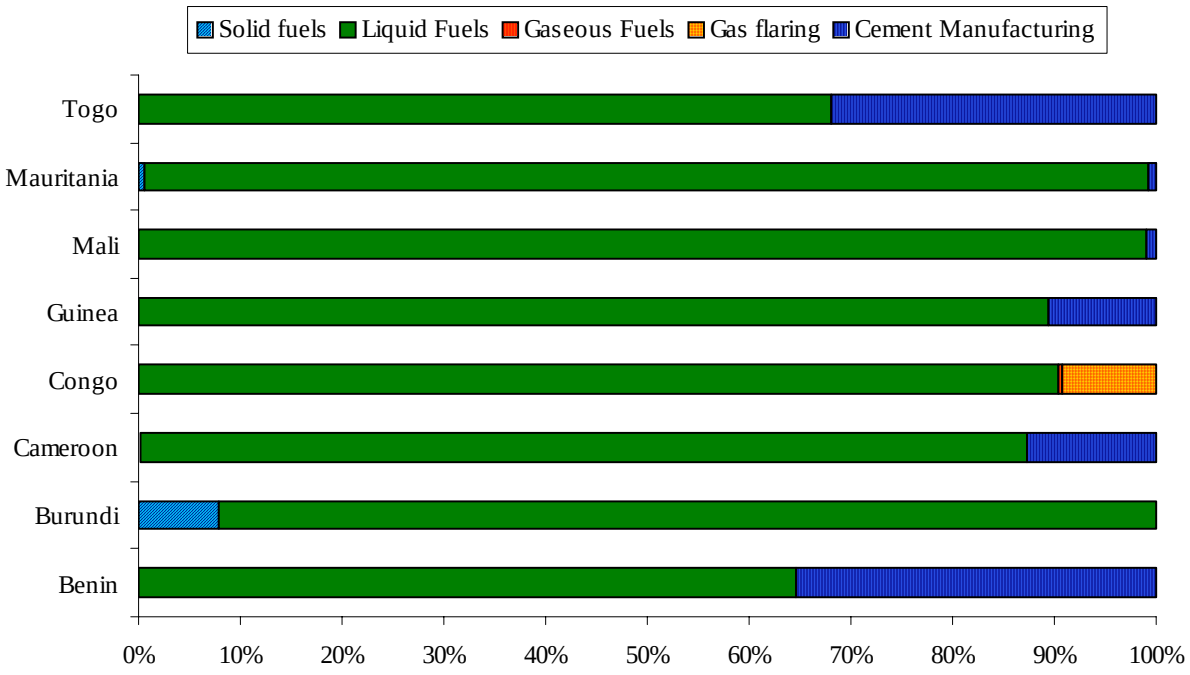

FIGURE 3 SHARE OF CO_2 EMISSIONS BY SOURCE (SOLID, LIQUID AND GASEOUS FUELS; GAS FLARING AND CEMENT MANUFACTURING) IN YEAR 1998, FOR THE EIGHT SUB-SAHARAN AFRICAN COUNTRIES UNDER STUDY.

Source: data from the World Resources Institute (2005).

Figure 4 below shows the sectors responsible for greenhouse-gas emissions in half of the eight countries under study (due to lack of data). The results show that transport is the sector source with most CO2 emissions, followed by the residential sector in some cases (like Benin and Cameroon) or manufacturing (like in Togo).

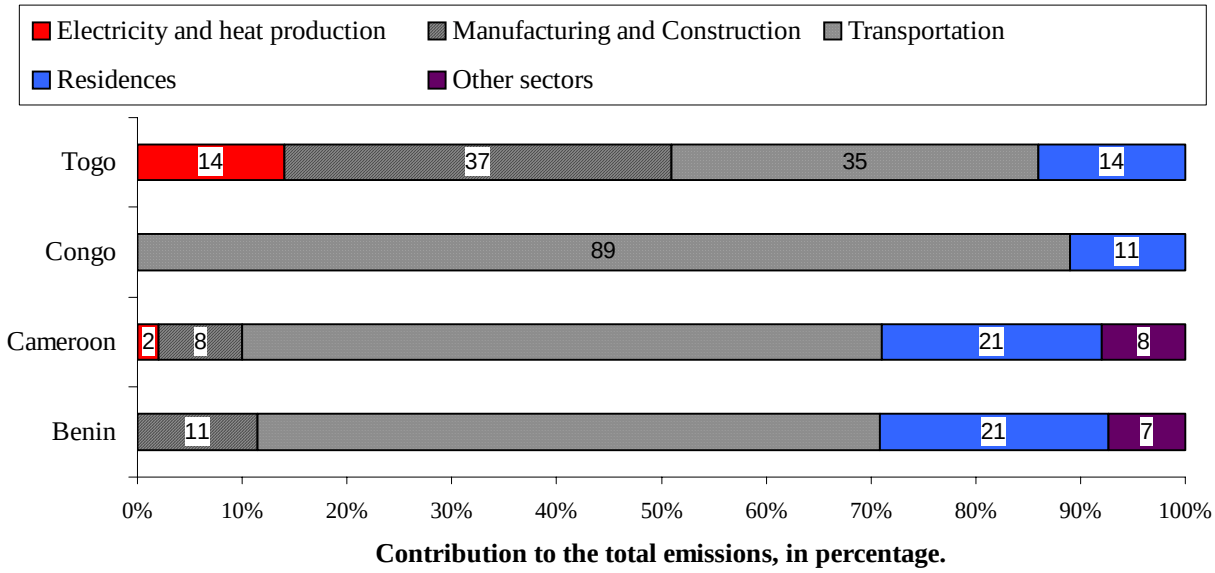

FIGURE 4 CONTRIBUTION OF ECONOMIC SECTORS IN TOGO, CONGO, CAMEROON AND BENIN TO THE NATIONAL AMOUNT OF CO_2 EMISSIONS, DURING YEAR 1999.

Source: data from the World Resources Institute (2005)

Regarding non-CO_2 sources, all countries show similar figures. Thus, the graph has been put in appendix (Appendix 3). It shows that the major non-CO2 source in Sub-Saharan countries is carbon monoxide [CO]. SO} and NO_2 emissions are generally characteristic of more industrialised countries, which is not the case of these countries.

2.1.3 *Relevance of climate change mitigation projects for the development of sub-Saharan Africa*

The distribution of costs and benefits from climate change impacts inevitably results in a number of global equity issues (Ekins, 2000). According to the third assessment report from the Intergovernmental Panel on Climate Change [IPCC] released in 2001 reveals that damage costs from climate change impacts will be higher for least developed countries because of their vulnerability to e.g. agriculture loss and rise in sea level. As previously mentioned, 67% of these countries are located in sub-Saharan Africa. The same report points out that climate change mitigation projects in developing countries are likely to facilitate the adaptability of vulnerable countries to these impacts by increasing their resilience.

In 2001, African leaders have reframed development through The New Partnership for Africa's Development [NEPAD] in an agreement with neo-liberal strategies, such as trade and market liberalisation. Despite similarities with other initiatives by World Bank and the IMF, this is the first regional framework for Africa developed domestically. Regarding the adoption of neo-liberal ideals, Owusu (2003 p. 1665) explains that "the proponents of the initiative may have learned from experience that in order for the voice of African leaders to be heard in discussions about the future of the continent, they must learn to speak the language of hegemonic discourse", that is, "neoliberalism". However, the success of this initiative is still uncertain, depending on the actual response of the international community and the participant African countries[5] (Owusu, 2003).

[5] Nabudere (2002) in Sebitosy & Pillay (2005) says sceptically that "The [African] Leaders have no confidence in the creative and innovative powers of their own people", a possible result of the prevailing view of rural populations, the majority in Africa, as "liabilities to national budgets", instead of "active contributors to development" (Sebitosi & Pillay, 2005 p.2045).

One of the problems to be solved is the high dependency of the continent, and especially of sub-Saharan countries, on Official Development Assistance [ODA] for 'survival' (Aryeetey-Attoh, 2003). Other primary goals of NEPAD include (1) poverty eradication, (2) sustainable growth and development, (3) globalisation and full integration into the global economy and (4) women empowerment. These objectives reflect some of the current issues in Africa such as gender inequality and poverty. They also correspond to the aims of the international Millennium Development Goals [MDGs] established by the United Nations in 2000, and to be achieved by 2015.

However, according to the UNDP (1997),"poverty has (so far) received scant attention from an energy perspective". Likewise, climate change has long not been considered a priority, compared to poverty alleviation, hunger, economic development and energy security (Beg et al, 2002). However, Sebitosi & Pillay (2005) and the Department for International Development [DFIP] (2002) argue that one of the consequences of poverty is the lack of energy services, and that energy consumption and human development are related.

Therefore, energy security is considered one of the biggest threats to Africa in particular (Davidson *et al.* 2003). While only 49 % of sub-Saharan Africa had access to electricity in 2002 (WER, 2004), this region also maintains a concentration of the lowest "Human Development Indices" according to the United Nations Development Programme (2005). Many climate-change mitigation projects are about energy provision, as it was shown on section 2.2.5) as for example biogas use for electricity production.

In Africa, greenhouse-gas mitigation projects have been studied by Halsnæs & Olhoff (2005), for two countries using cost-benefit analysis: Zimbabwe and Botswana. They concluded that projects such as efficient household lighting and paved roads (to reduce fuel consumption) could often generate indirect social benefits, e.g. reduced air pollution and increase mobility. However, "price distortions, capital constraints, limited information, and institutional weaknesses" may prevent their implementation (p. 2322). In this case, financing and technology transfer could help overcome such barriers (Halsnæs & Olhoff, 2005)

2.2 The Clean Development Mechanism: experiences, requirements and procedures

2.2.1 *Experiences and possibilities of project outcomes*

Considering that the Clean Development Mechanism is a recent piece of the climate policy (given the Kyoto Protocol's ratification in 2005, most CDM activities are at an early stage), studies on its concrete outcomes are still rather limited. However, a pilot phase of the Clean Development Mechanism called Activities Implement Jointly [AIJ] was launched in 1995 by the UNFCCC. Countries with such previous experiences can potentially take better advantage of Clean Development Mechanism opportunities than African countries that have not. Countries in Latin America but also in Asia, have had the opportunity to acquire experience with AIJ projects, and have thus developed expertise with sustainable development issues, what to expect from them, and their difficulties.

Klooster & Masera (2000) and Fearnside (2000) have shown that forest carbon projects in Mexico could provide biodiversity conservation and rural development, and that projects in land-use, land-use change and forestry may be "the most important statement of an emerging global partnership between developed and developing countries to address the global climate issue" (Bernoux *et al.* 2002 p. 385). However, these kinds of projects also raise worries such as that technological and financial transfers might decrease and commercial plantations or exotic species will spread (Mwandosya, 2000; Dutschke, 2001).

Cosbey (2005) illustrates the case of a CDM project targeting the transportation sector where the emissions where found to come from individual vehicles, revealing that any large-scale projects would have proven unworkable unless it is done at a sectoral level.

Tucker (1999) gives an example of solar cooking programmes in Haiti financed by the CDM, which assisted to solve fuel wood scarcity and protect forests, and where cultural barriers revealed to be an important issue.

Moreover, examples for studies in India and China on the CDM show that larger developing countries might benefit from the additional financial resources put in the market by the CDM (Mathy *et al.*, 2001; Zhang, 2004). However, the link between economic growth and "environmental sustainability" is rather ambiguous and has been well documented by Ekins (2000). Table 7 gives other examples on how the CDM projects may contribute to emissions reduction and financing.

In Appendix 4 the application of the Clean Development Mechanism to attain the Millennium Development Goals can be better understood through links connecting sustainable development and energy provision. It shows that the CDM has high potential to contribute to poverty reduction and environmental sustainability, through e.g. the creation of employment, indirect forest protection, energy provision for several activities (manufacturing, residential use, commercial establishments). However, it will depend on the type and placement of the activity. The kinds of projects that are more likely to contribute to these goals are small-scale community-based projects in renewable energy and forestry projects (Brown & Corbera, 2002).

2.2.2 *Participation and institutional requirements*

The CDM is open for voluntary participation of private and public entities from both Annex I and Non-Annex I countries. Projects in the Clean Development Mechanism usually include at least the following participants:

- The Project Proponent (company or Non-Governmental Organization interested in developing the project);
- The Host country for the CDM project
- An independent Designated Operational Entity [DOE] in charge of the project's validation.
- The Executive Board (supervisory body of the CDM) composed of 10 members representing different regions
- The Certified Emission Reductions Purchaser (which can be either a public, private or multilateral institution or fund).

To be part of the Clean Development Mechanism, all participant parties must have ratified the Kyoto Protocol and have a Designated National Authority [DNA] set in place[6]. The National Authority is responsible for the approval of the project at the national level, checking if it complies with the national sustainable development criteria.

2.2.3 *Steps in the project cycle*

Table 4 below shows a summary of the CDM project cycle. In a pre-operational phase, the project developer must consider the (economical, technical, legal) feasibility of the project idea. Then, a Project Design Document[7] [PDD] should be completed, containing the sustainable development benefits that the project is likely to offer and the comments from the stakeholders (e.g. neighbouring

[6] For a comprehensive guide on how to establish National Authorities in developing countries see Figueres (2002).
[7] The Project Design Document is available through the UNFCCC official website.

community) on future activity. This step includes feedback from the various stakeholders involved in the investment.

TABLE 4 STEPS INVOLVED IN THE PROJECT CYCLE OF THE CLEAN DEVELOPMENT MECHANISM, FROM THE PRE-OPERATIONAL PHASE TO THE SALE OF CERTIFIED EMISSION REDUCTIONS.

STEP	DESCRIPTION OF THE ACTIVITY
Pre-operational phase	
Feasibility Study	Project idea, economic assessment, etc.
Project Design	The project proponent must describe the project in a Project Design Document (PDD). Requirements include: contribution to national sustainable development (approved by the DNA) and demonstration of additionality (see page 20).
Approval of new methodologies	If the project uses a new methodology for calculating baselines, it must be submitted for approval to the Methodology Panel before the project may be validated. It takes on average 276 days.
Validation	An independent consultant (Designated Operational Entity – DOE) accredited by the EB reviews the PDD and certifies that the project meets the requirements as set out by the EB. It is kept available 30 days for public comments.
Registration	The EB reviews the project and, if all is in order, formally registers it as a CDM project. It takes 8 weeks for large-scale projects, and 4 weeks for small ones.
Operational phase	
Monitoring	The project activities and results must be monitored on an ongoing basis according to the plan submitted in the PDD
Verification/ Certification	A DOE verifies through the monitoring process, and by an ex-post review, that the project met certain mitigation goals. Its written assurance to that effect is certification.
Issuance and sale of CERs	After review, the EB issues the appropriate number of CERs, which are now ready for sale.

Source : Cosbey *et al* (2005 p. 24)

In addition, an emission baseline must be calculated using a methodology (existing or new) that has been approved by the Methodology Panel of the CDM Executive Board, with validation approval by the "Designated Operational Authority", chosen by the host country, with registration and final approval by the Executive Board. If registered, a project enters the operational phase. During this phase, the project is implemented and the emissions monitored for possible leakages. According to these measurements, the Executive Board will issue a certain amount of certified emission reduction credits that can be put for sale (UNFCCC, 2001).

2.2.4 *Sustainable development strategy and criteria*

The definition of "national sustainable development strategy" represents a major issue due to the "wide variance of priorities among and within developing countries" (Cosbey *et al.*, 2005 p.22). Therefore, the perspective of "sustainable development" in the Clean Development Mechanism gives each country the responsibility to define its own priorities and to verify whether the CDM projects address them or not (UNFCCC, 2001). The meaning of sustainability here can be interpreted as a "normative term", providing "a policy framework for democratisation" (Boehmer-Christiansen, 2002).

Although each country sets up a National Authority in charge of verifying the compliance of the project with the opted sustainable development strategy and criteria, the danger is that a weak policy, while more easy to implement, will not assess the expected social, environmental, economical and technological benefits. On the other side, a strong set of national criteria, more worth being trusted, also implies greater difficulties for project appraisal and approval, and eventually implementation.

Appendix 1 provides different examples of general sustainable development criteria, in the economic domain as well as in social and environmental dimensions, some of them being similar. Likewise,

Appendix 2 gives an example of criteria and indicators for forestry carbon appraisal.

Some Non-Government Organizations [NGOs] have attempted to design broad sustainable development appraisal methodologies for Clean Development Mechanism projects. One example is the Gold Standard[8], created by the World Wide Fund [WWF]. The Gold Standard is a type of ecological label for CDM projects, which have to go through a stricter project cycle and comply with a rigorous set of sustainable development requirements for small renewable energy and energy efficiency projects. However, the use of such methodologies is not mandatory.

2.2.5 *Project areas and eligibility*

The Kyoto Protocol specifies modalities and greenhouse gases suitable for projects in the Clean Development Mechanism. Eligible project areas include energy efficiency, fuel switch and renewable energy, within four economic sectors: power generation, industry, residential and community projects, and transportation.

Only reforestation and afforestation projects are eligible in the category of land use, land-use change and forestry projects [LULUCF] during the first commitment period, but the amount of credits for these is very limited. They should not exceed 1% of the initial-year emissions of the assigned amount for a developed country (UNFCCC, 2001). The decision of the Executive to consider only these two modalities for LULUCF projects is criticised by several scholars. Cosbey *et al* (2004) considers that avoiding deforestation, for example, could contribute largely to sustainable development while keeping greenhouse-gas emissions low.

All the projects types mentioned above can vary on scale from small to large. Small-scale projects have restricted modalities and simplified sets of rules. Small-scale renewable energy projects are perhaps the most suitable for delivering sustainable development benefits, especially in the least developing countries. In addition to the fact that the industrial sector is usually not very large, projects could benefit rural communities, which have normally an extremely low rate of access to electricity.

However, small-scale projects are at a disadvantage in terms of economic feasibility. In order to lower transaction costs, the Executive Board has set simplified procedures[9] and standard baselines. Three categories are eligible for Small Scale CDM project activities: renewable energy, energy efficiency and other projects emitting less than 15 000 tCO_{2eq} per year. (UNFCCC, 2001)

Table 5 presents the greenhouse-gases (GG) considered suitable for CDM projects are the ones in the Kyoto Protocol and the magnitude of the global warming effect each gas has in relation to the effect of one unit of carbon dioxide [CO_2]. Higher GWP are found usually on GG of industrial source (see Appendix 5 for other sectors).

[8] WWF Gold Standard website: http://www.panda.org/climate/goldstandard/

[9] More details on simplified procedures for small-scale projects on: http://cdm.unfccc.int/Projects/pac/pac_ssc.html/

TABLE 5 DIRECT GLOBAL WARMING POTENTIALS OF HUMAN-AFFECTED GREENHOUSE GASES. THE UNIT FOR GLOBAL WARMING POTENTIAL IS CO_2 EQUIVALENTS [CO_2EQ].

TYPE OF GREENHOUSE-GAS	CO_2	CH_4	N2O	HFCs	PFCs	SF_6
100 YRS GLOBAL WARMING POTENTIAL (GWP)	1	23	296	12000	5700 - 11900	22200

Source: IPCC (2001). Note: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) [Perfluoromethane (CF_4), Perfluoroethane (C_2F_6)], Sulphur hexafluoride (SF_6)

Usually, the primary source for emissions is the burning of fossil fuels for energy and electricity. The secondary source is the emissions that are directly derived from industrial processes. Estimates show that improving the process of aluminium production could reduce PFC emissions by up to 50%. Fuel switch could also account for reducing 20% of GG emissions (El-Fadel, 2001 p. 1039).

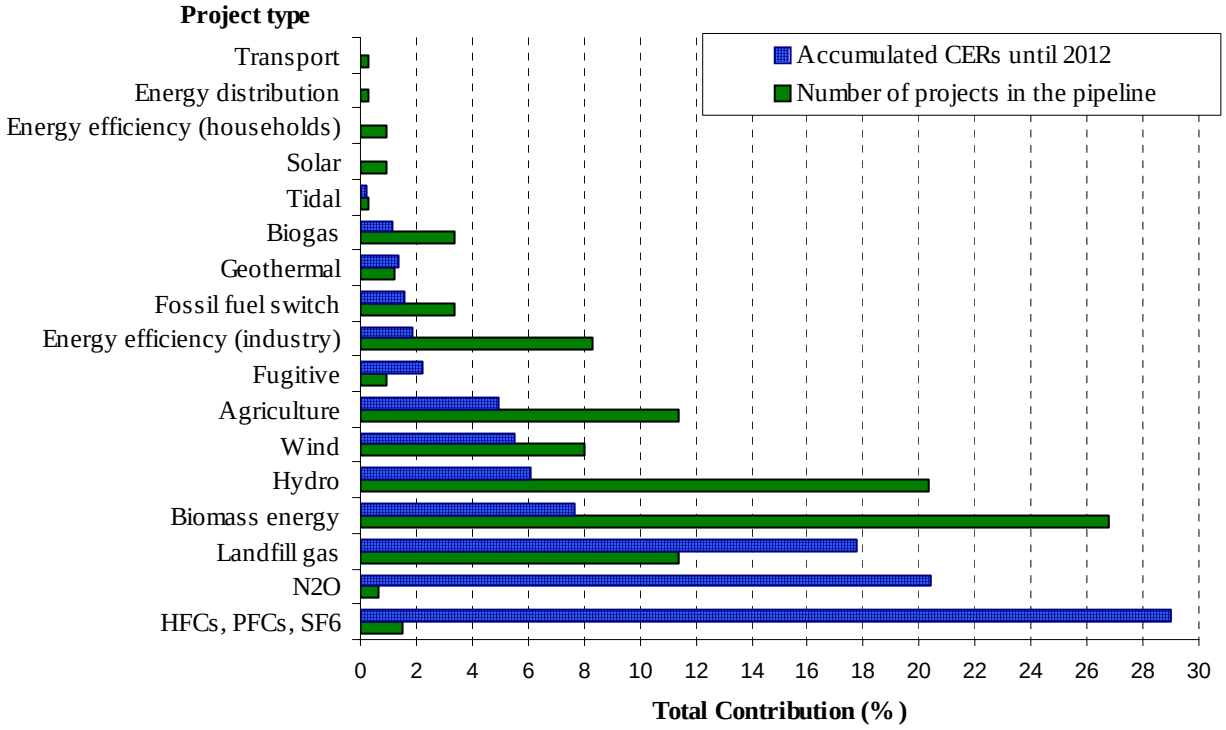

FIGURE 5 CDM PROJECT TYPES AND ACCUMULATED CERTIFIED EMISSION REDUCTIONS (CER) UNTIL THE END OF THE COMMITMENT PERIOD (2012), AS OF OCTOBER 2005.

Source: data from the UNFCCC official website. Available at http://www.unfccc.int/cdm/ Retrieved on October 2005.

2.2.6 *Environmental additionality*

"The environmental integrity of the Clean Development Mechanism depends in avoiding giving emission credits to projects that would have happened anyway" (Greiner & Michaelowa 2003). Therefore, the amount of emissions of a CDM project should be below the "baseline", which refers to a *status quo* or "business-as-usual scenario" (UNFCCC, 1997b). The difference between the baseline and the estimated emission line with CDM project [10] is called environmental "additionality" (UNFCCC, 1997).

[10] Kyoto Protocol, Art.12 para5(c)

One problem in the measurement of the baseline is the degree of uncertainty in the calculation. One of them, called "leakage", occurs when a source of greenhouse gases (machinery or an entire industry, for example) is being displaced out of the considered boundary, and is not taken into account in the calculation (UNFCCC, 1997) Effective monitoring and verification can reduce this to a certain extent.

Moreover, the host country must prove that "there are barriers that would prevent the implementation of the type of proposed project activity from being carried out if the project activity was not registered as a CDM activity" (UNFCCC, 1997b; p.5), such as constraints due to financial, investment and technological issues, or prevailing practice.

A condition to meet the investment additionality is that the project funding should not come from other assistance funds like the Global Environmental Facility [GEF] or the Official Development Assistance [ODA]. Moreover, the value of the Certified Emission Reduction Unit [CERU] should improve the financial and commercial viability of the project (p.6).

2.2.7 *Transaction costs*

Table 6 indicates the estimated transaction costs range for small and large-scale projects, during the pre-operational and operational phase. Throughout the project cycle, transaction costs are uncertain and depend on the Executive Board's administrative costs, the Operational Entity's charge, the cost for the whole operation process, including costs for: project searching, project design, validation and registration, monitoring, verification and issuance (Chen, 2003).

TABLE 6 STEPS ON THE CDM PROJECT CYCLE ASSOCIATED TO ESTIMATED TRANSACTION COSTS

STEP	ESTIMATED TRANSACTION COSTS (IN US$)*
Pre-operational phase Total: 70 000 – 110 000	
Feasibility Study	5 000 – 20 000
Project Design	25 000 – 40 000
Approval of new methodologies	No cost
Validation	10 000 – 15 000
Registration	10 000 (see Figure 6), Legal work (20 000 – 25 000)
. Operational phase	
Monitoring	3 000 – 15 000 per year
Verification/ Certification	
Issuance and sale of CERs	Adaptation fee [11] of 2 % of the CERs sold (does not apply to CDM projects in LDCs). Risk mitigation against lost of incremental value as a consequence of project risk (5 – 20 % of the project total cost)

Source: CCPO (2005), UNEP (2004). Note: *Value over the first five years of operation, and discounted to present value at 6 % per year.

Jensen (2003) has compared small and large-scale CDM projects in terms of transaction costs. The model small project given as an example was a 2MW biomass plant, with 20-years lifespan, and which results in an emission reduction of 35,000 tCO_2/year. For the large project, the example used was a 150MW gas plant with the same lifespan, but resulting in 10 times more emissions reductions than the smaller project.

Assuming the price per Certified Emission Reduction in present value terms is approximately US$5,00 (a reasonable estimate) the small-scale project would receive about US$ 175,000 and the

[11] Marrakesh accords in UNFCCC (2001), Decision 17/C.P. 7 Para15 (a): *"the share of proceeds to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation, as referred to in Article 12, paragraph 8, of the Kyoto Protocol, shall be two per cent of the certified emission reductions issued for a clean development mechanism project activity"*.

large one US$ 1,750,000. The up-front costs for each of them would be about US$ 50,000 for the small and US$ 105,000 for the large. Consequently, the small-scale project would have up-front cost representing 28% of the CER revenue, while it only accounts for 6% in the case of the large-scale project.

The Executive Board demands registration fees according to the estimated annual emission reductions over the crediting period (see Figure 6 below). In addition, choosing a Designated Operating Entity from a developed country to conduct the validation process could raise costs for developing countries. In addition, Cosbey *et al* (2005) point out that, contrary to what is expected, that reducing the number of verification and certification would not efficiently reduce transaction costs because investors would fear the risk related to CERs delivery, decreasing its market value.

Still, pre-operational costs represent the up-front payments the project developer must consider, without receiving any guarantees that the Executive Board will register the project. However, the positive impact of the sales of emissions in the Internal Rate of Return [IRR] of the project can help readily recover the costs because of the additional revenues (CCPO, 2005).

Once registered, the revenues from the sale of Certified Emission Reductions depend on the market price. The withdrawal of the United States from the Kyoto Protocol due to low "willingness to pay" for emission reductions compliance costs, reduced considerably the market potential and the price of emission credits (Böhringer and Vogt, 2004; Chen, 2003).

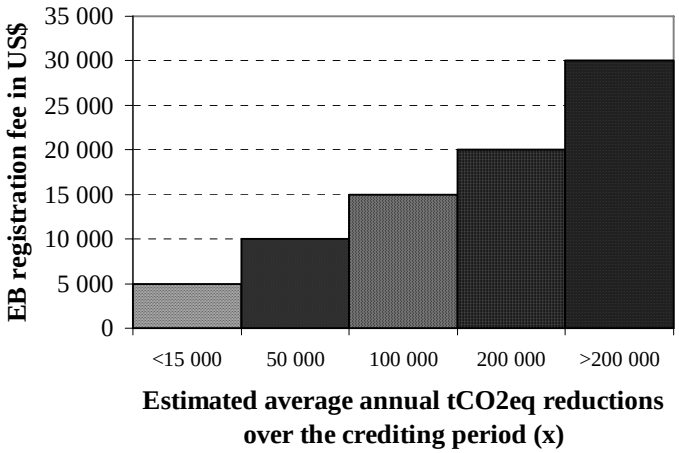

FIGURE 6 CURRENT REGISTRATION FEES FOR CDM PROJECTS, IN US$ DOLLARS.

Source: Adapted from CDM Executive Board, Sixth Meeting, October 2002. Retrieved on Oct 2005 at http://cdm.FCCC.int/Projects/pac/howto/CDMProjectActivity/Register/regfee.pdf

Table 11 gives examples on financial incentives the CDM can have to facilitate the implementation of climate change mitigation projects. Projects can be both financed and developed by indigenous entities ("unilateral" project development) or through multi/bilateral international cooperation (e.g. equity financing).

In the first case, the host country takes alone most of the project risks and up-front costs for project submission, but can sell the credits for emission reductions at a higher price (Jahn *et al.*, 2004). Nevertheless, some developing countries might not be ready to assume these high up-front project costs and risks (Gupta & Preety, 2000). Nonetheless, risk management and insurances can be taken.

TABLE 7 EXAMPLES OF THE FINANCIAL INCENTIVE THE CDM CAN HAVE OVER CERTAIN PROJECTS

PROJECT TYPE	SOURCE OF ONSITE EMISSIONS REDUCTION	SOURCE OF OFFSITE EMISSIONS REDUCTION	BASELINE TECHNOLOGIES	TYPICAL ROLE OF CDM CONTRIBUTION
Industrial process efficiency	Fuel savings and changes in Greenhouse Gas process emissions	Electricity savings and reduction in emissions from fossil fuels production	Existing process and power grid mix	Full or co-financing of process upgrade
Community or residential lightning efficiency	None	Electricity savings	Existing power grid mix	Financing of market barrier removal
Landfill gas recovery and power generation	Greenhouse Gas losses and flaring	Reduced future electricity production	Existing power grid mix	Full or co-financing of gas recovery and power plants
Wind power generation	None	Reduced future electricity production	Current/future power grid mix	Full or co-financing
Improved transit system	Reduction in automobile use	Reduction in emissions from fossil fuel production	Current automobile/transit mix	Full or co-financing
Biofuels	Reduction in fossil fuels	Reduction in emissions from fossil fuel production	Current vehicle efficiency	Financing of fuel distribution infrastructure or vehicle conversion

Source: Pembina Institute for Appropriate Development (2003 p. 12)

3.1 Distribution of CDM projects among regions and countries

3.1.1 *Regional distribution of validated and registered CDM activities*

As of November 2005, 33 projects had been registered by the CDM Executive Board, and more than 400 have been validated. Figure 7 shows the distribution of these projects among five regions: Latin America, Eastern Europe, Asia & Pacific Developing Countries, North Africa and Middle East (represented only by Israel and Morocco) and sub-Saharan African countries (represented by South Africa, Nigeria and Uganda).

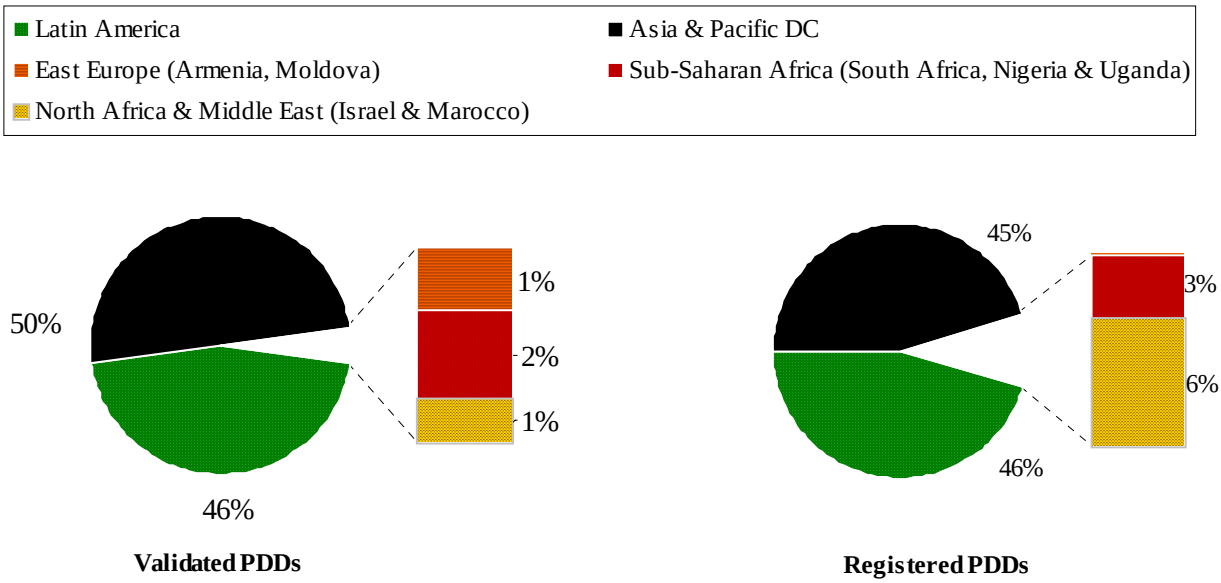

FIGURE 7 GEOGRAPHICAL DISTRIBUTION OF VALIDATED AND REGISTERED CDM PROJECT DESIGN DOCUMENTS (PDDS), AS OF NOVEMBER 2005.

Source: author, data from UNFCCC website http://www.unfccc.int/cdm/

3.1.2 *Current countries with registered CDM projects*

Figure 8 shows the number of registered projects per country. India is the country with most projects hitherto. Latin America and Asia have almost the same number of projects (8 and 7 countries, respectively). However, the only African countries with projects hitherto were Morocco and South Africa and no Eastern Europe country has registered any project so far.

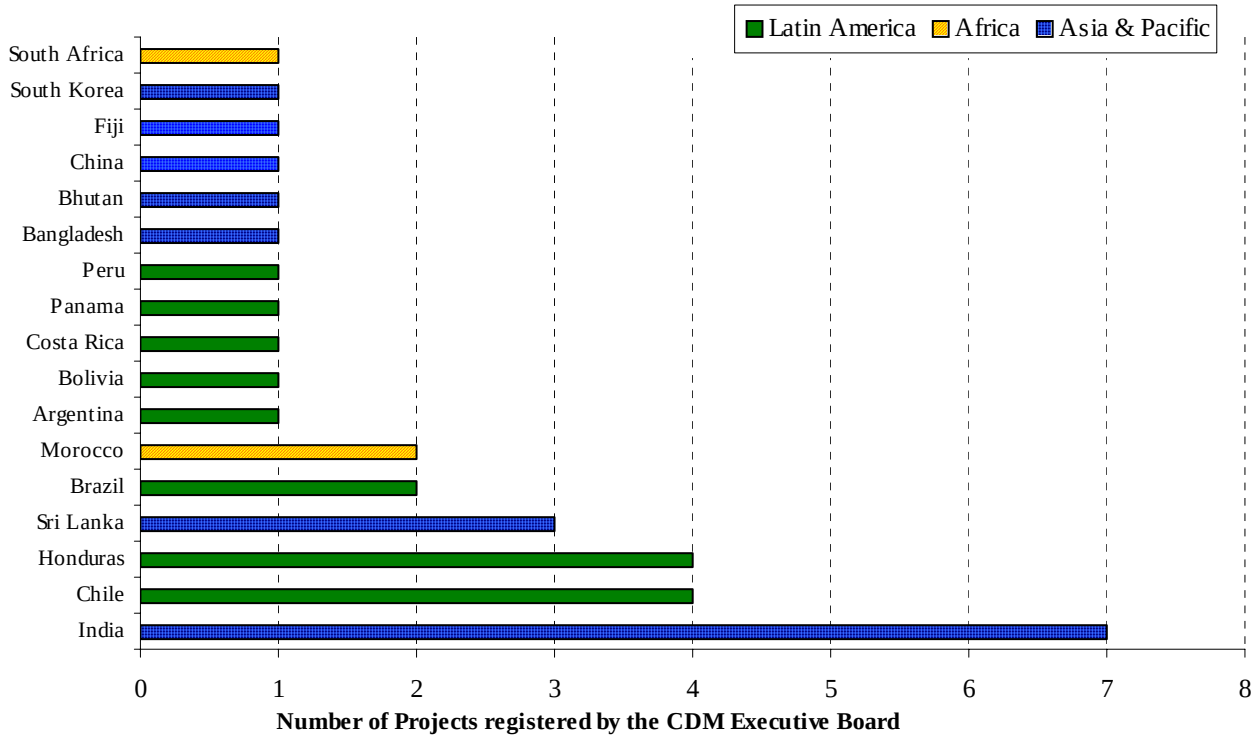

FIGURE 8 NUMBER OF REGISTERED CDM PROJECTS PER COUNTRY, AS OF NOVEMBER 2005.

Source: UNFCCC official website. Available at http://www.unfccc.int/cdm/ Concentration of projects related to population.

Table 8 below compiles and compares data on the regional distribution of CDM projects, using population as a unit of comparison. The calculations used in this table are explained in the Methodology section. Three regions were considered (Africa, Latin America and Asia).

TABLE 8 COMPARISON BETWEEN REGIONAL POPULATION, NUMBER OF COUNTRIES AND NUMBER OF PROJECTS.

	AFRICA & MIDDLE EAST	LATIN AMERICA	ASIA	AFRICA & MIDDLE EAST SHARE %	LATIN AMERICA SHARE %	ASIA SHARE %	TOTAL
Number of countries*	53	32	45	40,8	24,6	34,6	130
Population (millions)**	849,5	434,3	3817,7	16,7	8,5	74,8	5101,5
Validated projects*	12	185	203	3	45,6	50	406
Registered projects*	3	15	15	9,1	45,5	45,5	33
Validated projects/million inhabitants	0,014	0,426	0,053	0,719	21,765	2,714	
Registered projects/million inhabitants	0,004	0,035	0,004	0,180	1,765	0,201	

Source: *UNFCCC (2005), as of November 2005, **UNDP (2005)

Considering the number of **projects per capita**, the results obtained were:

- Latin America has the largest concentration of projects (validated and registered) per capita.
- Africa & Middle East and Asia have the same concentration of registered projects.
- Africa & Middle East have 4 times less validated projects than Asia and around 30 times less then Latin America.

Regarding the concentration of **projects per population share (**where per capita is the regional share of the total population in the three regions) each of these regions represents on the total sum, the results were:

- Asia and Africa & Middle East have approximately the same concentration of projects.
- Africa & Middle East have around 10 times fewer projects allocated in comparison to Latin America.

3.2 Constraints for CDM project development in sub-Saharan countries

3.2.1 *Policy and institutional constraints*

As previously explained in section 2.2.1, all participant parties in the CDM must have ratified the Kyoto Protocol and have a Designated National Authority [DNA] set in place. Table 9shows the share of country groups that fulfil these conditions. Notice that Africa has the smallest percentage of ratifications (although close to that of Asia), and it is far behind, regarding establishment of DNAs. This shows already a potential constraint for these countries.

TABLE 9 STATUS OF THE KYOTO PROTOCOL AND DNAS IN PLACE IN NON-ANNEX I COUNTRIES. (AS OF 05 NOV 2005)

COUNTRY GROUP	NO. OF COUNTRIES	HAVE RATIFIED THE KP	%	HAVE A DNA IN PLACE	%
Africa	47	35	**74**	9	**19**
Asia	40	31	78	17	43
Latin America	24	22	92	18	75
Eastern Europe	12	10	83	5	42
Small Island D. States	27	23	85	8	30

Source: UNFCCC (2005).

Table 10 shows the status of the Kyoto Protocol and the Designated National Authority in the eight sub-Saharan countries under study. The only countries to have both ratified the Kyoto Protocol and set National Authorities are Benin and Mali, which are therefore fully eligible for taking part in CDM projects, while Congo and Mauritania have still yet to ratify the Kyoto Protocol.

TABLE 10 STATUS OF THE KYOTO PROTOCOL AND THE DNA IN SUB-SAHARAN COUNTRIES UNDER CONSIDERATION

	BENIN	BURUNDI	CAMEROON	CONGO	GUINEA	MALI	MAURITANIA	TOGO
Kyoto Protocol	Ratified in 2002	Ratified in 2001	Ratified in 2002	Not yet ratified	Ratified in 2000	Ratified in 2002	Not yet ratified	Ratified in 2004
National Authority	Mr. Ibila Djibril	no	no	no	no	Mr. Boubacar Dembele	no	no

Although, all governments except that of Guinea declare being aware of CDM primary objectives, only three countries actually have a national forum where issues regarding the CDM can be discussed (Mali, Togo and Benin). They are usually the same as the discussion forum on climate change, set by the national committee. In Congo, this forum is currently being established. None of these countries has Research & Development centres that could assist in developing CDM projects.

3.2.2 *National Sustainable Development strategy and criteria*

CDM projects require, in order to be approved, that a national strategy for sustainable development be established, as well as the criteria for CDM appraisal (see section 2.2.4). However, neither Mali, Togo nor Congo has developed national sustainable development strategies. In Cameroon and Burundi, the framework is still not under formal or rigorous application.

Regarding national sustainable development criteria for the appraisal of CDM projects, only Mauritania already has one, while in Togo and Congo it is under progress.

3.2.3 *Awareness constraints*

According to the survey, civil society is reacting differently toward the implementation of the CDM. In Congo, several NGOs are concerned with climate change, as opposed to Burundi, Mauritania and Guinea. On the other hand, the private sector is already allegedly noticing the potential of the CDM in most of the countries, except in Burundi and Guinea.

3.2.4 *Technical and technology constraints*

Regarding the necessary knowledge and skills in the fields of energy efficiency and renewable energy to undertake these projects, the answers to the survey were quite different. Togo and Cameroon have declared having the sufficient expertise in all domains, although Togo stressed that the civil society expertise was limited and that the public and private sectors needed more capacity building. Guinea only described a lack of expertise in the private sector, while it is the only sector favoured in Mauritania. In Congo, this expertise is only found in the public sector. Finally, Mali, Benin and Burundi acknowledge limited capacities in all sectors.

Figure 9 below shows the ranking of how challenging the steps in the CDM project cycle (presented in section 2.2.3), according to the respondents. Only Cameroon and Congo did not answer this question. The results from the average of weighted percentages indicate that the economic and financial analyses are the most difficult tasks to undertake, according to the largest majority of respondents.

The second most challenging step is the additionality criterion, probably due to its complexity and time expense. The baseline calculation and stakeholders consultations come almost alike in the ranking. However, to be able to differentiate between a favoured solution and an unpopular solution, we have drawn the mathematical standard deviation in the evaluation of the answers: the higher the deviation, the more there is disagreement over an issue, the lower, the more the respondents have actually scored the issue alike. Therefore, stakeholders' consultation can be put into third position before the baseline step. On the other hand, the application and development of methodologies seems to be a minor issue for the majority.

3.2.5 *Legal constraints*

Regarding awareness of the legal aspects of the Kyoto Protocol concerning the CDM project cycle, there was not much divergence in the answers. The exception from positive answers was Mr. Bignom, respondent of Cameroon, who pointed out the lack of knowledge of the country in all these legal matters. In addition, Mali and Burundi also indicated the legal aspects of the negotiations between the host country and the Certified Emission Reductions purchaser as "unfamiliar".

3.2.6 *Financial and economic constraints*

Only three countries (Mali, Cameroon and Benin) are allegedly aware of the additional risks implied in CDM projects, namely market risks, the risk of non-approval of the project and the risk of non-delivery of the Certified Emission Reductions. Likewise, there is a reported limited awareness concerning the transaction costs, which are extremely relevant in the case of CDM projects, as discussed in section 2.2.7 p.21. Only Ms. Itoua from Congo observes that simplifying the procedures of the project cycle is needed in order to reduce transaction costs and bring more benefits to least developed countries.

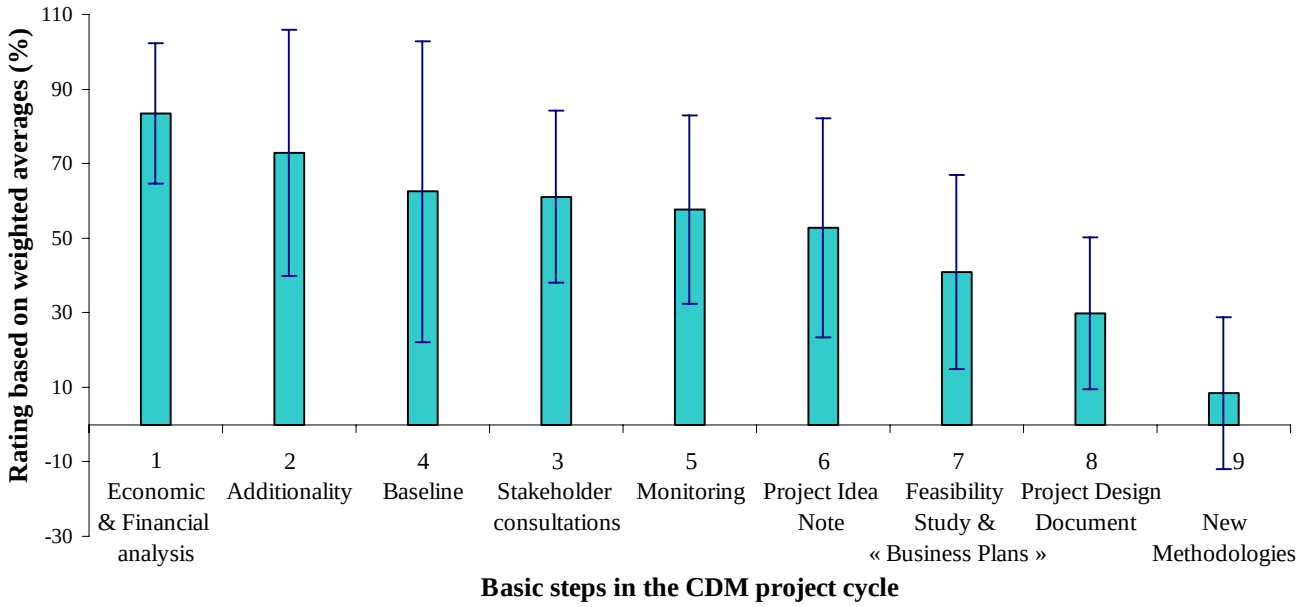

FIGURE 9 RANKING OF MOST CHALLENGING STEPS INVOLVED IN THE CDM PROJECT CYCLE ACCORDING TO RESPONDENTS, IN DESCENDING LEVEL OF DIFFICULTY.

3.3 Ideas suggested for potential CDM project activities

3.3.1 *Opinions concerning the CDM ability for meeting development goals*

According to the survey, all respondents consider that CDM projects might contribute to achieve the Millennium Development Goals, while alleviating poverty, improving the conditions of women's life and life quality in general. However, three respondents disagree regarding the potential of CDM projects in reducing social inequalities.

As the respondent of Togo commented, it all depends on the CDM project type, the national criteria for project appraisal, the negotiations and the efficiency of the institutional and legal framework. For Mr. Djibril from Benin, CDM projects could mean an extra source of revenue for stakeholders, improve production by technology transfer and improvement, and build national capacities in many areas. For the respondent from Cameroon, "some projects may help to improve women's condition, namely in the rural zone". Examples are the electrification projects, which may reduce the burden of energy provision from women that are in charge, in some regions, of collecting firewood. Projects could also help to reduce inequalities of infrastructure access.

3.3.2 *Preferences and ideas for CDM projects*

Regarding the types of projects that would be more beneficial to each country, each respondent had a different preference when ranking the four types: renewable energy, energy efficiency, biomass and other. Figure 10 below shows a general result, translating the ranking positions (1-4) to percentages of appreciation (0-100%).

In average, the majority of the countries quite agreed for energy efficiency as the most beneficial type of project. Biomass is the second most favoured type of CDM project. In third place comes renewable energy, with 50 % of the preference. Only Congo has chosen this option as the first.

Regarding the choice of the size of the projects, small-scale projects were considered almost unanimously as the most beneficial. The exception was Burundi, where large-scale reforestation projects were considered valuable to the country. The respondent of Togo points out that the country has low emissions of greenhouse-gases; while the respondent from Benin says the country do not have a large industrial sector. For Congo, small projects could be especially beneficial for low-income communities.

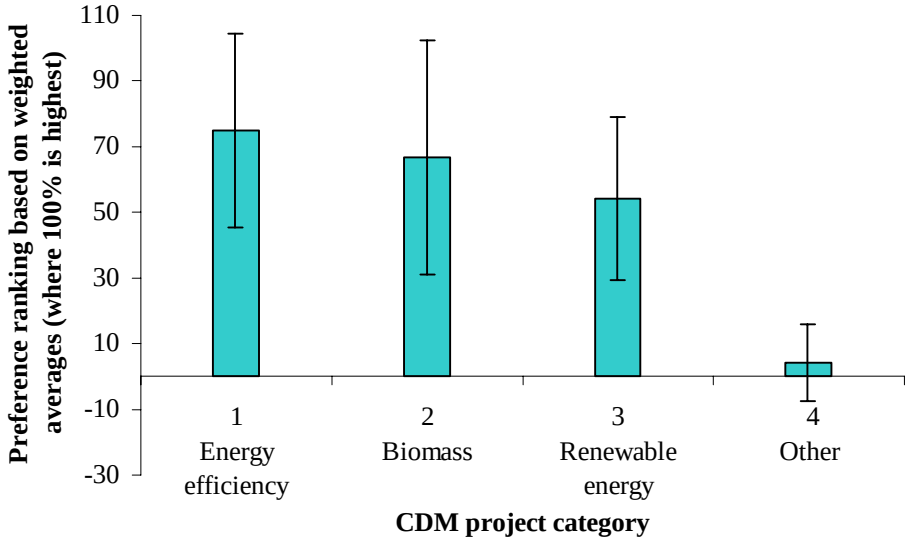

FIGURE 10 AREAS OF PREFERENCE FOR CDM PROJECTS, ACCORDING TO THE RESPONDENT'S IDEA OF NATIONAL PRIORITY.

Regarding potential projects to be developed in assistance to the Clean Development Mechanism, the respondents had several suggestions (see Table 11 below). The ideas were summarised and divided according to their CDM project category, as shown on Figure 11. Burundi and Congo suggested the improvement of wood stoves in residences. Cameroon and Congo mentioned small –scale hydropower plants to deliver electricity in rural areas. Only Mauritania pointed out fuel switch in transportation. However, several countries proposed biomass projects, such as waste valorisation and biodigestors. Togo has a project idea with a sub-product of shea (*karité,* in french) processing waste for power generation.

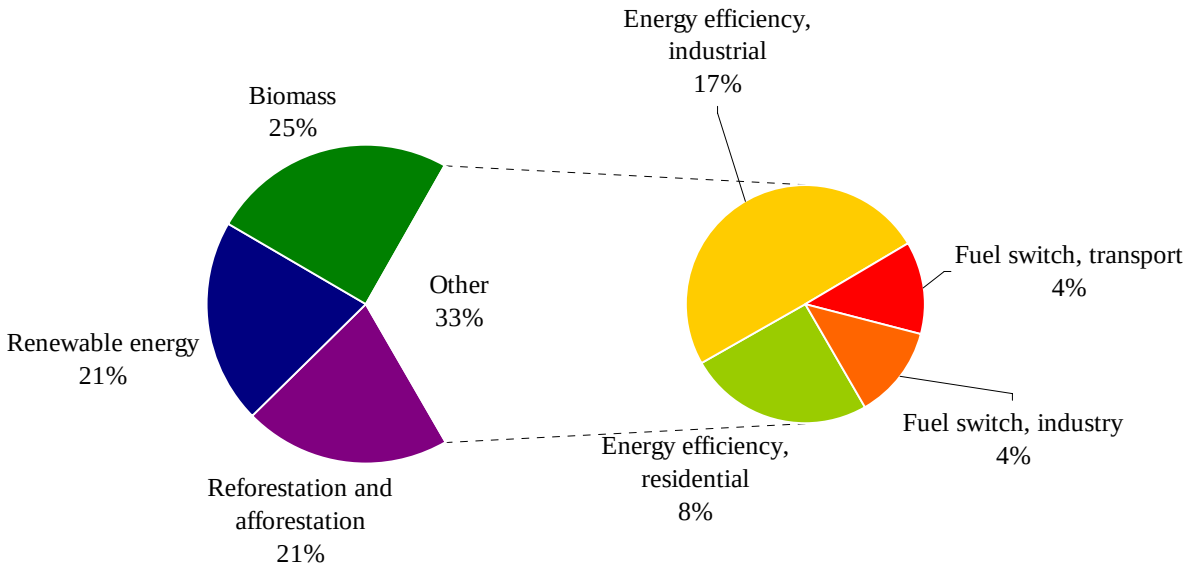

FIGURE 11 PROJECT IDEAS IDENTIFIED BY THE SURVEY RESPONDENTS DISTRIBUTED INTO CDM PROJECT CATEGORIES.

TABLE 11 PROJECT IDEAS IDENTIFIED BY THE RESPONDENTS.

COUNTRY	SUGGESTED IDEAS FOR CDM PROJECTS	PROJECT CATEGORY IN THE CDM
Benin	Afforestation Waste valorisation Electrification to reduce firewood use	LULUCF Biomass, power generation Renewable energy, power generation, community
Burundi	Improved wood stoves Reforestation	Energy efficiency, residential LULUCF
Cameroon	Micro hydropower plants in rural zones Valorisation of domestic waste in Yaoundé Energy efficiency in breweries Biomass valorisation at sugar and agro industries	Renewable energy, power generation Biomass, power generation, community Energy efficiency, industrial Biomass, industrial
Congo	Small Hydropower plants Forestry waste valorisation Energy efficiency for carbonisation Improved wood stoves Biodigestors Forest management (community forests) Industrial energy efficiency	Renewable energy, power generation Biomass, power generation Energy efficiency, industrial Energy efficiency, residential Biomass, power generation LULUCF, community Energy efficiency, industrial
Guinea	Bio-digesters in rural areas to replace firewood Photovoltaic systems GPL Afforestation	Biomass, power generation, community Renewable energy, power generation, community Fuel switch, residential LULUCF
Mali	Industrial – process improvement	Energy efficiency, industrial
Mauritania	Transport sector Rural Electrification outside the network (solar, wind) Carbon sinks	Fuel switch, transport Renewable energy, power generation, community LULUCF
Togo	Electric energy production from the combustion of karité flour: fuel switch. 3240 MWH.	Biomass, industrial

Chapter 4. Discussion and Analysis

4.1 Comparison of investments in the CDM and Foreign Direct Investment flows

The latest data concerning CDM projects validated and registered worldwide has shown that the geographical distribution is rather skewed, but also indicated surprising results. Latin America has far the largest share of the CDM market, in comparison to its relatively small population among the three regions analysed (Africa & Middle East, Asia and Latin America). Latin America has large developing countries such as Brazil, Chile, which account for the majority of the CDM projects (validated and registered) so far, after India.

Nevertheless, Asia's participation is also significant (specially with India taking the lead), but in one of the results – the number of projects per share of the region's population in the total – Africa & Middle East and Asia have the same proportion.

Comparing the results on the geographical distribution described above to the Foreign Direct Investment flows in Figure 12, a co-relation between the geographical distribution CDM projects and Foreign Direct Investment flows is not very clear. While Asia is the major receptor of foreign investmenent, and has received more then double the amount of that of Latin America in 2004, it is not the leading region in the CDM. Therefore, this result indicates that other factors are also determinant for CDM investments.

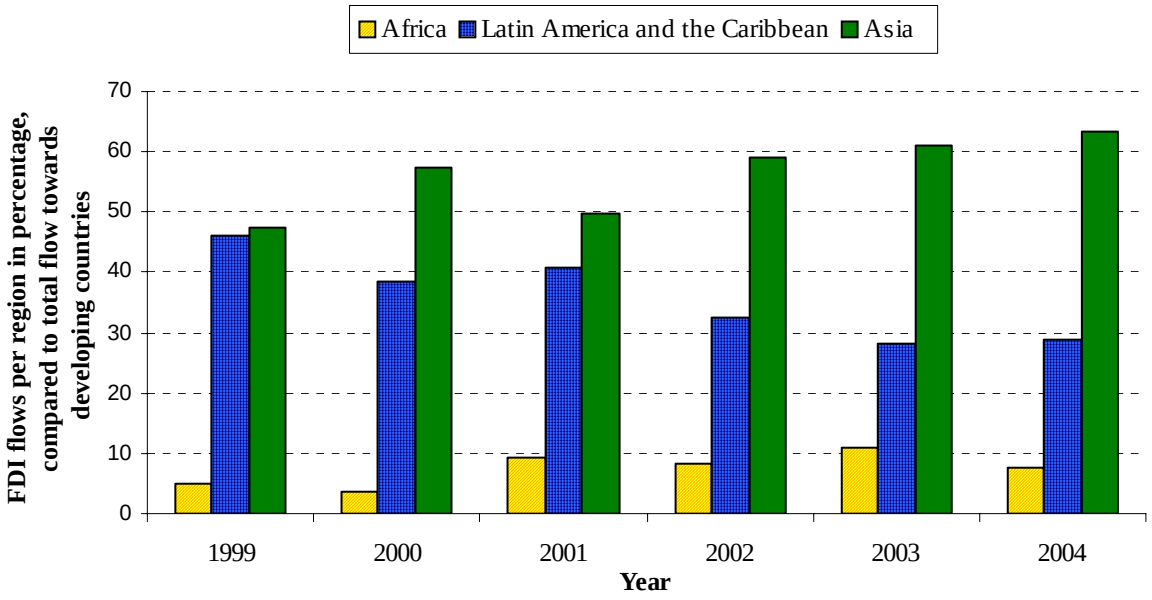

FIGURE 12 GEOGRAPHICAL DISTRIBUTION OF FDI INFLOWS TO DEVELOPING COUNTRIES, 1999-2004.
Source: Adapted from UNCTAD (2005).

Goldberg *et al* (2005) studied the "human dimension" as a decisive factor in international investment location. They analysed three main issues for human interaction that might have some influence on FDI: (1) language, affecting interaction, (2) travel, as a measure of the interaction between the investor and the host country, and (3) distance. The conclusion was that language was a much bigger determinant then any of the other factors, followed by travel. Our result supports this assertion that language might be the major factor affecting CDM projects as well. In the case of sub-Saharan Africa, if we consider the two single countries with validated CDM project so far:

South Africa[12] and Uganda, both countries are actually English speaking. This could be another hypothesis to be tested in further research, which demands a comparison between several countries and their CDM investor entities or Certified Emission Reduction purchaser.

Nevertheless, Figure 13 illustrates one hypothesis for the current trend of investment-flows in the Clean Development Mechanism is leading to more projects in larger developing countries, as a typical scheme of the "success to the successful archetype" (Senge 1990). With more CDM projects, these countries get more experienced in the mechanism (as shown in section 2.1.3 concerning countries that have participated in the Activities Implemented Jointly pilot mechanism) and can develop more easily other projects, and this enhances again the perception that investments are more secure there. Investment being limited, the mobilization of most investments by large developing countries results in a smaller share of the CDM market for investments in least developed countries, and especially Sub-Saharan Africa.

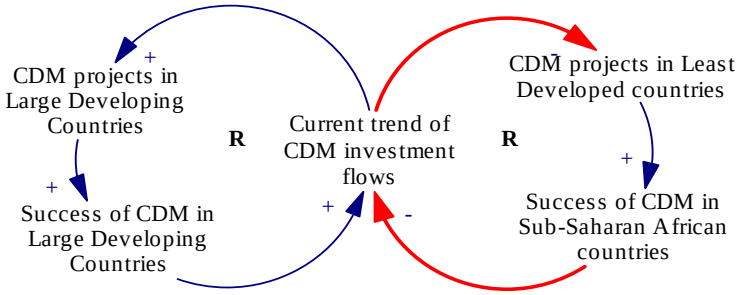

FIGURE 13 HYPOTHETICAL MODEL OF THE TREND OF CDM INVESTMENT FLOWS, POSSIBLY CREATING THE CURRENT GEOGRAPHICAL INEQUITY.

Source: author Note that the red/bold arrows on show the critical links. The signs close to the arrows indicate a proportional (+) or inversely proportional (-) relation. The symbols within the loops show reinforcing [R] or balancing [B] tendencies.

However, according to Niederberger & Sane (2005), India is the major supplier of Certified Emission Reductions, despite having a low inward Foreign Direct Investment [FDI]. The conclusion we can draw from this is that countries that are not successful in attracting FDI, might still manage to represent a CDM potential, if it reacts proactively to meet the prerequesites for participation. In opposition to this statement, Jung (2005) has concluded that a good investment environment has a large influence over the host country attractiviness.

Davidson et al (2003) suggest that African countries should set up an "African CDM Fund", in order to overcome this bias and concentrate financial resources for projects in the continent. This fund could be either financed by regional or by international organisations. Moreover, Samiego and Figueres (2002) suggest a "sectoral CDM approach", combining several projects in one sector (transport, electricity) or even in a region. A third suggestion, given by the author, is to improve government communication tools to enhance the perception of the countries by investors.

4.2 Suggestions for an equitable geographical distribution of CDM projects

Sokona *et al.* (1998) and Rowland (2001) suggest geographical quotas to ensure that CDM activities would enhance more equitable benefits for the society and opportunities for facilitating adaptive management. However, Banuri & Gupta (2000) argue that such a solution would carry the risk of distorting the market for Certified Emission Reductions, generate projects of poor quality

[12] Because although most of the population cannot be considered as "English natives", English is the working language in the industry of South Africa.

and discourage countries to participate in the CDM. Besides, the market for CDM projects is still uncertain and therefore no real number is available. Therefore, Silayan (year?) considers that country quotas are counterproductive. The results obtained in this research could possibly push further such discussion, by contemplating an idea of regional quotas or even proportional to development indexes.

Moreover, the IPCC already 1996 examined equity within the climate-change mitigation framework as "the challenge […] to ensure that neither the impact of climate change nor that of the mitigation policies exacerbates existing inequities both within and across nations". Therefore, if the Kyoto Protocol is to be implemented in an equitable manner, Brown & Corbera (2002) recommend three elements to be incorporated into its policy: "equity in access to carbon markets", "equity and legitimacy in institutions and decision-making" and "equity in outcome" (p.44).

The first element, access to markets, depends on the level of "information, communication and knowledge, while in issues related to institutions and decision-making, equity is related to the "inclusion and negotiation of competing views", according to rules and procedures. Finally, "equity in outcomes" is concerned about the distribution of benefits created by these policies (Brown & Corbera, 2002 p.45).

4.3 Solutions for constraints to CDM project development and implementation

4.3.1 *Summary of the constraints identified*

The survey was successful in determining certain constraints for the implementation and development of Clean Development activities in sub-Saharan African countries. However, the method did not leave much flexibility to consider additional constraints point out by the respondents. Nevertheless, the main constraints identified were.

a. Sustainable development criteria and national strategy missing in all countries
b. Delay in establishing a National Authority for project appraisal
c. Low awareness about the Clean Development Mechanism potentials, at different levels
d. Lack of Research and Development centres to develop new technologies
e. Low capacity for undertaking economical and financial analysis
f. Lack of expertise in energy projects
g. Unawareness of additional project risks
h. Unawareness of project transaction costs

On the sustainable development criteria and strategy, it is the government's role to establish it. Even if the country does not enter in the Clean Development Mechanism, defining these criteria and priorities can be useful to start analysing the integration of policies in a country. It is also important as a way to reframe national development priorities. Nevertheless, although each country sets up a national authority in charge of verifying the compliance of the project with the opted sustainable development strategy and criteria, the danger is that a weak policy, while more easy to implement, will not assess the expected social, environmental, economical and technological benefits.

This can be the case of India, shown on section 3.1.2 to be having a disproportionate amount of projects registered as opposed to other countries. However, it must be clear here that this is just a hypothesis. Nevertheless, if identified as true, this fact could affect the credibility of the Clean Development Mechanism. On the other side, a strong set of national criteria, more worth being

trusted, also implies greater difficulties for project appraisal and approval, and eventually implementation.

4.3.2 *Solutions for the constraints identified above*

Solving the problem in sub-Saharan countries would include: ratifying the Kyoto Protocol in the countries that have not yet, and then establishing a National Authority for project appraisal, which implies for the government to allocate a budget to it. Lobbying of the stakeholders in potential Clean Development activities might help to catalyse the ratification of the Protocol. An international fund should be created to support the Designated National Authorities.

The lack of Research and Development Centres implied into Clean Development Mechanisms is possibly another cause for these countries failing to develop projects on their own. These technology centres should be stimulated and financed by national educational policies together with the industrial sector. Regarding renewable energy, such as solar power and wind energy, Papineau (2006 p.429) argues that Research and Development [R&D] institutions are important tools for mainstreaming this category of projects, because they reduce costs "in the same way as experience". Moreover, capacity building programmes and 'cross-pollination' between African pilot developers of CDM activities in already successful countries such as South Africa and Uganda, with others that are still beginning in the market can help diffuse knowledge at a lower cost.

The solution to the above constraints regarding economical and financial analysis and energy expertise request setting capacity building programmes, while the last two require awareness raising seminars or workshops. Moreover, the last point suggests that the second hypothesis (relative to transaction costs being too high for sub-Saharan countries, and therefore being the main constraint for participation) cannot be confirmed because most countries answered that they are uninformed of these aspects.

A subsequent study could assert the hypothesis of constraint as a lack in these countries of appropriate resource and competences to embrace opportunities such as those of the Clean Development Mechanism. Literature should be supplied in all official United Nations language as soon as possible.

This lack of awareness could also result in a delay in solving the institutional constraints and an apprehension to invest in the CDM transaction costs, since what we are considering here is a sample of countries with no previous experiences in the CDM. It would be interesting therefore, to analyse the opinion of countries that have been further in the process, and identify possible constraints due to the high transaction costs involved.

In addition, this research has shown heterogeneities among the eight countries in Sub-Saharan countries, and the positive results of this study tend to show that:

- Benin and Mali are institutionally fully eligible for participation in the CDM
- Cameroon and Togo have local expertise for CDM projects

Finally, the project ideas suggested by the participants were very balanced in terms of project category. Biomass, energy efficiency and land-use, land-use change and forestry had around the same number of indications by the respondents. Fuel switch options received just a few indications place. However, as shown on previous results, transport was the primary source of greenhouse gas emissions in these countries.

4.4 Potential sources for greenhouse mitigation projects in sub-Saharan Africa

Regarding potentials for climate-change mitigation in sub-Saharan countries, as Davidson *et al* (2003 p. 106) observes, renewable energy and "sustainable forestry" are important on areas for

investment in sub-Saharan countries. However, sustainable forestry would not be applicable for Mauritania, which has in addition the highest value of CO2 emission per capita.

Table 12 justifies this statement. It shows that Mauritania has the lowest percentage of forest and arable land of all the eight countries: 0,5 and 0,3 respectively. Located in Northern Africa, it is already part of the Sahelian region.

TABLE 12 INDICATORS ON ENERGY AND ENVIRONMENT, YEAR 1996, SELECTED SUB-SAHARAN AFRICAN COUNTRIES.

	ENERGY CONSUMPTION (COAL EQ PER CAPITA)		AGRICULTURAL AREA AND FORESTS	
COUNTRY	FUELWOOD, CHARCHOAL AND BAGASSE	COAL, OIL, GAS AND ELECTRICITY	% OF ARABLE LAND AND LAND UNDER PERMANENT CROPS	% OF LAND COVERED WITH FORESTS
Benin	344	116	20,1	24
Burundi	218	20	45,3	3,7
Guinea	221	69	6,2	28,2
Mali	191	23	3,8	10,8
Mauritania	1	530	0,5	0,3
Togo	94	152	46,3	9,4

Source: UNCTAD (2005b)

Therefore, due to scarcity of natural resources as opposed to other Sub-Saharan African countries, the country relies primarily on oil to generate electricity (UNCTAD, 2005b). As a solution, Mauritania has suggested fuel switch as a project idea in the transport sector. In addition, the country indicated solar energy systems as one of the potential project ideas for the country. If proved feasible, this kind of project could reduce the dependence of the country on a non-renewable resource (oil), while decreasing greenhouse gas emissions and pollution. However, the production of the photovoltaic panels is still costly and produces toxic chemicals (Miller, 2004).

Nevertheless, if solar systems are considered in another context, as for example in substitution to wood stoves, solar cooking might indirectly avoid deforestation, while addressing the issue of fuel wood scarcity (Tucker, 1999). Countries like Benin and Burundi, which highly depend on fuel wood (Table 12), could benefit from such projects.

The second highest CO_2 emission per capita is Congo. It differs in emission sources from other countries due to gas flaring. Gas flaring usually occurs in landfills. Landfills produce methane, which is a gas with medium global warming potential (see section 2.2.5). Instead of flaring, this gas could be used as a source of energy to generate electricity (Miller, 2004).

Moreover, the fact that the transport sector is the main source of CO_2 emissions also is due to the small industrial sector of these countries. In the transport sector, many projects could be set up: fuel switch (depending on the availability of natural gas, Biodiesel, etc.), public transport improvement. However, as shown previously in the literature (section 2.1.3) large-scale projects in this sector have proven unworkable.

Chapter 5. Conclusions and Recommendations

The results obtained in this thesis provided limited information on how operational rules in the mechanism are affecting the geographical distribution of CDM projects. Nevertheless, they were enough to conclude that constraints that hinder sub-Saharan African countries come to a large extend from within the country, although the degree of influence of the market over CDM investment flows should not to be neglected.

The allocation of financial resources for these activities as well as the abilities of a few countries to develop a handful of projects is creating doubts on the distributional justice of the Clean Development Mechanism. This should be taken seriously by policy makers, since the creation of 'winners and losers' in such an important environmental treaty may affect its integrity and credibility, especially when those marginalized are countries already considered most deprived of opportunities, as is the case for Sub-Saharan African countries.

The objective concerning the identification of constraints for development and implementation of Clean Development activities was successful to determine that sub-Saharan countries face barriers in the institutional, political and technological levels. Concerning institutional barriers, it was identified that only two out of eight countries fulfil the fundamental eligibility criteria for the participation in the CDM, namely the ratification of the Kyoto Protocol and the designation of a National Authority.

As a solution, we suggest thus political actions such as lobbying to help reduce the inertia of sub-Saharan African governments on ratifying the protocol, while an international fund could be created to give financial support and reduce the delay in setting of National Authorities in these countries. And even if a DNA is set, some of the countries studied were also missing a sustainable development strategy and criteria, thus preventing possible project appraisal.

Contrary to one of the hypothesis set, transaction costs are not **yet** as a major barrier for these countries, mainly because respondents have declared that their country was generally unaware of the magnitude of this financial constraint. However, once these countries become actively engaged in project development and start in the CDM project cycle, they might face financing problems. Therefore, the CDM procedures should be reviewed to reduce these costs or apply other rules for least developed countries.

In addition, the study has confirmed the hypothesis that lack of knowledge, skilled labour and information on the CDM are constraints in all sectors (government, civil society and private). It is necessary then to strengthen these points with capacity building programmes and 'cross-pollination' between African pilot developers of CDM activities in all levels. These capacity building programmes take into account regional context and focus on the constraints identified in this study. Moreover, literature should be supplied in all official United Nations language as soon as possible.

However, results have also shown that although sub-Saharan African countries have already ideas where potential projects could be implemented within the Clean Development Mechanism, these countries have not yet taken effective action to overcome institutional and technological barriers that prevent them from doing so.

Therefore, there is a need for a proactive approach of these sub-Saharan African countries to act fast to meet institutional pre-requisites and benefit from climate-change mitigation projects. Capabilities should be built and development locally so that these countries can become the actors of institutional and technological adjustments. These approach is similar to the one defined by the New Partnership for African Development, which aims to build local capacity to solve Africa's inequalities and mainstream development and sustainability.

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Appendices

APPENDIX 1 EXAMPLES OF GENERAL SUSTAINABLE DEVELOPMENT CRITERIA THAT CAN BE USED FOR APPRAISAL OF PROJECTS IN THE CLEAN DEVELOPMENT MECHANISM.

	ECONOMIC	SOCIAL	ENVIRONMENTAL
(1)	Generate employment Reduce economic burden of energy imports Provide financial return to local entities Positive impact on balance of payments Technological change Cost effectiveness	Increase equity Increase energy access Gender issues Education and training Health Alleviate poverty Legal framework Governance Information sharing	GG emission reductions Local environmental benefits Pollution, water, soil, waste Decrease use of exhaustible resources Use of renewable resources Preserve biodiversity
(2)	Provide financial returns to local entities Result in positive impact on balance of payments Transfer new technology	Improve quality of life Alleviate poverty Improve equity	Reduce GG emissions Reduce the use of fossil fuels Conserve local resources Reduce pressure on local environments Provide improved health and other environmental benefits Meet local renewable energy portfolio standards and other environmental policies

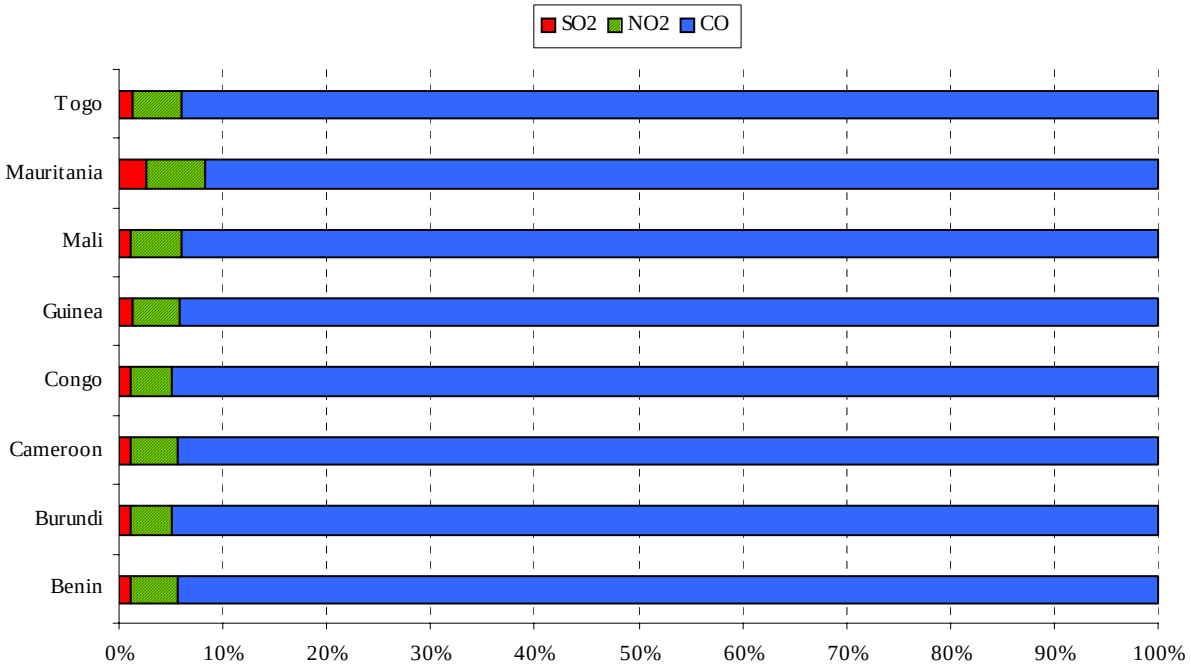
Sources: (1) Olhoff et al. (2004) (2) Pembina Institute for Appropriate Development (2003)

APPENDIX 2 EXAMPLE OF CRITERIA AND INDICATORS FOR APPRAISAL OF FORESTRY PROJECT S

CARBON	ECOLOGICAL	SOCIAL DEVELOPMENT
Net Carbon sequestered Internal rate of return Risk of leakage and natural hazards Eligibility for CDM	Regional ecological value Impact on habitat contiguity Species richness Impact on hydrology Erosion process Soil fertility	Household income Clarification of property rights Forest resources access to poorest households Involvement of community-based formal and non-formal organisations in project design, management and decision-making Number of local people participating in project activities and who perceive benefits Investment in education, health services and capacity building

Source: Brown & Corbera (2002)

APPENDIX 3 NON-CO2 EMISSIONS CONTRIBUTION DURING THE YEAR 1995 FOR THE EIGHT SUB-SAHARAN COUNTRIES UNDER CONSIDERATION IN THIS STUDY.



Source: data from the World Resources Institute (2005)

APPENDIX 4 MILLENNIUM DEVELOPMENT GOALS, SUSTAINABLE DEVELOPMENT, ENERGY PROVISION AND THE CDM

MDG GOALS	SUSTAINABLE DEVELOPMENT LINK	ENERGY SECTOR LINK	CDM CONTRIBUTION POTENTIAL
1. Eradicate extreme poverty and hunger.	Social dimension: Intra-generational equity, poverty alleviation	Related employment to/and Energy for local enterprises, machinery, agriculture outputs, irrigation, etc.	High
2. Achieve universal primary education for all	Social dimension: Intra-generational equity, gender equity, investment in human capital	Reduce time spent by children in energy provision, lightning for reading, energy for educational media (TV, PCs) and rural areas	Low
3. Promote gender equality and empower women. .		Reduce time spent by women in energy provision, Access to information from home through electronic media. Reduce indoors air pollution. *	Medium
4. Reduce child mortality by two-thirds the mortality rate among children under five.		Provide energy for health clinics, reduced air pollution from traditional fuels, reduced time spend in energy provision increases time spent on childcare.	Medium
5. Improve maternal health by three-quarters the maternal mortality ratio.		Provide energy for health clinics, reduced air pollution from traditional fuels (e.g. improved wood stoves)	Low
6. Combat HIV/AIDS, malaria and other diseases.		Provide energy for health clinics and cooling for vaccines and medicine	Low
7. Ensure environmental sustainability.	Environmental dimension, Social dimension: health, poverty alleviation,	Decrease deforestation caused by firewood collection, decrease use of non-renewable resources, Decrease GG emissions.	High
8. Develop a global partnership for development.	Economic dimension	Support sustainable development including the deliver of affordable, reliable and environmentally sustainable energy services. *	Low

Source: adapted from UNEP (2004), *DFID (2002)

APPENDIX 5 PROJECT SECTORS AND CATEGORIES IN THE KYOTO PROTOCOL AND THEIR RESPECTIVE GREENHOUSE-GASES EMISSIONS.

SECTOR	SOURCE CATEGORIES	TYPE OF GREENHOUSE-GAS
Energy	Fuel combustion Energy industries Manufacturing industries and construction Transport Other sectors Other Fugitive emissions from fuels Solid fuels Oil and natural gas Other	Carbon Dioxide (CO_2), Methane (CH4), Nitrous Oxide (N2O)
Industrial processes	Mineral products Chemical industry Metal production Other production Production of halocarbons and sulphur hexafluoride Consumption of halocarbons and sulphur hexafluoride Solvent and other product use	Hydrofluorocarbons (HFCs) Perfluorocarbons (PFCs) Sulphur hexafluoride (SF_6) N2O, CO2
Agriculture	Enteric fermentation Manure management Rice cultivation Agricultural soils Prescribed burning of savannas Field burning of agricultural residues Other	CH_4, N2O
Waste	Solid waste disposal on land Wastewater handling Waste incineration Other	CH_4

Source: Adapted from Niederberger and Saner (2005 p.3)

APPENDIX 6 QUESTIONNAIRE PROTOCOL (ENGLISH VERSION)

Political Aspects - Indicator		**Yes/No**	**Comments**
Is your country receptive to the objectives of the CDM in the following sectors:	Government		
	Civil society		
	Private sector		
Does your country have sustainable development criteria for the evaluation of CDM projects?			
Does your country have defined a strategy for sustainable development? In that case, is it formally implemented?			
Does your country have a forum to discuss and spread information about CDM-related topics?			
Technical Aspects - Indicator			
Does your country have the necessary expertise for implementing renewable energy or energy efficiency CDM projects, in the following sectors:	Government		
	Civil society		
	Private sector		
What is the priority issue for CDM projects implementation in your country (please number with growing importance)?	Renewable energies		
	Energy efficiency		
	Biomass		
	Other…		
Which type of project do you believe is profitable for your country?	Small scale		
	Large scale		
Is there in your country an R&D center that helps develop CDM projects?			
Which of these aspects from the CDM cycle are the most problematic in your country (please number with growing importance)?	Additionality		
	Baseline		
	Methodologies		
	Monitoring		
	Consultations with the actors		
	Economic and financial analysis		
	PIN elaboration		
	PDD elaboration		
	Feasibility study formulation and "business plans"		
Financial aspects - Indicator			
Is your country aware of the risks posed by CDM projects?	Market-related risks		
	Risk of project approval failure		
	Risk of project itself failing		
Are these sectors in your country aware of the trade costs of CDM projects?	Government		
	Civil society		
	Private sector		
Is your country aware of the impact of the CER trade in the project's own financial balance, (e.g. IRR)			
Legal Aspects - Indicator			
Is your country aware of the Kyoto Protocol's legal aspects concerning the:	Start of the project		
	Participants approval		
	Negotiation process		
	Responsibilities in the project		
	CER use and trade		
Sustainable Development Aspects - Indicator			
Do you think that CDM projects could contribute to:	Reach the Millennium Development Goals		
	Reduce poverty		
	Diminish social inequalities		
	Improve women's condition		
	Increase the overall population living standards		
Which CDM project ideas would be interesting to develop in your country?			

APPENDIX 7 SUMMARY OF THE RESULTS FROM THE SURVEY, INCLUDING ADDITIONAL COMMENTS FROM THE RESPONDENTS.

LEGEND	yes	no

SUSTAINABLE DEVELOPMENT		MALI	TOGO	CAMEROON	BENIN	BURUNDI	MAURITANIA	GUINEA	CONGO
Potential of CDM projects to:	Achieve the MDGs		(A)		(C)				
	Alleviate poverty								
	Reduce social inequalities								
	Improve women life conditions			(B)					
	Improve life quality of all								

Comments:

(A) Depends on CDM project, national criteria for project appraisal, ERPA negotiation and the efficiency of the institutional and legal framework.

(B) E.g. energy projects reduce the burden over women concerning energy provision and reduce inequalities of infrastructure access

(C) Projects are a source of revenue for stakeholders, they improve production technology, build national capacities in many areas, etc.

POLICY ASPECTS		MALI	TOGO	CAMEROON	BENIN	BURUNDI	MAURITANIA	GUINEA	CONGO
Awareness on CDM objectives	Government		Beginning						
	NGOs		Just a few						(D)
	Private sector		Beginning						(E)
SD criteria for the appraisal of CDM projects?			Ongoing						Ongoing
National strategy for sustainable development				(B)		(C)			(F).
National discussion forum regarding the CDM			(A)		(A)				(G)

Comments:

(A) National Committee on Climate Change

(B) Not rigorously applied - connected to poverty

(C) Not formally applied

(D) Several NGOs against climate change

(E) Potential CDM projects

(F) A framework is under approval

(G) One forum shall be set to discuss the UNFCCC, SD criteria and the CDM.

TECHNICAL ASPECTS		MALI	TOGO	CAMEROON	BENIN	BURUNDI	MAURITANIA	GUINEA	CONGO
Expertise in energy projects	Government		(A)						
	NGOs		Very few						
	Private sector		(A)						
Priorities CDM projects	Renewable energy	2	3	2	3	2	3	3	1
	Energy efficiency	3	2	1	1	1	1	2	3
	Biomass	1	1	4	2	3	2	1	2
	Other	4	4	3	4	4	4	4	4
	Comments			(C).	(E)	(G)			
Project size preference	Small scale		(B)		(F)		Above all SC		(I)
	Large scale					(H)			
R&D centres to assist in developing CDM projects				(D)					
Most challenging steps in project cycle?	Additionality	2	1		4	3	8	1	
	Baseline	3	1		2	9	7	2	
	Economic and financial analysis	1	1		1	4	3	4	
	Feasibility study and business plans	8	3		3	8	4	5	
	Methodologies	9	4			5	9	9	

	Monitoring	6	3		5	1	5	3	
	PDD development	7	2		8	7	6	8	
	PIN development	4	2		7	6	1	7	
	Stakeholder consultations	5	2		6	2	2	6	

Comments:

(A) Needs more capacity building

(B) Low GG emissions

(C) No official CDM priorities

(D) Private R&D interested

(E) Biomass is largely used by the population and causes deforestation

(F) Small industrial sector

(G) Energy deficit

(H) Reforestation

(I) benefit low income populations

FINANCIAL ASPECTS		MALI	TOGO	CAMEROON	BENIN	BURUNDI	MAURITANIA	GUINEA	CONGO
Country awareness of the need of investments on CDM projects		(A)		(A)	(B)				(C)
Risks associated to the CDM	Market related risks			(D)					(E).
	Risk of the project not being approved								
	Risk of failure of the project itself								
Awareness of the transaction costs involved	Government		(F).	(F)..					(H)
	NGOs			(F)..					
	Private sector			(F)..			(G)		
Awareness off the impacts of the CERs sold in the overall project economy, as e.g. in the internal rate of return		(A)		(F)..	-				(A)

Comments:

(A) More awareness needed

(B) Risks decrease the will of investing

(C) They should also be supported institutionally.

(D) Not much different from those of other problems. An additional one is the validation by the host country.

(E) No information concerning risk is available so far

(F) No previous experience

(G) Better informed in general

(H) Yes, but simplifying the procedures of transaction is necessary, specially to benefit lower income populations

LEGAL ASPECTS		MALI	TOGO	CAMEROON	BENIN	BURUNDI	MAURITANIA	GUINEA	CONGO
Awareness of legal aspects of the KP concerning:	Project start							(A)	.(B)
	Participants Parties Approvals					?			
	ERPA negotiations								
	Project responsibilities								
	Transaction of CERs								

Comments:

(A) KP ratified

(B) More capacity building is needed